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17 May 1994
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ADVISORY ASSISTANCE IN THE MINING OF RUTILE IN SIERRA LEONE FOR LOCAL AND INTERNATIONAL MARKETS

SI/SIL/93/801

MISSION REPORT

Prepared for the Government of Sierra Leone
by the United Nations Industrial Development Organisation

Based on the work of
Graham Smith, Peter Stitt and J-P Viellard
Consultants

Backstopping Officer: Ms. L. Riabova

United Nations Industrial Development Organization
Vienna

Explanatory Notes

Value of the local currency:

560 Leones for one U.S. dollar in November 1993

Inflation rate in %:

1988	32.6	1991	86.4
1989	62.8	1992	30.5
1990	110.9	1993	18 to 20% (e)

Value of gold:
November 1993 average US$374/oz

Production of principal minerals:

('000 tons unless otherwise indicated)

	1984	1985	1986	1987	1988	1989	1990	1991	1992
Diamonds (k carats)	188	349	327	314	28	2	13	7	49
Rutile	91	80	97	113	126	126	144	154	148
Bauxite	1041	1184	1242	1391	1403	1562	1445	1376	1212
Gold (k ounces)	20.8	18.1	8.7	13.6	0.8	2.4	12.9		

Source: Bank of Sierra Leone and The Economist Intelligence Unit

SIERRA RUTILE SALES (in million dollars):

1987: 47.5	1990: 78.5
1988: 46.1	1991: 75.9
1989: 75.9	1992: 70.4

Abbreviations:

GOSL : The Government of Sierra Leone
DMR : The Department of Mineral Resources
DITSE: The Department of Trade, Industry and State Enterprises
UNCTC: The United Nations Center for Transnational Corporations
MMA : The Mines and Minerals Act

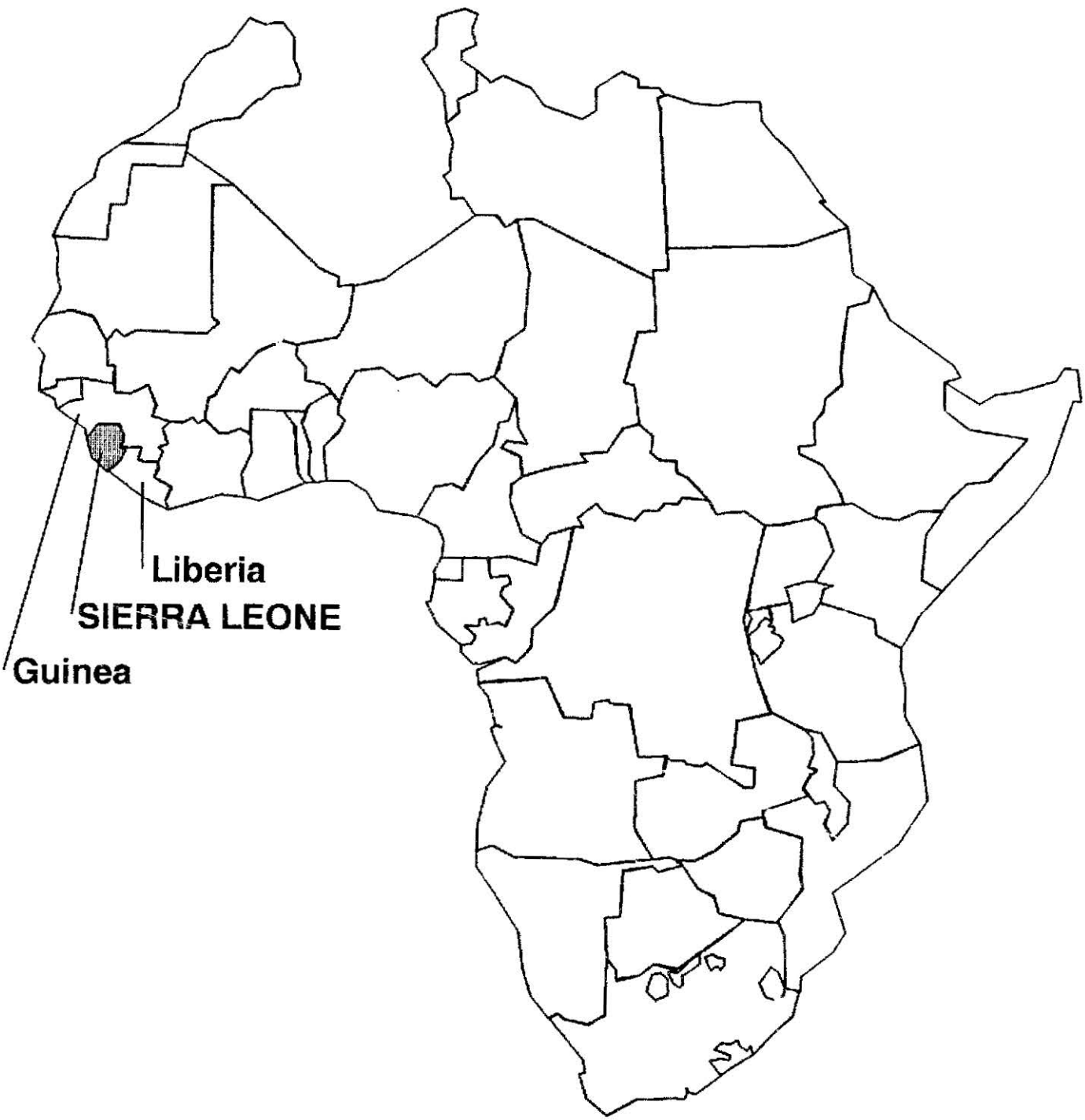
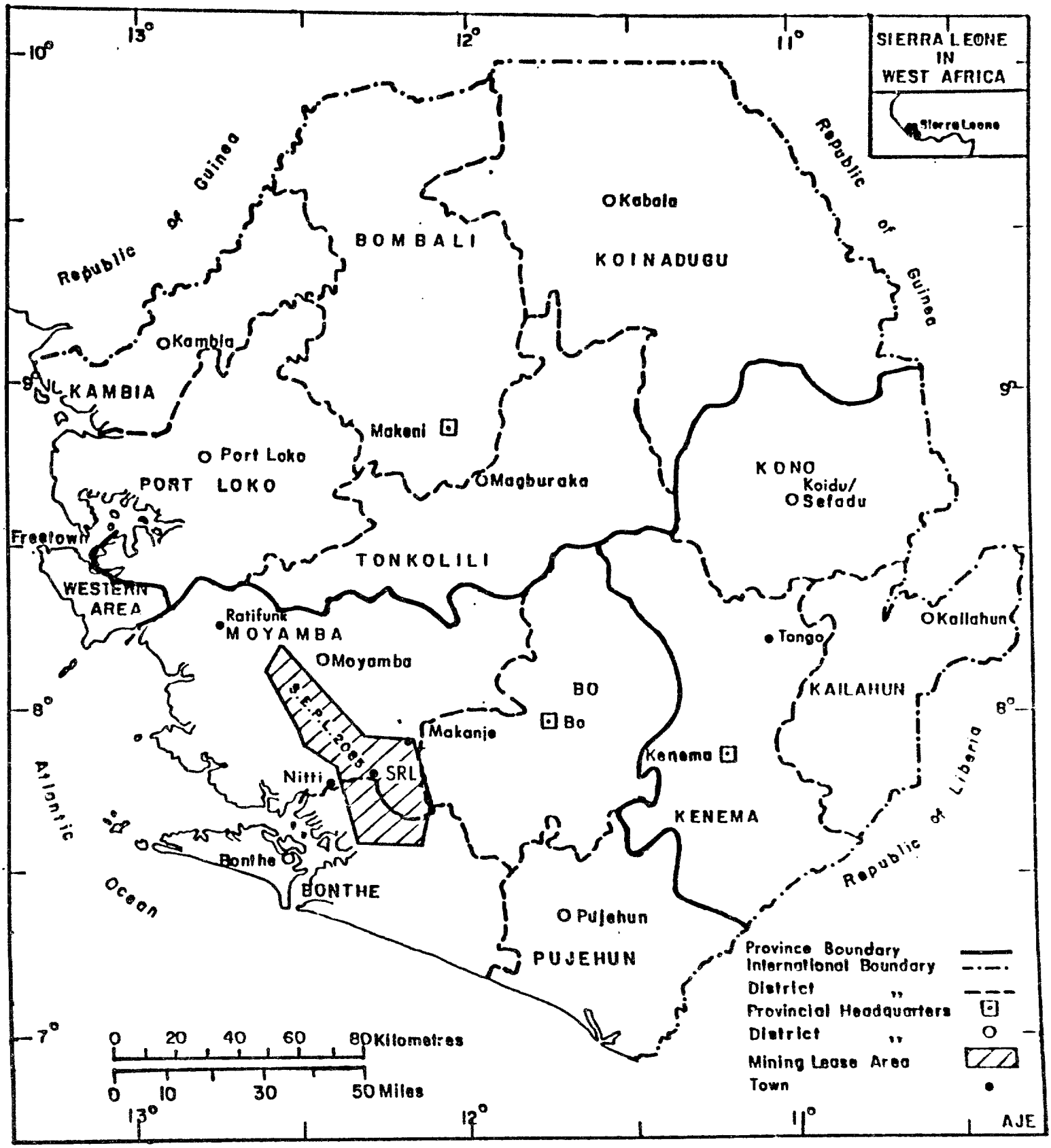


Figure 1 : MAP OF AFRICA SHOWING SIERRA LEONE AND NEIGHBOURING COUNTRIES

Figure 2 DISTRICT MAP OF SIERRA LEONE

After Hanvey, 1990



SECTION 1

Geological Series (D.O.S. Geol.) 1081.
Sheets published or in preparation at December 1959.

Figure 3 GEOLOGICAL MAP OF SIERRA LEONE

Courtesy of Sierra Leone Geological Survey

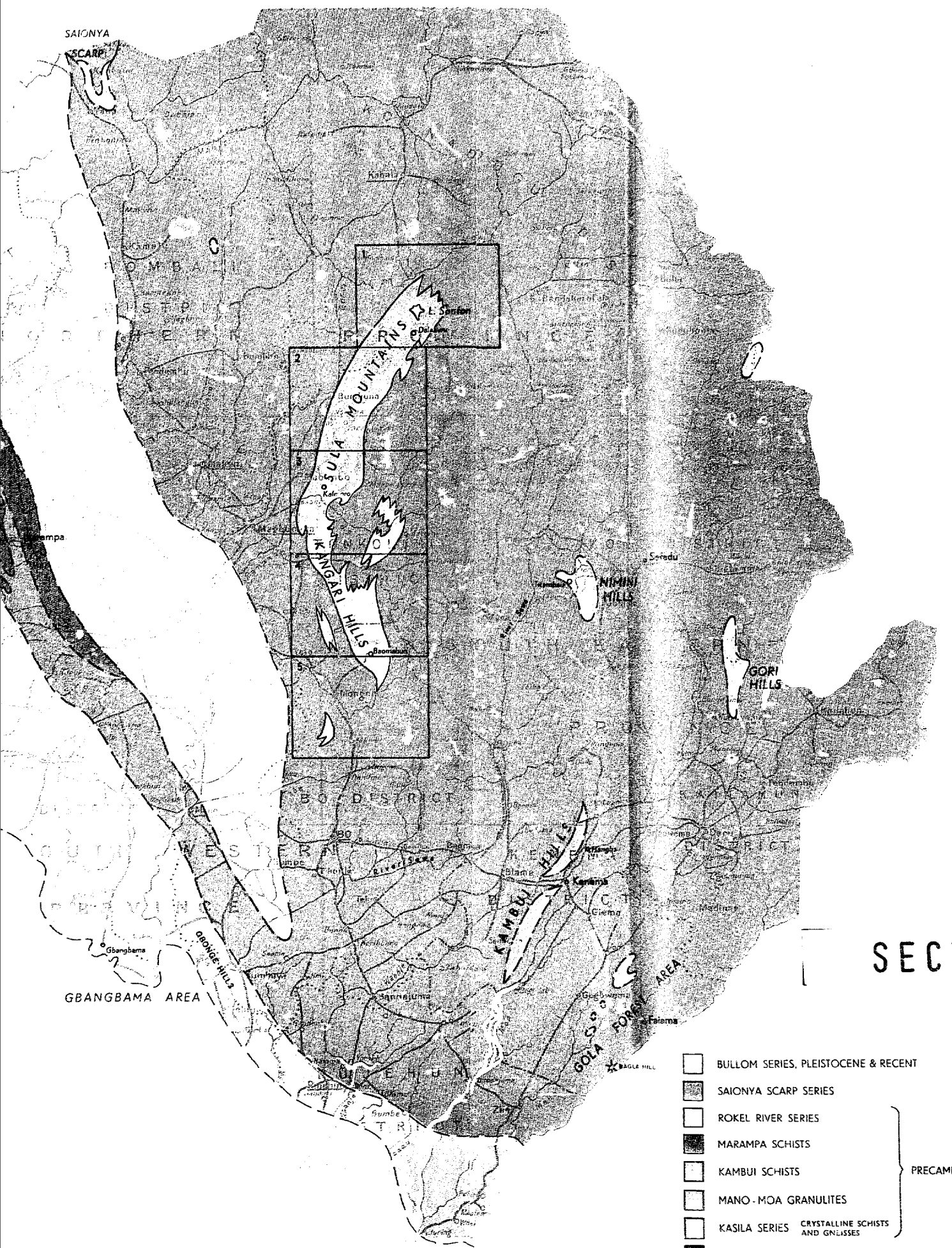
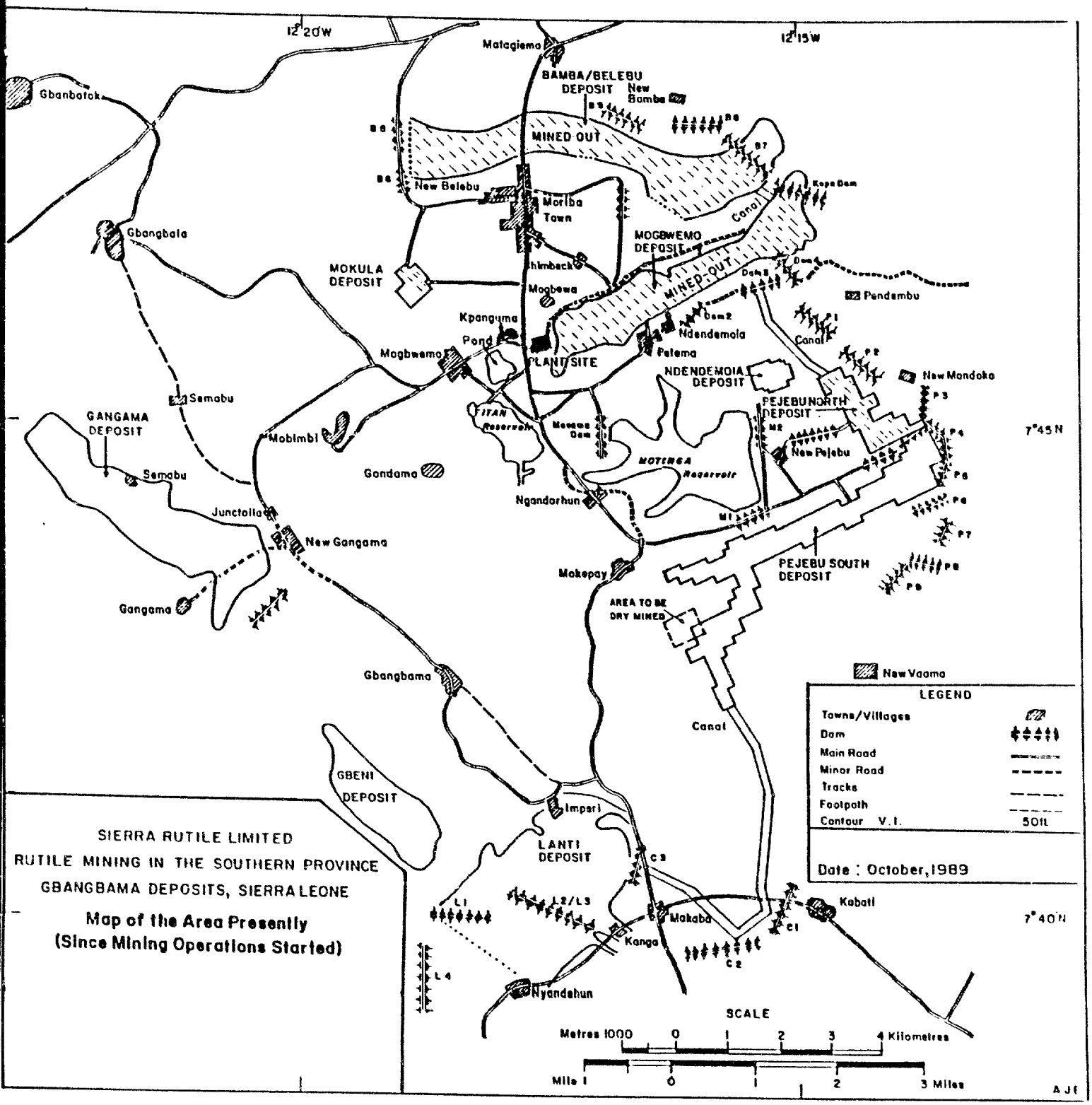


Figure 3 GEOLOGICAL MAP OF SIERRA LEONE

Courtesy of Sierra Leone Geological Survey

Figure 4 MAP OF SRL MINING AREAS

After Hanvey, 1990



SIERRA RUTILE LIMITED

RUTILE MINING IN THE SOUTHERN PROVINCE

GBANGBAMA DEPOSITS, SIERRA LEONE

Map of the Area Presently (Since Mining Operations Started)

FIGURE 5 SRL Dredge in Operation

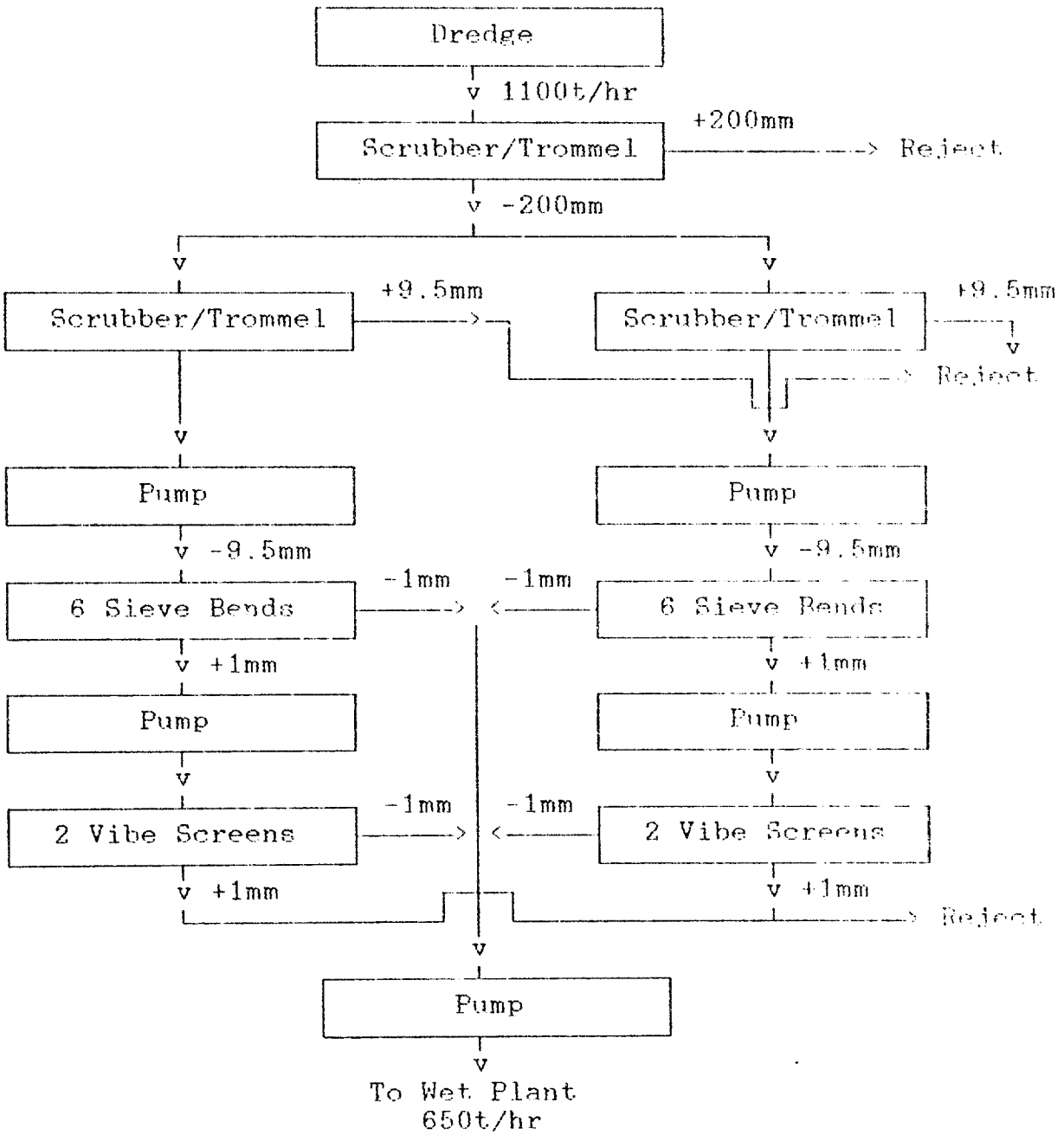


Figure 6: SRL Simplified Flowsheet for on Dredge Pre Wet Plant Processing

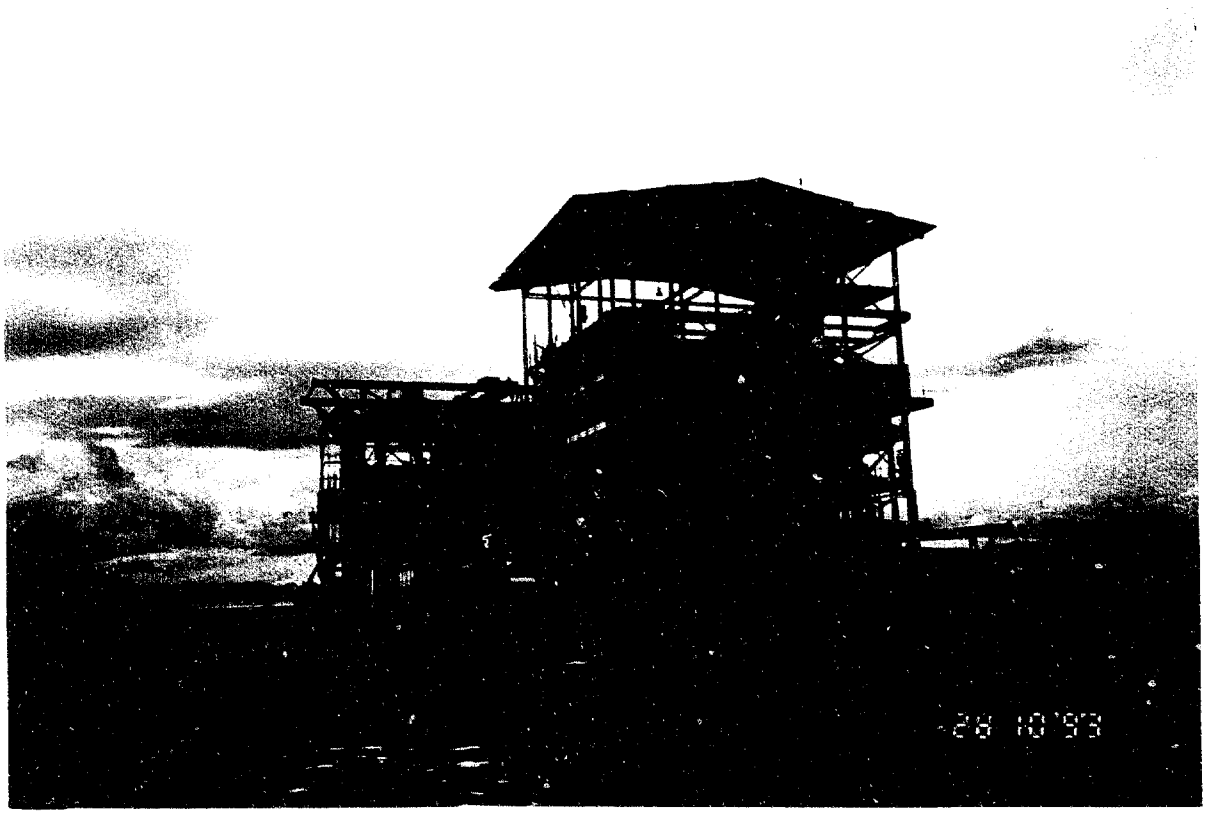


FIGURE 7 SRL Floating Wet Plant

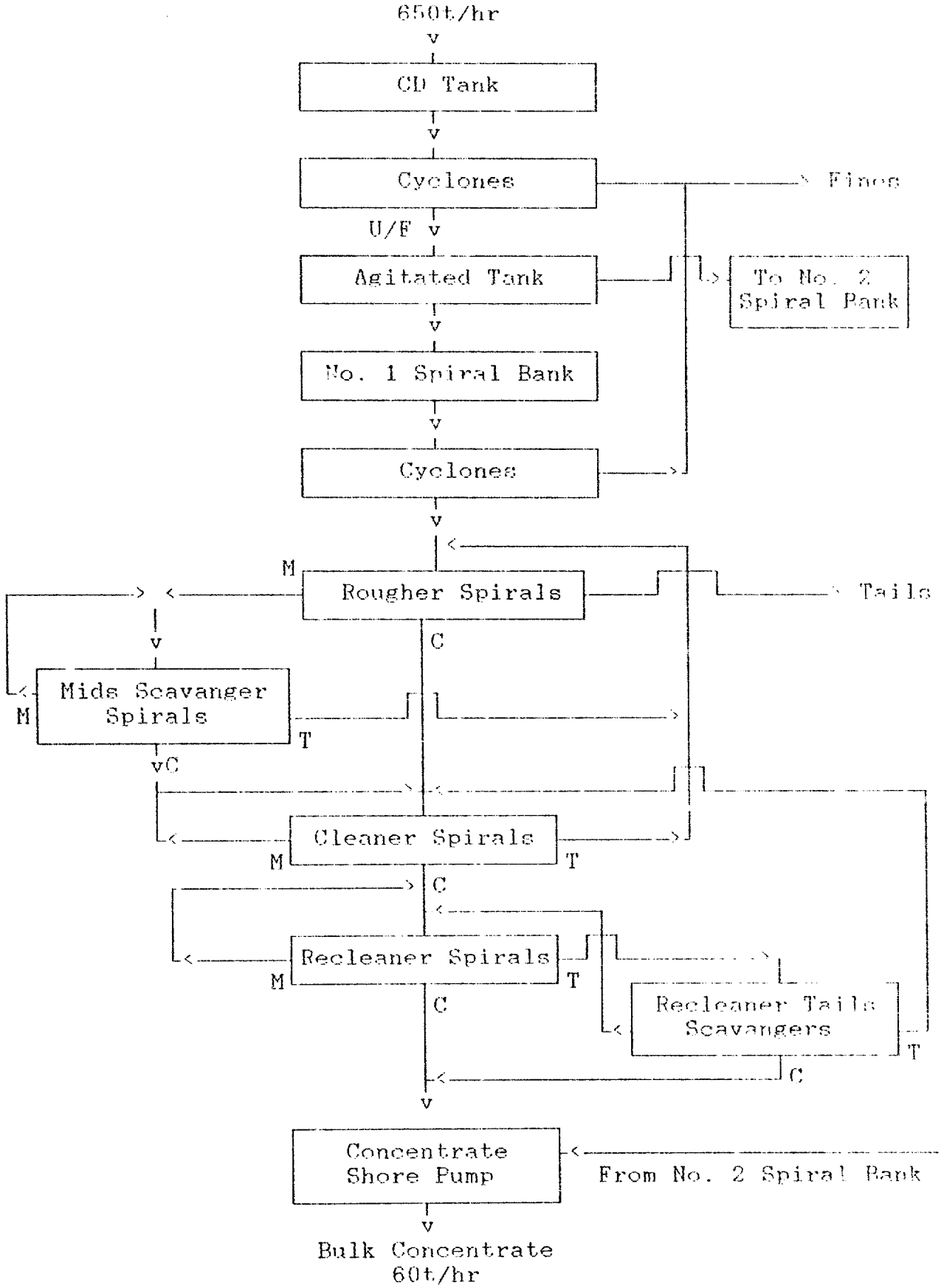


Figure 8: SRL Simplified Flowsheet for The Wet Plant.

c = Concentrate
m = Middlings
t = Tailings

FIGURE 9 Sieromco - Mining Bauxite

FIGURE 10 Sieromco - Bauxite Being Unloaded at the Godoma Washing Plant

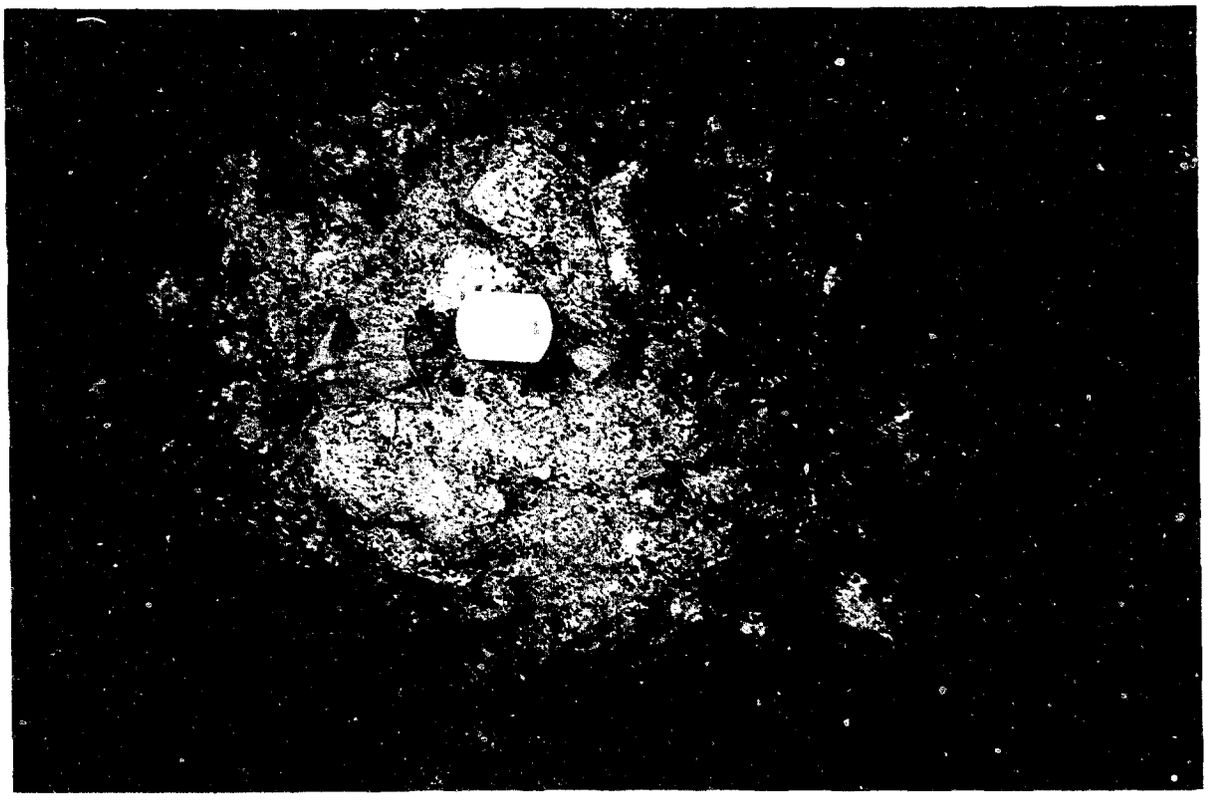


FIGURE 11 Kimberlite with Granite Xenoliths
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FIGURE 15 Artisanal Mining Tongo

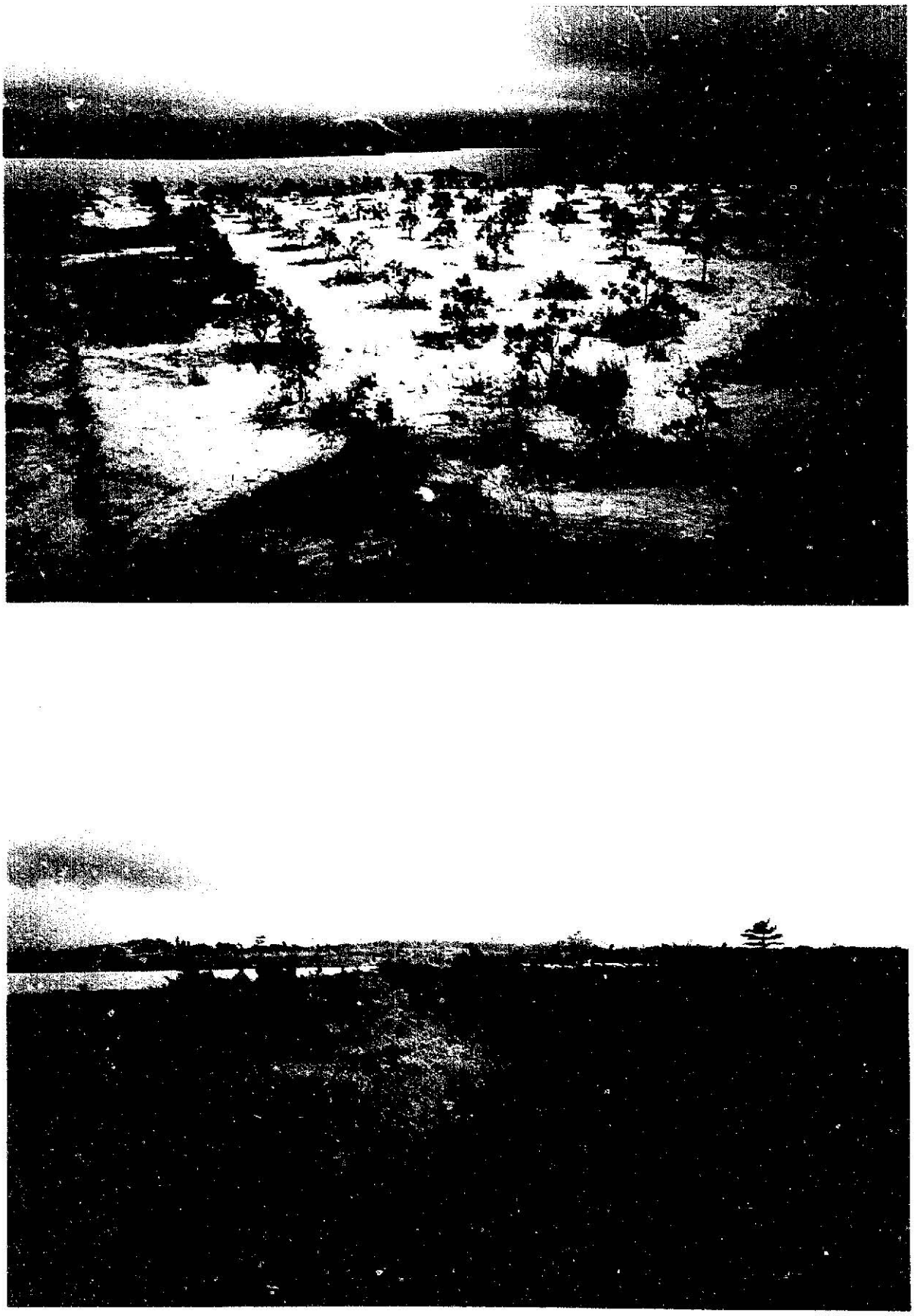

FIGURE 16 SRL - Rehabilitation of Dredge Tailings, Top Cashew Trees, Bottom Palm Oil Trees

ABSTRACT

The mining sector of Sierra Leone has been going through a difficult period, especially over the past two years, as both the rutile and bauxite mining operations, the main export earning industries of the country, have been suffering from weak demand for their products due to the world recession. In addition there is an over-supply of titanium feedstock on the world market and rutile prices have collapsed from a price of around US$595 in 1991 to slightly less than $400 in November 1993. A similar situation has occurred with bauxite due to an over-supply of aluminium on the world market, which has forced down the prices of the bauxite, the raw material for aluminium.

At the same time the Government has had to deal with a rebel war, which has disrupted diamond production, or at least the legal diamond production and also gold production.

One of the mission's main objectives was to determine if more revenue could be obtained from the mining sector. The Mission concluded that due to the current economic conditions, there was, in fact, very little opportunity of obtaining further revenue from the existing rutile and bauxite operations, apart from that which would accrue automatically due to the planned expansion programme of the rutile operation. The rutile operation has already passed through two liquidations and is currently barely profitable at current world market prices. To try to increase the Government earnings from the operation still further could push the company into a loss-making situation and another liquidation could result.

As both Sierra Rutile Limited, the rutile producer and Sieromco, the bauxite producer have in the recent past, renegotiated their mining agreements with the Government and these were ratified by Parliament, to try to renegotiate these agreements again, after such a short period would send a strong negative message to the entire international mining community.

The terms of reference included an assessment of the possibility of secondary processing of rutile in Sierra Leone to produce titanium

dioxide pigment. This is an extremely capital and energy intensive and highly technical industry, which has serious environmental problems, especially with the sulphate process. The Mission determined that the local market for titanium dioxide pigment was, at most, 100 tonnes per year. This can be ignored for the purposes of planning a pigment plant which typically has a capacity in the order of 70,000 tonnes per year. Such a plant could cost approximately $200 million, would require a stable electricity supply which Sierra Leone does not possess and all the products would have to be exported to the main market areas of Europe and North America, where an over-supply of pigment production already exists.

The secondary processing of rutile for minor uses, such as titanium metal, welding rods, advanced coatings and micro-electronics are judged, by the Mission, not to be viable options in Sierra Leone, due to the extremely advanced scientific requirements; the lack of any significant local market and the fact that adequate capacity for these items already exists in North America, Europe and Japan.

In view of this situation the Mission expanded its brief to examine the potential of increasing the revenue of the Government by expanding the mining base, both for exportable minerals and for those that could be used locally for the production of building materials and ceramic products, which are currently imported. Production of building materials and ceramics would not only reduce imports but would provide significant new employment opportunities. In addition this would also provide a new tax base for the country.

It was determined that, although all necessary raw materials required for building materials and ceramic products are available in the country, very little testing work has been carried out due to the lack of suitable laboratory facilities in Sierra Leone. None of the industrial minerals are currently used for commercial-scale production except for two small-scale rural building material operations. A UNIDO COMFAR financial analysis of a proposed small to medium-scale building materials project for the Freetown area was therefore carried out by the Mission. This clearly indicates that such a project is viable with a low break-even point providing

that funding is primarily by equity with a small proportion of development bank loans in foreign exchange.

The present economic environment in Sierra Leone, although improving due to the International Monetary Fund (IMF) supervised Structural Adjustment Programme, is still not attractive to potential investors. This is particularly true for the secondary processing of minerals and manufacture of products from industrial minerals, such as fired clay bricks, clay roofing tiles and other ceramic products, such as tableware items. The lack of available bi-lateral lines of credit, insurable supplier credit terms, extremely high short-term borrowing rates of around 50% and the reluctance of commercial banks to give loans to new industrial projects even at these high interest rates all combine to deter potential investors from establishing new industrial projects. Only further improvements in the reduction of inflation and reduction in interest rates will alter this situation.

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2. REASON

Currently revenue derived from Sierra Leone's small mining industry contributes approximately 15% of the country's budget income and about 70% of export income. An expanded industry has the potential to make a greatly increased contribution to the economy and to the standard of living of the people of Sierra Leone. Following a request from the Government of Sierra Leone (GOSL), the United Nations Industrial Development organization (UNIDO) implemented this study to assist the GOSL in examining how to maximize the benefits to the country from mining and mineral processing.

3. SUMMARY AND CONCLUSIONS

3.1 Sierra Leone is a mineral rich Least Developed Country (LDC) with the potential to substantially raise the standard of living of the population through mining and minerals processing development.

3.2 This potential has only been exploited to a limited extent; and then not always in a manner which benefits the country at large.

3.3 The mining sectors with the greatest export potential appear to be mineral sands (rutile and ilmenite), diamonds, gold, bauxite and perhaps base metals.

3.4 Currently the mining industry comprises Sierra Rutile mining rutile and subordinate ilmenite, and Sieromco mining bauxite together with artisanal miners operating (generally illegally) on alluvial gold and diamond resources.

3.5 Sierra Rutile and Sieromco together generate the bulk of the country's hard currency earnings and are major contributors to Government revenues. Without them, the country's already shaky economy would be in jeopardy.

3.6 Sierra Rutile is a well run, high cost producer operating in a world climate characterized by depressed commodity prices. Any attempt to extract substantially more revenue from the company, apart from that which will naturally follow from the company's current expansion programme, would risk putting the rutile project into liquidation for the third time.

3.7 Extraction of substantially more revenue from SRL beyond that alluded to in 3.6 would require a unilateral renegotiation of the Company's Mining Agreement with GOSL. This would be counterproductive to any attempt to encourage further mining investment in Sierra Leone.

3.8 Similar comments probably apply to Sieromco, particularly in light of the fact that the Sieromco agreement was renegotiated in 1992 with the United Nations Center for Transnational Corporations (UNCTC), supplying professional assistance to GOSL.

3.9 The Sierra Leone Development Company Limited (DELCO) mined and exported haematitic ore from the Marampa deposit for about forty years. Operations ceased in 1975 mainly due to resource depletion. Prospects for re-establishing an iron ore project are not good, given grade considerations and poor international market conditions.

3.10 A highly successful diamond mining operation was commenced in 1934 by Sierra Leone Selection Trust (SLST). Production reached two million carats of quality stones by 1970. In

1970, a new company, National Diamond Mining Company (NDMC), was set up basically to nationalize the operation. Initially, GOSL held 51% of the shares and SLST 49%.

3.11 With alluvial resources apparently approaching depletion, SLST wanted to phase in kimberlite mining for diamonds whilst GOSL did not want to make the investment required for kimberlite mining. SLST withdrew and further management changes gave GOSL virtually total control of NDMC. The fortunes of the company rapidly deteriorated and NDMC is currently in liquidation.

3.12 Artisanal mining of alluvial diamonds was made legal in 1956, largely to break SLST's monopoly. Currently all diamond production is from this sector which also accounts for all gold (alluvial) production.

3.13 The bulk of artisanal mining appears to be illegal and there is a marked tendency for illegally mined diamonds to be also sold illegally. This results in little contribution to Government revenue or to hard currency earnings.

3.14 It is not possible to accurately estimate diamond production. A plausible figure for 1992 is that about 830,000 carats were exported to Belgium; the country which is thought to handle over 90% of Sierra Leone's diamond production. As registered exports for 1992 were about 49,000 carats it would appear that over 90% of exports for that year were illegal.

3.15 It would appear that the main factors driving this illegal trade are the cost and the hassles in selling legally, restrictions on mining eligibility, and local opposition to the requirement to have to obtain a licence to mine on what Sierra Leonians consider to be their own land.

3.16 It was put to the mission that the existing system for buying and exporting diamonds tends to be used as a cover for illegal operations. It was claimed that the bulk of the stones exported legally are of low value, whilst high value stones

tend to be exported illegally.

3.17 The problems outlined in 3.15 and 3.16 need to be addressed. Possible solutions would be a simplified system for selling gold and diamonds and an investigation into options for increasing the percentage of legal artisanal mining operations.

3.18 Current low levels of foreign investment in Sierra Leone indicate that most investors do not view the country with favour. The single exception is SIERRA RUTILE's US$ 71 million plant upgrade. It would boost investors' confidence in Sierra Leone if this programme could be seen to have been subject to minimal bureaucratic interference.

3.19 To attract further foreign investment into mining to Sierra Leone , the creation of a stable political and economic climate conducive to mining is urgently required. This could involve:

* the adoption by Sierra Leone of a mining law familiar to western mining companies,

* minimal Government involvement,

* the adoption of adequate incentives to generate investor interest; such as the lower income tax rate (37.5% instead of 45%) and the more generous depreciation allowances provided for in the MMA,

* the setting up of a one-stop shop investment advisory group attached to the Department of Mineral Resources,

* the preparation by the Geological Survey of:

  . an inventory of known mineral occurrences in a form suitable for presentation to exploration companies,

- . the preparation of a set of 1:250,000 geological maps,

- . the preparation of a geological data base,

* a strengthening of the Department of Mineral Resources and especially the Geological Survey by the addition of specialist staff; e.g. a legal expert, an environmental expert and a mineral economist.

3.20 The Mission is aware that the World Bank has already put forward many of the suggestions set out in 3.19 and has, in cooperation with GOSL, produced a draft Mines and Minerals Act (MMA). The Mission endorses these initiatives.

3.21 Much of the draft MMA is standard and it does protect fully the rights and interests of the GOSL. However, the ultimate test of the MMA will be whether the international mining industry sees it as providing an acceptable operating environment. If they do, they will come to Sierra Leone; if they do not, they will not come.

3.22 It is possible that the international mining industry may see some of the provisions of the draft MMA as providing a considerable disincentive to exploration and development. Accordingly, it may be worthwhile seeking the opinion of a selection of companies on the draft. If this course is taken, care will have to be exercised in order to minimize delays.

3.23 The MMA will have serious limitations unless it is accompanied by an appropriate set of regulations to cover such matters as mining rights application procedures, licence demarcation, etc. Urgent attention needs to be given to this matter. The Mission is strongly of the opinion that input to the drafting of the regulations should be sought from professionals who work with mining acts on a day to day basis, e.g. titles consultants from a major mining country. This would also be a cost effective approach to drafting the regulations.

3.24 As recently as 1989 the declared Mining Policy of GOSL was to acquire a 51% interest in any major mining project. This policy finds expression in the Sierra Rutile Agreement and the Sieromco Agreement; however it is not mentioned in the draft MMA. As this issue could be seen as a major negative by potential investors, it needs rapid clarification.

3.25 Initiatives to attract foreign investment should not discriminate against local investment. For Sierra Leone this is seen as a particularly important issue since it may prove possible to increasingly attract investment from the artisanal sector.

3.26 The two projects which appear to have the greatest potential to be brought into production in the shortest time are the mining of the kimberlites at Kono/Tongo and the Baomahun primary gold project. These projects should be accorded maximum political support and be subject to the minimum of bureaucratic interference.

3.27 The kimberlite project is more advanced and appears to have the greatest technical potential. However, its history and the liquidation of N.D.M.C. coupled with the current state of the international diamond market are significant negative factors.

3.28 A realistic time frame to get either of these projects into production is two to five years; assuming adequate political support by the GOSL and minimum Government interference.

3.29 At first sight the most likely prospect for a significant secondary minerals processing industry would appear to be the construction of a plant to produce titanium pigments from rutile. However, given current world over capacity and overseas perceptions of foreign investment in Sierra Leone, it is unlikely that in the short term, an investor could be found, who would be willing to advance the considerable funds required (probably over US$200 million).

3.30 A better short term prospect for secondary processing would be the establishment of an indigenous ceramics industry. This could save the country foreign exchange, create employment and help to create confidence in more advanced secondary minerals processing projects.

3.31 Previous UNIDO missions (SIL/93/007/A/01/62) have made similar suggestions. They are endorsed by this mission. However taking this matter further will require a raw materials survey and the setting up of a small testing facility.

3.32 Both SRL and Sieromco were late to adopt mining rehabilitation strategies. For each company, work in this area commenced about 1987. However, results to date are quite impressive and auger well for the long term.

3.33 The Sierra Rutile Agreement and the Sieromco Agreement both foreshadow a 51% acquisition of each project by GOSL. Notwithstanding the comment in 3.32, problems may arise with rehabilitation on these projects and it would be prudent for the Government to monitor progress. **Reclamation costs money and there is a risk that GOSL may end up buying a reclamation liability.**

3.34 Experience elsewhere in the world and a study of Sierra Leonean operations leads to the conclusion that the artisanal mining sector is likely to present the greatest long term problem from an environmental point of view, especially as it affects significant areas of land. Environmentally, this sector is virtually uncontrolled and is likely to remain so; the operators have absolutely no interest in mine rehabilitation and no incentive to participate in this activity.

3.35 The draft MMA does address rehabilitation and artisanal mining. However the issue needs further consideration particularly from the viewpoint of:

* specific rehabilitation techniques,

* damage done by past operations,

* operators who elect to abandon a lease without rehabilitation,

* illegal mining,

* funding.

4. RECOMMENDATIONS

4.1 Facilitate Sierra Rutile's current expansion programme, basically by ensuring that the project is subject to the minimum of bureaucratic interference.

4.2 Simplify and liberalize the system for legally exporting gold and diamonds from Sierra Leone, for instance by reducing the number of permits and authorizations required and by setting up a one-stop shop for handling all export formalities.

4.3 Consider options for increasing eligibility for those engaged in artisanal mining for alluvial gold and diamonds, including the right for non-citizens to be involved. Also the possibility of granting an artisanal mining lease within a prospecting or an exploration license, subject to the right of the tenement holder to object to the artisanal mining lease.

4.4 As a matter of priority, have the mining industry (particularly local companies) and other interested parties offer their comments on the draft MMA, amend it as deemed necessary and then have it gazetted. Particular attention should be given to the possibility of amending the draft MMA

along the lines discussed in section VIII of this report so as to remove any constraints which may impede foreign investment.

4.5 Clarify the Government's policy regarding its participation in major mining projects.

4.6 Also, as a matter of priority have the regulations prepared to support the MMA, in consultation with professionals of a major mining country (e.g. mining titles consultants) who have day to day familiarity with the operations of mining acts.

4.7 Set up a one-stop shop investment advisory organization attached to the Department of Mineral Resources to advise potential mining investors in Sierra Leone.

4.8 Prepare, design and publish a promotional brochure to attract potential investors.

4.9 Launch a promotional action to attract international mining companies.

4.10 Strengthen the Department of Mineral Resources and especially the Geological Survey.

4.11 Ensure that any initiatives to attract foreign investment do not discriminate against local Sierra Leonean investment.

4.12 Finalize the liquidation of NDMC and give political support to the kimberlite diamond project and the Baomahun gold project.

4.13 Give support to the establishment of a local ceramics industry to produce items such as bricks, clay roofing tiles and low cost tableware.

4.14 Investigate how best to resolve the legal complications concerning the ownership of the assets of Sierra Brick and Ceramic Company Limited, so that these assets can be utilized in the establishment of a new clay brick and roof tile production unit.

4.15 Establish a small ceramic testing laboratory and pilot plant at Njala University College. In parallel with this development, training courses for skilled bricklayers should be established at the College.

4.16 Carry out a raw material survey of all industrial minerals through the Geological Survey in conjunction with Njala University College.

4.17 Examine options for the rehabilitation of artisanal mining areas.

4.18 Monitor progress of rehabilitation on SRL's and Sieromco's mining areas and the estimated costs of outstanding rehabilitation works on those areas.

4.19 Monitor avenues for more sophisticated minerals processing such as pigment production with a view to attracting investors at an appropriate time.

INTRODUCTION

Sierra Leone is an equatorial West African country bounded by Guinea to the north and north-east and Liberia to the south-west (Figure 1). To the south and the south-west the Atlantic coastline is approximately 400km long. The total land area is 73,350km2.

The capital is Freetown (population 400,000 to 500,000) and the total population of the country is approximately 4,100,000. Freetown was founded in 1787 by English philanthropists as a "homeland" for freed African slaves following the American War of Independence.

Sierra Leone is divided into four administrative regions comprising one area and three provinces. The provinces are sub-divided into districts with the districts being even further subdivided into chiefdoms.

The four administrative regions are (Figure 2):

* The Western Area, comprising Freetown, its suburbs and the mountains of the Freetown Peninsula.

* The Eastern Province, capital Kenema.

* The Northern Province, capital Makeni.

* The Southern Province, capital Bo.

The districts comprising the three provinces are (Figure 2):

* The Eastern Province
  - Kono
  - Kenema
  - Kailahun

* The Northern Province
  - Koinadugu
  - Bombali

- Tonkolili
- Kambia
- Port Loko

* The Southern Province
  - Moyamba
  - Bonthe
  - Bo
  - Pujehun

The civil war in Liberia has spilt over into the eastern provinces (the Eastern Province and the Southern Province) of Sierra Leone. This conflict is referred to elsewhere in the Mission's report as the "Rebel War". The Rebel War has heavily occupied Sierra Leone's military in recent years and has had a disastrous effect on the country's economy.

Currently the two major mining projects in Sierra Leone are those of Sierra Rutile Limited (Sierra Rutile or SRL) and Sierra Leone Ore and Metal Company (Sieromco).

Sierra Rutile mines an alluvial/eluvial rutile resource in the south west of the country to produce a premium grade rutile (titanium di-oxide). Sierra Rutile is in fact the largest single mine producer of natural rutile in the world.

Rutile and another titanium mineral, ilmenite (iron titanium oxide) are the major ores for the production of titanium compounds and titanium metal. Most of the world's production of rutile and ilmenite goes into the manufacture of non-toxic high performance paint pigments; but also into the production of titanium metal (predominantly for the aerospace industry) welding rods and a range of low volume, often high technology, applications (e.g. solid state electronics).

Sieromco produces a beneficiated bauxite, also from a resource in the south of the country. Bauxite (more specifically gibbsite, $Al_2O_3.3H_2O$) is used to produce calcined alumina the bulk of which goes to the production of aluminium metal. Minor uses for calcined

alumina include the production of high performance refractories and ceramics, glass melting and aluminium chemicals.

The 1993/94 budget of the Government of Sierra Leone (GOSL) shows Sierra Rutile and Sieromco contributing approximately 15% to total budget income and as the country's main hard currency earners.

Following a request by Dr. Arthur Abraham, then Secretary of State, Trade, Industry and State Enterprises; the United Nations Industrial Development Organisation (UNIDO) agreed to fund a study of rutile production in Sierra Leone and the possibility of secondary processing of rutile in the country. The resulting project was titled:

> *"Advisory Assistance in the Mining and Processing of Rutile for Local and International Markets"*

The immediate objective of the project as defined in the Project Document was:

> *"To enable the Government to formulate and decide on a strategy for further development of rutile mining and processing."*

The long term objective was to assist GOSL to:

> *"... expand the revenue base of the country."*

The Mission charged with executing the project comprised:

1.	Ms L. Riabova	Backstopping Officer - UNIDO, Vienna
2.	Mr G.J. Smith	Expert/Industrial Economist
3.	Mr P.H. Stitt	Expert on Rutile Production
4.	Mr J.P. Viellard	Legal Expert in Mining

Ms Riabova arrived in Freetown on 16 October 1993 and left 30 October. During this time she laid the ground work for the Mission. Smith and Stitt arrived in Freetown 23 October 1993, Smith Departed 22 November and Stitt 4 December. Viellard arrived 24 October and departed 28 November.

The Mission's early investigations lead it to the conclusion that Sierra Rutile is a well run, high cost, rutile producer operating in a world climate characterised by depressed commodity prices. In this situation the additional revenue which GOSL could extract from the Sierra Rutile operation, apart from that which will naturally follow from the Company's current expansion programme, is seen as strictly limited and could risk forcing the project into liquidation for the third time.

In addition any move which could give a substantial increase in revenue from Sierra Rutile would require a renegotiation of the Sierra Rutile Agreement, 1989 (Ratification) Act. A unilateral move by GOSL to force a renegotiation of the Sierra Rutile Agreement would undoubtedly be resisted by the company and would be counter-productive to any attempt to attract further foreign investment into mining in Sierra Leone.

As regards secondary processing of rutile, the obvious move is to examine the possibility of installing a titanium di-oxide pigment plant in Sierra Leone. This would be a value-added operation supplying titanium pigments to the world market. However in the Mission's opinion there are two major impediments to such a scheme at this time:

1. There is currently an excess of capacity for pigment production on the world scene; together with depressed pigment prices.

2. The current investment climate in Sierra Leone is characterised by uncertainty and most investors would be reluctant to fund a project requiring capital of the magnitude required for the construction of a pigment plant (probably +US$200,000,000).

The Mission was also of the opinion that similar considerations would probably apply to any scheme to extract more revenue from Sieromco or to try to force them to secondary processing.

However the Mission is firmly of the opinion that the creation of a

climate conducive to investment in mining and minerals processing in Sierra Leone has the potential to greatly expand GOSL's mining revenue base; AND RAPIDLY.

We therefore elected to alter the focus of our brief to include all minerals; and secondary processing of minerals generally. This lead to the adoption of an amended objective as follows:

> **"A review of the current mining industry in Sierra Leone and of the future potential for the mining industry with a view to maximising the benefits of mining and associated development to the people of Sierra Leone."**

A "Preliminary Draft Report Outline" was then prepared as a basis for the Mission's terminal report. A preliminary executive summary was also prepared which set out the Mission's views, as they then stood. However as work progressed it became apparent that the World Bank had already covered many of the areas which the Mission had intended to review and had, in broad terms, already come to similar conclusions.

Although it should increase confidence in a particular set of recommendations if two separate groups of experts independently come to a similar set of conclusions, the Mission was anxious to avoid needless repetitive discussion of the same issues. We have therefore attempted to prepare a report which is complementary to the World Bank work to which we are privy. In essence this has involved placing more emphasis on issues which appear to have only been dealt with in a preliminary manner by the World Bank.

This report is the Mission's findings in terms of its redefined objectives and constraints. The authors' views have been set out separately in three sections or parts, each dealing with that person's particular area of expertise. The division is as follows:

* PART ONE P H Stitt
* PART TWO G L Smith
* PART THREE J P Viellard

Each of the above three parts is based on the individual reports of the three Experts. PART FOUR is a brief discussion of the views of the Experts.

PART ONE

TECHNICAL AND GEOLOGICAL ASSESSMENT OF MINING IN SIERRA LEONE

I. EXISTING MINING OPERATIONS

A. Sierra Rutile Limited

1. Background

Sierra Rutile Ltd is a wholly-owned subsidiary of Nord Resources Corporation of Dayton, Ohio, U.S.A. However Consolidated Rutile Ltd of Australia is currently negotiating to acquire a 50% interest in the Company.

Sierra Rutile mines a unique heavy mineral resource in South Central Sierra Leone (see Figures 1 & 2). The Company owns the largest mining operation in the country and with a workforce of approximately 1,600 men and women, is the largest single private employer in Sierra Leone.

Out of a senior management staff of 130, approximately 30 are expatriates. Turnover over the period 1990-1992 inclusive, has ranged from US$78,000,000 down to approximately US$70,000,000. By way of taxes, royalties and import duties, the Company contributes approximately US$10,000,000 (approximately 14% of its turnover) to the Government. This represents approximately 10% of GOSL's current fiscal income, whilst the Company generates approximately 50% of Sierra Leone's hard currency earnings.

Although SRL is the World's largest single mine producer of rutile, in terms of total TiO_2 feedstock, the Company's output represents <5% of current World production.

Nearly 95% of the world's production of titanium feedstock goes into the manufacture of titanium dioxide pigments and the remaining 5% primarily goes to the production of titanium metal, Harmor (1986). The manufacture of products such as titanium chemicals and of welding rod coatings consume minor quantities of titanium feedstock.

Titanium dioxide pigments are chiefly used to manufacture high performance non-toxic paints. The very high refractive index (RI

2.75) of the rutile isomorph (crystalline form) of titanium dioxide scatters light very effectively and gives rutile based pigments great "hiding power". By way of contrast the lead based pigments previously used in paint manufacture only have a refractive index range of 1.90 to 2.0. Besides being toxic the low RI of lead based pigments only gives 8 to 12% of the "hiding power" of rutile based pigments.

The light scattering characteristics of rutile pigments also find a use in the manufacture of plastics, rubber, paper and various other materials. Particularly for plastics, a high light scattering ability helps prevent sunlight induced deterioration of plastic products and plastic composites, eg glass reinforced plastics.

The feedstocks from which titanium dioxide pigment is made are:

* Rutile
* Synthetic rutile
* Ilmenite
* Titanium slag
* Mixtures of the above; eg ilmenite and titanium slag

There are two technologies for producing titanium dioxide pigments from feedstock material, the Sulphate Process and the Chloride Process. These technologies are discussed in more detail in Part II of this report.

2. History

Rutile was first discovered in Sierra Leone by the Geological Survey between 1920 and 1930, Hanvey (1990). Further discoveries of rutile in 1954 in the sands and gravels of the Lanti River in the central south of the country led to detailed exploration being commenced in 1955 by British Titan Products (BTP). This programme led to the discovery of a significant rutile resource. In 1957 Pittsburg Plate Glass (PPG) became a partner in the project. Besides glass, PPG were and are a major paint producer so that their participation in the project was apparently driven by a desire to increase vertical integration in the paint sector of their operations. Consolidated Zinc Corporation (CZC) took an

interest in the project in 1959, but withdrew in 1961.

PPG and BTP formed Sherbro Minerals Ltd (80% owned by PPG) about 1961.

Exploration work indicated that the most promising portion of the resource was the Mogbwemo deposit, located in the Moyamba district (Figures 2 and 4). Mining commenced on this deposit in 1966 using a conventional suction cutter dredge. This unit proved incapable of handling the difficult ore, resulting in the production of only 118,000 tonnes of rutile for the period 1966-1970. The target figure for this period had been 500,000 tonnes. In 1971 Sherbro Minerals went into receivership.

In 1971 Nord Resources Corporation and Armco Steel acquired the assets of Sherbro Minerals and founded Sierra Rutile Ltd. Bethlehem Steel Corporation subsequently purchased Armco's interest in the project and increased its shareholding in SRL to 85%.

After an extensive exploration and evaluation programme, Sierra Rutile commenced mining in 1979, again on the Mogbwemo deposit. Although a better dredge had been acquired, poor plant availability and a bad marketing strategy led to low sales. This resulted in the project being shut down again in mid-1982. In late 1982 Nord acquired Bethlehem's interest in the project and became sole owner. Nord Resources moved swiftly to overcome SRL's problems and operations re-commenced in 1983. SRL has operated successfully since that date.

3. Geology

Most mineral sand resources are developed in present day or ancient beach environments as a result of wave action or Aeolian processes. Sierra Rutile's resource is unique amongst major mineral sand occurrences currently being mined. It comprises an alluvial/eluvial rutile accumulation developed on the Precambrian Kasila Gneisses (Figure 3). The Kasila Gneisses have been dated at approximately 2,100,000 years Before Present (BP) and are locally enriched in rutile, ilmenite, zircon and other accessory heavy minerals. Typical in situ rutile grades in the richer part of the

resource are in the range 0.3-0.4wt%. After being subject to weathering and alluvial processes there is a natural upgrading to something in the range 1.5 to 2.0wt% rutile. The rutile deposits occur as valley accumulations of Tertiary to Pleistocene Age which are generally unrelated to the present drainage system. They comprise poorly consolidated sands and clays which commonly have a laterite capping. A typical heavy mineral assemblage is set out in Table 1.

TABLE 1
SPL - Typical Heavy Mineral Assemblage as a Percentage of Plant Feed

Mineral	Wt%
Rutile	2.0
Ilmenite	0.7
Zircon	0.06
Monazite	0-0.01
Light Heavies	0.06
Corundum	?0.01

Because the mineral has been subject to relatively little transport, it tends to be angular and has a broad size range; typically 63 to 1,000 microns.

Grades tend to be richest at the surface and to decrease with depth. Deposit thickness ranges from 0-25.3m (0-83') beneath a kaolinised overburden which is itself up to 16.5m (54') thick. Pyrite and marcasite occur in parts of the resource; chiefly in heavily vegetated swamp areas which are below present day sea level.

A feature of the resource is that the various deposits within it can be at significantly different levels (say up to 21.3m (70')). This presents significant problems in moving the dredge and floating wet plant (concentrator), since a canal may have to be constructed with a set of temporary locks.

Elsewhere the Kasila Gneiss has feldspar-rich pods. Laterization effects have developed massive bauxites in these areas, some of

which are in close proximity to Sierra Leone's operations.

Sierra Rutile's resource status as of 31 December 1991 is set out in Table 2.

TABLE 2
SRL Resource Status as at 31.12.91

	Tonnes Ore	Wt% Rutile	Tonnes Rutile
Proved Ore	222,892,000	1.54	3,421,700
including			
Lanti	96,512,000	1.85	1,785,500
Gbeni	33,381,000	1.61	537,400
Gangama	23,009,000	1.72	395,800
Probable Ore	154,397,000	1.25	1,930,000
Totals	530,101,000		8,070,400

On-going exploration will add substantially to these totals

4. The Operation

Mining

Mining takes place in an artificial lake. Lakes are formed by damming and are arranged to cover the bulk of a particular resource. At the time of the Mission's visit the Lanti deposit was being worked (Figure 4).

Mining is carried out by a purpose-built bucket-ladder dredge similar to those used in tin mining. The mining rate is nominally 1,100 tonnes/hour. The hull of the dredge is approximately 43m long x 24m wide with a 4m draught (140' x 80' x 15'). It weighs 4000 tonnes and is electrically powered with an installed capacity of 5500kW. The digging range is from 6m above water table to 15m below (+20' to -50').

Manoeuvring is effected by means of sidelines (steel wire ropes) and a headline. Benches are slices, typically 4.6m wide by 427m long x 0.3-0.6m deep (15' x 1400' x 1-2' deep). Figure 5 shows the dredge in operation.

Pre Wet Plant Processing

Provision is made for liberation and partial separation of mineral from clay and laterite on the dredge. Ore gravitates from the bucket ladder to a rotary drum scrubber/trommel which gives a preliminary break-up of clay lumps and rejects +200mm laterite overboard. The -200mm trommel product is split into two streams and gravitates to two smaller scrubber/trommels (Figure 6). Plus 9.5mm material from the trommels is rejected overboard, whilst the -9.5mm fraction is pumped to a bank of six sieve bends servicing each scrubber/trommel. The +1.18mm sieve bend oversize is pumped to two vibrating screens for each bank of sieve bends. The +1.18mm oversize from each pair of vibrating screens is also rejected overboard.

The -1.18mm material from the vibrating screens is combined with that from the 12 sieve bends and pumped via a floating line at a nominal rate of 650 tonnes/hr to a floating Wet Plant or concentrator.

Wet Plant

Wet Plant (Figures 7 & 8) feed is delivered to a Constant Density (CD) sump and from there is pumped to a bank of 20 x 254mm (10") diameter hydro-cyclones. Cyclone overflow goes to a slime storage tank and then is pumped to reject. Cyclone underflow gravitates to a large agitated storage tank.

From the agitated storage tank on; the ore is treated in two parallel, almost identical circuits. Considering one of these circuits; ore is pumped to a bank of 10 x 254mm (10") diameter cyclones with the overflow again going to the slimes tank and thence to tailings. Cyclone underflow gravitates to a sump and is pumped to the rougher spirals comprising ten banks of 8 column, 3 start spirals (240 starts). Tails from the roughers go to reject and the concentrate goes to the cleaner spirals.

Rougher middlings go to the mids (scavenger) spirals comprising four banks of 8 column, 3 start units. Middlings recycle to mids scavenger feed and concentrate goes to the cleaner spirals.

Cleaners comprise five banks, each of 8 column, 2 start spirals. Cleaner mids recycle to feed and cleaner tails to rougher feed. Cleaner concentrates go to re-cleaner spirals.

Re-cleaners comprise three banks of 8 column, 3 start spirals. Re-cleaner mids recycle to feed, tails go to cleaner tail scavengers and concentrates are pumped ashore.

Concentrates are pumped via a Zimpro hydraulic pump at a nominal rate of 54.5m_3/hour (235 US gallons per minute) and at a pulp density of 60-65% solids through a 75mm (3") line to shore. A tower mounted cyclone is used to stockpile the bulk concentrate, which is nominally 50% rutile.

When and as required bulk concentrate is loaded into trucks by Front End Loader (FEL) and trucked to the dry plant site approximately 10km due north of the mine site (Figure 4).

Dry Plant

The Dry Plant is relatively conventional, apart from the wet section.

The wet section differs from common practice in three respects:

i) The wide size range of the rutile (typically 63 to 1000 microns) results in a number of sizing steps to facilitate rutile concentration.

ii) There is a froth flotation zircon recovery plant.

iii) Refractory grain coatings dictate a heavy duty approach to grain cleaning for the bulk concentrate. This is necessary to obtain acceptable selectivity in subsequent separation unit operations.

Feed rate into the Wet Section is a nominal 50-60tph with high pulp density attritioning an early unit operation. Attritioning removes the refractory coatings from the grains of the bulk concentrate. Sodium hydroxide (caustic soda) is used when and as required

as a de-flocculant, normally at the rate of 150g/t. The cells are operated at the maximum possible pulp density short of bogging. Pulp density control is effected on the basis of the power being drawn by the first cell. One of the authors (Stitt) developed such a control mechanism for a glass sand plant in 1975. Experience with that installation was excellent and we gathered that was also SRL's experience.

A single stage cyclone wash follows attritioning with the bulk concentrate going to a surge bin. Surge bin discharge is again cyclone washed with the cyclone spigot product going to a two product hydraulic classifier. Classifier coarse and fine products go to further sizing and to gravity upgrading of the bulk concentrate.

The froth flotation based zircon recovery plant was installed in 1990 and had its origins at a time of record mineral prices. With the collapse of zircon prices on the World market, the plant is mainly used now to improve rutile recoveries. Zircon is stockpiled.

The cleaned and upgraded bulk concentrate is left to drain to reduce moisture and is then dried in a rotary dryer. Separation of the individual mineral species takes place in a conventional dry section using electrostatic separators and induced roll magnetic separators.

Product rutile and ilmenite is stored in bins prior to being transported in enclosed hopper trucks to the Company's port facility at Nitti, some 19km to the west (Figure 2).

From time to time and as required, mineral is loaded on to covered barges at Nitti and barged approximately 20 nautical miles (37km) downstream to the mouth of the Sherbro River and trans-shipped to bulk freighters for transport to Europe and North America.

5. The Future

SRL have to some extent been insulated from the current downturn in mineral prices by long term sales contracts. However as these

contracts terminate the Company is being placed under increasing financial strain. If SRL did nothing it is the Mission's view that the Company would be forced into a loss situation.

Sierra Rutile's strategy to avoid this happening is to spend approximately US$70,000,000 to increase production and to reduce unit costs. There are two main elements in this strategy. The first element involves purchasing a new Dredge/Wet Plant whilst the second involves upgrading the Company's power generation plant so as to significantly reduce energy costs.

The "new" dredge is in fact a rebuilt second hand tin dredge. It differs significantly from the existing purpose built unit in that the Wet Plant (concentrator) elements will be all on board the dredge rather than on a separate hull. This scheme will allow SRL to increase production by approximately 30% for a relatively modest capital expenditure.

It would boost investor confidence in Sierra Leone if SRL's upgrade programme could be seen to have been subject to minimal bureaucratic interference.

6. Rehabilitation

Apparently there was little or no rehabilitation for the original Sherbro Minerals operation. The same situation seems to have held in the early days of SRL. However by about 1987 the Company began paying serious attention to rehabilitation.

The Company recognised three rehabilitation environments:

* sand tailings
* lateritic subsoil
* dredged out mining ponds or lakes

Much of the early work focussed on trial plantings to determine the best tree species for rehabilitation, particularly comparing firewood and timber species. This work indicated that the firewood species tended to grow much more quickly and rehabilitation has taken advantage of this finding. In addition there have been trial

plantings of crop species such as cashews and palm oil. These plantings also appear to have been successful as may be seen from Figure 16.

Since 1987 in the order of 200-245ha (500-600 acres) of land has been rehabilitated, 60% of this being sand tailings and 40% being laterite subsoil. The main planting season for tree seedlings was 1990. It is part of Sierra Rutile's rehabilitation strategy that the mining operations of Sherbro Minerals as well as its own early operations will be progressively rehabilitated.

The mining ponds are quite large lakes which have the potential to be a more productive food source than the same area of agricultural land. For this reason it is intended to leave most of the ponds in place after cessation of mining. To increase pond productivity the Company is currently breeding 250,000 fish fingerlings each year, which are transferred to the major dredge ponds. The fish are bred on a 4-month cycle and fed on a diet of rice bran and fish meal. Cost of food is Le100,000/month. This programme is proving to be very successful.

The rehabilitation staff numbers 23 under a plant botanist (Abdul Hassam-King) trained at Kew Gardens. The 1993 budget is US$200,000, including fish farming. This sum covers materials and machinery and does not cover either permanent staff or contract labour. Contract labour is used for work such as hand brushing of sand tailings. Rehabilitation of sand tailings typically costs US$99/ha (US$40 per acre) at current prices. Again this does not include labour.

There was some discussion between SRL and the Mission on the possibility of discharging liberated fines on top of tailings. This procedure has been used in Australia in recent years and has been shown to have the potential to boost plant growth rates. Sierra Rutile are aware of the procedure and are examining means of implementing it.

7. Exploration

Sierra Rutile holds Special Exploration Prospecting Licence (SEPL)

2085 in the Moyamba and Bonthe districts of Sierra Leone (see Figure 2). The SEPL has an area of approximately 1,550km2. Within the SEPL there are 8 mining lease areas totalling about 500km2.

Sierra Rutile has carried out extensive exploration within their SPL and, we understand, to a much lesser extent elsewhere in Sierra Leone.

Exploration drilling in the Company's normal mining environment is executed using a 203mm (8") hollow flight auger drill. Each flight is 1.52m (5') long and has a hollow centre tube with a diameter of about 86mm (3.38"). An undisturbed sample tube is run down inside the hollow flight and percussion driven in 3 x 508mm (20") advances.

This methodology produces three undisturbed samples which together represent a 1.52m (60") advance. The 1.52m total interval is logged and the three samples bagged together.

The laboratory procedure involves:

* Dry
* Weigh
* Attrition
* Wet screen on 1.18mm
* Reject +1.18mm material and slimes
* Dry and split
* Magnetically separate one split using a Frantz isodynamic magnetic separator into magnetic and non-magnetic fractions.
* Pulverise and fuse (lithium tetraborate?) each fraction.
* XRF analyse each fraction for titanium.

Composite samples are prepared from the interval samples, each representing a total hole. These samples are magnetically separated and a heavy mineral separation is carried out on both the magnetics and the non-magnetics. Grain counts are made for each of the heavy mineral fractions and the data is reconciled back to the titanium assay results referred to above.

The Sierra Rutile drilling and assaying procedure is somewhat different to that generally employed in Australia and, to some extent, is an adaptation to the Company's unique resource. It is however a methodology capable of accurately categorising that resource.

Tailings are drilled with 76mm (3") diameter Banka-type Drill using a cable operated sludger. It is the Mission's experience that this particular technique may not produce a representative sample since it is not possible to accurately control the sample weight recovered per interval drilled. In our experience this potential problem could be overcome by using a smaller diameter (50mm) rig with a rod-operated rather than a cable-operated sludger.

It is difficult to comment as to how much of a problem the cable-operated sludger would present in assessing tailings. For a situation where mineral is uniformly distributed there would be no problem at all. However if the mineral were to be concentrated in narrow bands in a similar manner to a wave concentrated deposit, the failure to control weight recovered per interval drilled would inevitably lead to a considerable down-grading. Much would depend upon the way in which the tailings are stacked.

We understand that the limited exploration work which SRL carried out further south in beach and fossil beach environments, have generally been with cable operated Banka-type rigs. In this situation significant down-grading could be expected.

8. Human Resources and Community Relations

The Sierra Rutile workforce is well educated and highly literate. Arguably in this respect the Company has the best workforce in Sierra Leone. A number of senior Sierra Leoneans have come from the National Diamond Mining Company. Further, the workforce appears to be stable, no doubt as a result of superior wages and conditions.

Sierra Rutile negotiates basic wages each year with the United Mine Workers Union; the single union representing the workforce. Conditions of service are renegotiated every two years.

Considerable attention appears to be given to safety. For instance no one is allowed aboard the dredge, the Wet Plant or the vessels attending them without a life preserver. There are on job training programmes and some staff are sent to longer term Government training schemes.

The need to mine large areas and to dam even larger areas means that some villages need to be relocated. Compensation is assessed and a new village is constructed in consultation with the community being moved. The Mission visited a relocating village which was under construction and a number of villages which had been relocated and which had been occupied for some time. The quality of the buildings and the community amenities seemed to be considerably better than those of villages elsewhere in the Moyamba District.

There is, however, a problem with compensation. Under the terms of its agreement with GOSL, SRL pays compensation to the Government and it returns to the landholder, at least in theory, via the Freetown bureaucracy and the Chiefdom. However virtually all the compensation payments made by SRL were being "lost" en route to the recipients. The matter was the subject of some debate in the press during the Mission's visit to Sierra Leone. The approach that SRL was taking was that the problem was basically between GOSL, the bureaucracy and the villagers. The unfortunate thing was that the Company was getting bad publicity from the matter.

Besides village relocation, SRL has community health and sanitation programmes for all communities affected by its operation. These programmes include training in respect to community health, sanitation and personal hygiene as well as assistance with installing latrines for each house and digging deep water wells for the various communities. The Company also assists a number of aid programmes eg SAVE, CARE and STARFISH.

For immediate health problems there is an eleven-bed clinic staffed by two doctors and ten nurses. In addition eye and dental clinics are held periodically.

B. Sierra Leone Ore and Metal Company

1. Background

Sierra Leone Ore and Metal Company (Sieromco), a wholly owned subsidiary of Alusuisse, signed an agreement with GOSL in 1961 to prospect for bauxite in Sierra Leone.

Mining operations commenced in September 1963 in the Moyamba District, South Central Sierra Leone (Figure 2). A town (Mokanji) was set up at this site which has become the headquarters of Sieromco's operations in Sierra Leone. Mokanji is also the site of a number of company workshops, the Main Laboratory, the Geology Department and the Central Stores.

Production in the first year of operation was 127,000 tonnes of bauxite which rose to approximately 1,400,000 tonnes/year by 1988. Production capacity remains at about this level.

By 1982 bauxite reserves in the Mokanji area were almost depleted. Operations were transferred to Godama, approximately 25km to the south east of Mokanji. A new washing plant was built at Godama, together with a workshop for servicing the mine earthmoving equipment. A new 19km road was built from Godama to Nitti; the site of the drying plant and the port.

2. Geology

Sieromco's operations are centred on an elongate NNW/SSE trending belt within the Precambrian Kasila Gneiss (Figure 3). The strike length is approximately 55km. Within this belt discrete feldspar rich lenses have undergone intense tropical weathering to yield a massive bauxite which displays relict structures from the parent gneiss. The bauxite is markedly different to the pisolitic bauxites found in other parts of the world; e.g. Australia.

The Mokanji deposit (the first deposit to be mined by Sieromco) was discovered in 1960 by the Geological Survey of Sierra Leone, working under contract to Sieromco. This deposit averaged 55% to 56% alumina and 4% to 5% silica, Anon (1983). The deposit is gradationally underlain by kaolinitic bauxite and kaolinite in that

order. The bauxite is low in organics.

The Gbonge Hills deposit (the one currently being mined, Figure 3) is similar to Mokanji except that the Kasila Gneiss has a higher feldspar content in this locality. The result is a bauxite containing about 58% alumina and 2% to 3% silica, Anon (1983).

3. Operation

Grade control planning ahead of mining is based on drilling and assaying. Overburden is removed by bulldozer and bauxite ore is loaded by hydraulic excavator into 18 tonne dump trucks for transport to the washing plant (Figure 9).

Typically ore from a number of pits is blended so as to give a consistent head grade.

Ore from the mine is tipped into a bin at the Godama washing plant (Figure 10). It is sized at 70mm on a wobble feeder/grizzly with the oversize going to an impact crusher and the undersize going to a rotary drum scrubber. The scrubber discharge goes to wash/screening with the -2mm undersize going to tails and the +2mm material going to product. Crusher discharge is also wash/screened with the -1mm fraction going to tails and the +1mm fraction to product. Tails are pumped to a large tailings disposal dam.

Plant recovery is normally in the range 60 to 65% and the plant capacity is in the order of 600 tonnes/hour. When allowance is made for plant availability, production is normally in the order of 4,400 tonnes/day. During the Mission's visit, operations were on a two by eight hour shift/day basis. The production of 1,400,000 tonnes/year of beneficiated bauxite requires operating on a two by ten hour shift/day basis.

Beneficiated bauxite is sent to Nitti harbour by truck convoy. The convoy approach was adopted to avoid head-on collisions on the Company haul road.

At Nitti the bauxite is either stockpiled or is sent to a rotary dryer (capacity 2,000 tonnes/day) where the moisture content is

reduced to less than 5% prior to stockpiling in a 50,000 tonne undercover facility.

When and as required bauxite is loaded on to 2,000 tonne capacity barges and barged approximately 21n miles (39km) downstream to be transferred to bulk (25,000t to 40,000t) ore carriers. Sieromco's markets are chiefly Europe and the United States.

After mining, the area is re-contoured and the topsoil pushed back as the first stage in rehabilitation. As the bauxite is typically developed in undulating country and the mining depth is generally less than 6m there is normally no problem in re-contouring to a self draining profile. The area is then replanted with seedlings, typically eucalypts.

Sieromco also runs community health programmes, sanitation programmes and personal hygiene programmes as well as a medical clinic. This appears to be similar to SRL, but on a smaller scale. Sieromco appears to have a higher percentage of expatriate to indigenous senior staff than does SRL.

The Sieromco operation is simple from a technological point of view. It does, however, appear to be well run and it does, particularly since the renegotiation of the Company's agreement with GOSL, contribute significantly to government revenue and to hard currency earnings. However as for Sierra Rutile, the Company is a minor player in a highly competitive international market characterised by depressed commodity prices.

As a consequence, profitability is likely to be low or non-existent. In this environment the options for GOSL to raise significantly more revenue from the Sieromco operation are seen as strictly limited and could risk putting the operation into liquidation. Further, extracting significantly more revenue from Sieromco would mean a unilateral renegotiation of the 1992 agreement. As is the case for Sierra Rutile, such a move would be counter-productive to any attempt to attract additional mining investment to Sierra Leone.

C. Sierra Leone Development Co. Ltd. (Delco)

This company was set up to export iron ore from the Marampa deposit about 8km east of the town of Lunsar (Figures 2 & 3) in the Port Loko District. The principals were the Scottish firm of William Baird and Co.

The Marampa iron ore deposit comprises a laterite capping developed on massive specularite schists within the Precambrian Marampa Schists (Figure 3). The major mineral is haematite and the ores are characterised by very low silica and phosphorous contents. The iron (Fe) content averaged 40%; 45% maximum.

The ore was transported approximately 80km via a company owned railway to a purpose built port at Pepel on the Sierra Leone River. Ore was loaded onto ships at Pepel for transport to Europe. Export volumes ranged from 500,000 to 1,000,000 tonnes/year.

Delco operated for approximately 40 years and closed down in 1975, chiefly due to ore depletion. The company was subsequently liquidated and the assets were acquired by the 100% GOSL owned Marampa Iron Ore Co. Ltd.

About 1981 Austromineral, a mining subsidiary of Austria's state owned steel industry, set out to re-activate the project. In the order of 5,000 tonnes of iron ore was exported before Austromineral withdrew.

The project is currently dormant. Given the present state of the international commodity markets and ore quality considerations, it is unlikely that this or any other Sierra Leonean iron ore project would be financially viable.

D. National Diamond Mining Company

1. Background

The National Diamond Mining Company (Sierra Leone) Ltd (known as NDMC or Diminco) carried out large scale alluvial diamond mining in

the Kono district and also at Tongo (Figures 2 & 3). In more recent years the company mined two kimberlite pipes at Koidu and processed the crushed material through its No. 11 alluvial processing plant, also at Koidu.

The Government is the major shareholder in NDMC and appoints the Chairman, the deputy Chairman and the majority if not all the other directors. NDMC is currently in liquidation.

2. History

The origins of the National Diamond Mining Company lie in the history of the discovery of diamonds in Sierra Leone and the operations of its predecessor company, Sierra Leone Selection Trust (SLST); a De Beers subsidiary.

Diamond prospecting in Sierra Leone began in 1926 with the first discovery made in 1930 near Yengama, approximately 10km west of the twin towns of Koidu and Sefadu in the Kono District (Figures 2 & 3).

Alluvial mining began in 1934 at Yengama by SLST under an exclusive agreement with the Colonial Administration. Following a 1952 discovery, mining began at Tongo in 1954; some 50km to the south of Yengema. Production increased rapidly to an average of about 650,000 carats/year and peaked at 2,000,000 carats in 1970. Following Government involvement in 1970 production began to decline from the mid 1970's, falling to 100,000 carats/year of recorded production in 1985. This drop in production is widely attributed to Government interference. However it has also been attributed to the depletion of the high grade alluvial deposits. This resource depletion thesis ignores the kimberlite potential of Sierra Leone and is also at odds with the production volumes allegedly being achieved by the illegal miners over recent years.

Large-scale alluvial diamond mining operations in Sierra Leone came under the sole control of SLST for about 50 years. However in September 1970 GOSL and SLST reached an agreement and incorporated NDMC, in which the Government owned 51% and SLST 49%. Under this agreement SLST retained technical management of the operation.

This development was, in effect, a partial nationalisation of the operations of SLST. SLST, concerned that the alluvial resources were approaching depletion, wished to gradually shift to the mining of diamondiferous kimberlites. Apparently GOSL did not want to make the investment that a switch to kimberlite mining would entail and vetoed the proposal.

In early 1980 British Petroleum (BP) acquired Selection Trust and as a result SLST became a wholly-owned subsidiary of BP Minerals International. In October 1984, BP Minerals withdrew from Sierra Leone and their 49% interest in NDMC was taken up by Precious Minerals Marketing Company Ltd (PMMC). PMMC is a Sierra Leone registered company in which the Government owned 25%. These moves gave GOSL an effective 63.25% interest in NDMC.

When BP Minerals pulled out, PMMC took over as managers of NDMC. Later in July 1986 the management was transferred from PMMC to a seven man Interim Management Committee appointed by the Government.

The fortunes of the NDMC operation began to go into decline almost immediately after GOSL's partial nationalisation in 1970. This trend accelerated after the October 1984 withdrawal of BP Minerals and resulted from a downturn in management capability and the commencement of a period of interference in NDMC's operations by individuals with little mining background.

In 1988/87 GOSL commissioned an independent investigation into NDMC. The investigation was carried out by Kwame D. Fordwor. Amongst Fordwor's comments the following perhaps most succinctly summarises the situation:

> *"There is much evidence that Diminco has been grossly mismanaged since 1984. Morale on the mine is non-existent due to a breakdown of normal lines of communication, erosion of lines of authority and responsibility, lack of proper funding and undue interference by individuals given authority by PMMC far in excess of their knowledge or competence in the mining industry. A well run mine is now in shambles. Accusations of corruption, nepotism, tribalism and favouritism are ripe.*

Competent men were fired and were replaced by incompetents; trust broke down and the corporate fabric was left in tatters ..."

NDMC (Diminco) is now in liquidation. The World Bank has come down heavily on the side of liquidation and the Mission agrees with their logic. However we note a puzzling paragraph in the World Bank Mission's November 1992 report on the matter:

"In the period between 1986 and December 1991 NDMC continued to defy the Ministry of Mines and continued with its operations without the benefit of a validly extended lease term. The company's leasehold expired at the end of 1985 and the company failed to request an extension thereof under Section 2 of Schedule D (Agreement between Government and DIMINCO) of the Act. That section permitted extensions of leaseholds for a period not to outlast beyond 1995."

The Mission was given copies of three documents which purport to be:

* A letter from the Managing Director of NDMC to the Minister of Mines dated 1 **October 1984** requesting an extension of the company's exclusive licence to "... *explore for, exploit and produce, take, dispose of and market diamond and gold throughout its lease areas at Yengema and Kono ...*"

* A reply to the above letter from the Permanent Secretary dated 23 **August 1990** in regard to the extension of NDMC's licence.

* A letter from the Chairman of NDMC to Minister of Mines on the subject of the Extension of NDMC's licence, dated **19 September 1990.**

From these documents it appears that, contrary to the World Bank Mission's belief, NDMC did apply for an extension to their licence as required under the terms of the Licence Agreement, and were

largely ignored by GOSL. A number of Sierra Leoneans confirmed this and claimed that there was, in fact, much more extensive correspondence than had been shown to the Mission.

Over the time of the debate on the extension of NDMC's licence the Company was majority owned by GOSL and for most of the time was managed by a GOSL appointed Committee. It would therefore have been a simple matter for the Government to resolve this matter. That they chose not to do so appears to have had more to do with GOSL's negotiations with a number of foreign companies (eg Sunshine Mining Company) on developing the kimberlite pipes (within NDMC's licence area) than with anything else.

The World Bank Mission appears to have been misled over this matter, as no doubt the current Mission has been misled over some details of its brief. Perhaps a more critical approach to information vetting is indicated.

3. Geology

Alluvials

Most diamond production in Sierra Leone has been from alluvial deposits. They cover extensive areas in the Koidu/Yengema region and also at Tongo, approximately 50km to the south.

The alluvial deposits have formed as a result of weathering and erosion of mainly granitic rocks intruded by kimberlite pipes and dykes. Gravels resulting from this process were transported by streams and deposited on the largely granitic bedrock. These gravels are overlain by clays and sands.

About 65% to 70% of Sierra Leone's alluvial diamonds comprise high quality gemstones which have a good reputation in international markets. Stone size generally lies in the range 0.03 carats to 50 carats with the largest recorded diamond being approximately 780 carats. Micro diamonds are found down to 0.002 carats.

Alluvial grades for properties being worked generally lie in the range 0.25 to 2.0ct/m3. Ground with grades of 0.4ct/m3 or above is looked on with favour; grades of 0.25ct/m3 and below are generally

viewed as marginal.

A trial dredging programme was run in the Sewa River (Figure 3) from 1962 to 1965. The Sewa is a major river draining the Kono District diamond fields. The dredge was a suction cutter unit with a throughput of 19m3/hr. Grades were <0.25ct/m3 and proved to be uneconomic. It is not known if the river bottom was cleaned up or not. Failure to adequately clean the bottom of the river would inevitably reduce recovered grades.

The indications then are that alluvial grades in the streams close to the source kimberlites are considerably higher than they are in major rivers such as the Sewa. Lower observed grades in the Sewa are almost certainly due to dilution effects.

The SLST method of assessing alluvials involved sinking 1.83m (6') diameter pits and processing the wash and so won through a prospecting plant basically comprising vibrating screens and jigs. Diamonds were hand picked from the jig concentrate, weighed and the grade calculated in terms of carats per cubic yard (ct/yd3) of alluvial wash.

Kimberlites

Kimberlite is the most common host rock in which the diamonds occur. Two occurrences are known within Sierra Leone with the first at Koidu/Sefadu in the Kono District and the second in the Tongo District some 50km to the south (Figures 2 & 3). At each location kimberlite occurs as dykes and "blows" (dyke enlargements); however at Koidu three small pipes have also been discovered. The kimberlite has been intruded into a Precambrian granitic basement.

At Koidu the kimberlite, for the most part, occurs in flat to gently undulating terrain. The three pipes occur within about 2.5km of each other.

The Koidu dykes occur as zones and average 1m wide and dip vertically. They are nearly parallel, striking between N60oE and N70oE. Overall individual dykes extend over strike lengths ranging

up to 5km.

The greatest number of dykes occur near Koidu where they join into the pipes. Some of these dykes have been mapped in detail and sampled. It is estimated that the total strike length of all dykes in the Kono District is about 500km.

All dykes contain porphyritic kimberlite with inclusions normally comprising scattered small granite xenoliths. The surface 10m of kimberlite is weathered to greenish-brown clay.

The Koidu kimberlite pipes and the dykes are all related.

Pipe No. 1 crops out 1.2km south of Koidu town. It is a true kimberlite pipe filled with kimberlite breccia containing granite xenoliths measuring 25-75mm across in a matrix of grey-green kimberlite (Figure 11). Although related to the dykes, this pipe is a separate body and is not a dyke enlargement. It is elongate and has a surface area of 2480m2 and plunges at 78° (Figure 12).

Sampling has been undertaken at the surface and near the surface, and underground down to the 120m level. The top 20m of the pipe has already been mined. Along certain sections of the pipe walls, but still within the pipe, are large irregular masses and pockets of porphyritic kimberlite without xenoliths. These are greenish-black, micaceous masses, riddled with carbonate veinlets, which are exceptionally susceptible to weathering. The pipe filling is often separated from the country-rock by a lining of dull-green or red-brown asbestiform material, about 10mm in thickness and consisting largely of talc and calcite.

The country-rock surrounding Pipe 1 is a coarse-grained hornblende granodiorite (granite) which is sliced through by flat-lying water bearing joint planes.

Pipe No. 2 (Figure 13) is circular, has a surface area of about 4645m^2 and is about 700m to the east of Pipe No. 1. It has also been surface mined (to a depth of approximately 24m) and again the resulting pit has flooded.

Four distinct types of kimberlitic material occur in this pipe:

i) Porphyritic kimberlite in the form of irregular masses, dykes, and possibly, sills.

ii) Polymict kimberlite breccia, similar to that which forms the bulk of Pipe No. 1.

iii) Fine feldspathic kimberlite breccia (tuffisite) which consists principally of fine granitic debris intimately mixed with a little kimberlite material.

iv) Boulder breccia, which consists of close-packed, well rounded granite boulders up to 1m in diameter in a tuffisite matrix.

All these four components of the pipe contain diamonds, and values appear to be highest in the porphyritic kimberlite.

The granodiorite country rock adjacent to the pipe outcrop is intersected by numerous dykes and stringers of porphyritic kimberlite, most of them with their strikes approximating to the usual kimberlite strike, N65°E.

The presence of large granitic boulders revealed by sampling at the surface, has been shown to decrease with depth.

Pipe No. 3 crops out about 2.5km to the east of Koidu Town and lies under a swamp. It has not been investigated in detail but appears at present to be smaller than Pipes 1 and 2 and consists of both kimberlite breccia and porphyritic kimberlite.

4. Ore Reserve Estimates

Geological mapping, sampling, diamond drilling and examination of drill cores have been used to outline the shape and extent of the kimberlite occurrences. Diamond grades have been determined from the treatment of bulk samples of the kimberlite.

A report due to Outokampu and NDMC (1988) details the methods used

for evaluating each pipe. Table 3 is taken directly from that report and summarises the estimates of reserves as they were then known.

TABLE 3
Outokumpu/NDMC Resource Estimate 1988
Revised Ore Inventory - Koidu Kimberlites

BLOCK LIMITS		RESERVES IN TONNES		
OREBODY	BY LEVELS	MEASURED	INDICATED	INFERRED
PIPE 1	41m-91m	323640 (0.63)*		
	91m-120m	187711 (0.75)		
	120m-300m			1165104 (0.67)
PIPE 2	40m-78m	460691 (0.4)		
	78m-300m			2991406 (0.4)
DYKE ZONE A	11m-22m	8096 (0.92)		
	22m-80m			42689 (0.69)
	80m-102m	16192 (0.57)		
	102m-300m			145732 (0.69)
	10m-300m			1229205 (0.43)
TOTAL TONNAGE		996330		5274136
AVG. GRADE (ct/tonne)		(0.55)		(0.48)
TOTAL CARATS		547982		2531585

* figures in brackets are grades in carats/tonne

5. The Operation

All NDMC's operations ceased in October 1992 when rebel forces invaded the Kono District and drove out most of the civilian population. The Sierra Leonean army subsequently pushed the rebels back towards the Liberian border, however NDMC is now in liquidation and operations will not recommence until the Company's future has been resolved. During the Mission's November 1993 visit to the Kono and the Tongo Districts there was still a very strong

military presence. Particularly in Kono, civil life was only slowly returning to normal and there was evidence of damage resulting from the rebel incursion. Descriptions of NDMC's operations therefore refer to activities prior to October 1992.

Alluvial material was mined by open-casting, using draglines ranging from $0.5m^3$ to $5.4m^3$ in bucket size. Bulldozers and scrapers were used for site preparation mostly during the dry season, and 20-35 ton dump trucks for haulage to No. 11 plant.

A heavy media diamond processing plant originally designed for the treatment of alluvial diamond wash at the rate of 73 tonnes/hour (80 short tons per hour) was commissioned in Yengema in 1968 (Figure 14). This plant is normally referred to as No. 11 Plant being the 11th in the series of plants that had been installed at various locations in the Yengema area over the time of SLST's operations.

Ore from the various mining areas within the lease was conveyed in trucks to the plant where it was tipped into a concrete lined elongate in-ground bin (Figure 14). Alluvials were recovered from the bin by a cable-operated slusher and the oversize rejected on fixed and vibrating grizzlies. Minus 150mm (6") material went to a 2.13m (7') x 4.88m (16') rotary drum scrubber/trommel which liberated diamonds from clay. Plus 55mm trommel oversize went to reject whilst -55mm undersize went to further processing.

Further screening took place to separate the -55mm material into two size fractions i.e. -10 +1.5mm and -55 +10mm. The former fraction was treated in a heavy media cyclone whilst the latter was treated in the heavy media cone separator. The heavy medium, which is a suspension of magnetite and ferrosilicon, has a specific gravity of 2.48 in the heavy media cyclone, and a specific gravity of 2.8 in the heavy media cone. Diamonds and heavy minerals sink whilst quartz, feldspar and etc. float.

The concentrate from the heavy media section gravitated to sealed bins which were subsequently conveyed to a separator house, 15km away, where final separation of diamonds was carried out by means

of X-ray sorters, grease vanners and hand sorting, under strict security.

Commencing in April, 1978, open-pit mining on Pipes 1 and 2 took place. The pipes were excavated in benches, using conventional explosives for blasting, and loaded with front-end loaders into dump trucks for haulage to the crushing plant at K-shaft adjacent to No. 1 pipe. After crushing to -37mm the kimberlite was trucked to No. 11 plant, 7km away.

Treatment of kimberlite in the plant followed almost the same route as that for the alluvials, except that it was stockpiled to weather for some months and the cone tailings were recrushed and screened to -10 +1.2mm for further treatment in the cyclone section.

Kimberlite was treated separately to the alluvials.

No. 11 plant was in reasonable, if somewhat rundown, condition when viewed in November 1993. It was judged as being fully capable of being refurbished and put back into production. However the kimberlite mining proposals (eg Outokumpu/NDMC) envisage building a new plant rather than using a refurbished No. 11 plant.

E. Artisanal Mining

1. Background

Artisanal mining is defined in the draft Mines and Minerals Act as:

> *"... operations carried out in the course of mining that do not involve expenditure in excess of US$0.5 million or the use of specialised technology for the production of limited amounts of minerals from deposits with few known ore reserves of a character not amenable to mass mining pursuant to Section 59; ..."*

Currently in Sierra Leone virtually all artisanal mining involves alluvial/eluvial resources of either diamonds or gold. Almost certainly diamonds predominate; however there is considerable

debate over the actual value of the annual production for each of these commodities. There is also considerable debate over the relative percentages of legal and illegal artisanal mining.

2. Diamonds

In 1956 the Alluvial Diamond Mining Scheme (ADMS) was set up primarily to break SLST's country-wide monopoly on diamond mining. The scheme, with amendments, still exists to-day and theoretically regulates artisanal mining. Currently all production in Sierra Leone is derived from artisanal mining.

In theory, under ADMS, a Sierra Leonean national (only a Sierra Leonean) is permitted to take out a 400' x 400' lease for a period not exceeding one year. Diamonds won from the lease are sold to a licensed diamond dealer who on-sells to a licensed exporter. In practice the licensee often takes out the lease on behalf of another party, or is financed by another party or sublets to another party. It is apparently comparatively rare for a Sierra Leonean to take out a lease, employ people and work the lease in his own right.

However a percentage of the production is mined illegally, bought illegally and exported illegally. There is a degree of interchangeability. For instance a stone which was mined illegally may be made legal by selling it to a licenced dealer. Further, some stones sold through Sierra Leone were mined in other countries and some Sierra Leonean stones are smuggled out of the country and sold as production from another diamond producing country.

It was put to the Mission that the licensing scheme for dealers in particular and to a lesser extent exporters, is little more than a cover for illegal operations. A licenced dealer unlucky enough to be stopped by the authorities, simply shows his licence and then sells any stones he had at the time, legally. If he is not stopped he sells them illegally.

Illegal export appears to be rampant. It is generally accepted that in excess of 90% of Sierra Leone's diamonds are exported to Belgium. In 1992 legal exports were recorded as 49,000 carats. An

estimate given to the Mission for total sales to Belgium in that year was 830,000 carats; implying the illegal export of about 780,000 carats. The 830,000 carats estimate purports to be based on survey data.

It should be noted that 830,000 carats/year is a higher production rate than that achieved by SLST through the late 1950's and for much of the 1960's.

Given:

* SLST's historic production figures,

* repeated predictions that alluvial resources are approaching exhaustion,

* that the Rebel War has disrupted life in the Eastern Province,

production of 830,000 carats for 1992 looks to be unrealistically high. However it appears to be the most soundly based estimate of those given to the Mission.

In support of a relatively high production figure we note that the World Bank believes that there could be up to 250,000 people employed in alluvial diamond mining in Sierra Leone. Such manpower figures imply a significant level of production. The only major alluvial operation noted during the Mission's brief visit to the Eastern Province was one at Tongo (Figure 15). This was a ticket mining operation involving some hundreds of miners who pay Le30,000/mth (US$53.60, say US$2.00/working day), for a "ticket" allowing them to mine. Ticket mining is a temporary scheme introduced in the aftermath of the Rebel War to quickly give employment to the local population. As US$1.00/day is a common wage in Sierra Leone a ticket cost of about US$2.00/working day implies significant production from this operation.

Although the ticket mining operation shown in Figure 15 was one of the few major artisanal operations sighted, quite a number of the streams crossed whilst travelling through the Tongo and Kono

regions were running muddy water, denoting sizeable upstream artisanal mining operations.

On th face of it and on a weight basis, in excess of 90% of the Sierra Leonean diamonds going to Belgium in 1992 were illegal exports. In money terms the situation is almost certainly worse since the Mission was informed that the bulk of the illegal exports comprise the more valuable stones. Much of the legally exported production was claimed to be in the US$100 to US$140/carat price range whilst a significant proportion of the illegally exported merchandise was said to be in the US$400 to US$10,000/carat range.

Assuming an average price of US$140/carat for the legal exports and an average price range of US$140 to US$500/carat for the illegal exports, we arrive at a rounded estimate of US$7,000,000 for the value of the legal exports and a range of US$110,000,000 to US$390,000,000 (say US$100,000,000 to US$400,000,000) for the value of illegal exports. The lowest creditable estimate given to the Mission for illegal diamond exports was US$50,000,000-US$60,000,000/year. The extreme range of estimates for the 1992 level of illegal diamond exports would thus appear to be in the range US$50,000,000-US$400,000/year against legal export of US$7,000,000. The Government (and hence the majority of the population of Sierra Leone) gets little return from the illegal sector.

Factors driving the illegal trade are:

* A marked tendency for diamonds that are mined illegally to be sold and exported illegally.

* The cost and hassles in selling and exporting legally.

* A prohibition on the involvement of the public service in mining coupled with very low salary scales.

The evidence suggests that some of these illegal operations are

quite sophisticated, involving bulldozers, hydraulic excavators and we gather, jigging plants. Some would probably fall outside the MMA definition of artisanal mining.

It is widely accepted that politicians, public servants and elements of the Lebanese community, have had a long term involvement in illegal alluvial diamond mining.

However a major problem with the current situation is the potential incentive that it gives to frustrate implementation of the MMA and regulations and perhaps even the return to civilian rule. The Mission considers this to be a major problem which needs careful consideration. A key element in arriving at a solution would be to find a formula whereby the majority of the current illegal players would not feel threatened by implementation of the MMA and the return to democratic rule.

The Mission has attempted to approach this problem in a non-judgemental manner. Even so, we could see no satisfactory solution. The only scheme put forward which appears to have any chance of success is to broaden the eligibility requirements for those who can be involved in alluvial diamond mining. This course of action has many problems; e.g. conflict of interest. However it can be argued that an even greater conflict of interest exists with the current situation and that this conflict is hidden.

Failure to find a solution to this problem could have as a long term consequence, a delayed return to democracy and an adverse effect on the standard of living of all Sierra Leoneans.

Now to the question of the illegal export of diamonds. As previously mentioned, this trade is largely driven by the tendency for diamonds which are mined illegally to be exported illegally and by the costs and hassles involved in legally exporting diamonds. The legal procedure has been made ever more complex in an attempt to prevent smuggling. The problem is that the procedures are now so complex that they encourage smuggling.

The current export procedure involves:

* Visiting the Government Gold and Diamond Buying Office (GGDO) and having your stones valued. This appears to be done in a fair and systematic manner, with independent checking.

* A 1.5% valuation fee is charged plus a 1.5% tax, calculated on the assessed value.

* The exporter then has to visit the Department of Mineral Resources and have an export form filled out. This is free but you have to make payments "on the side".

* Then to the Bank of Sierra Leone to fill out a CD-2 form, surrender or show your dollar import form and more payments "on the side".

* Then back to the GGDO to show all your documents and pick up your diamonds. By this time everyone in Freetown knows your business and you are, according to one person interviewed, a marked man.

* Then to Lungi Airport to be checked by Customs, the Anti-smuggling Squad, the CID and the Military Intelligence. And more payments "on the side".

Not only is this system cumbersome and costly but the only people to have had problems with diamond exporting in recent times appear to be some of those who attempted to export legally. Two instances of groups attempting to legally export and running into major problems were put to the Mission. There appeared to be no recent cases where the authorities had made arrests in connection with a major illegal export operation.

A much simpler system for exporting diamonds is essential. One possibility would be to set up a "one stop shop" through the GGDO. Under this system an exporter would take his/her parcel to the GGDO, have them valued, pay all charges, obtain all approvals and go direct to Lungi International Airport with his/her sealed parcel

of stones, hand in is paper work and depart.

No review of artisanal mining can be complete without a comment on environmental damage and rehabilitation, or lack of it. The situation shown in Figure 15 is typical of artisanal mining operations around the world, particularly in third world countries. To be fair it should be noted that the type of environmental damage depicted in Figure 15 was exactly what happened in countries such as America and Australia during those countries' 19th Century gold rushes. By way of contrast, Figure 16 shows revegetation on tailings on one of SRL's mining areas.

The problem is that with a large number of miners (the World Bank estimates perhaps 250,000) considerable areas are affected and substantial damage is done. The artisanal sector in fact has the potential to do the greatest amount of environmental damage of any mining sector in Sierra Leone.

From an environmental point of view the artisanal mining sector is virtually uncontrolled and likely to remain so. The miners are generally living a subsistence lifestyle and have absolutely no interest in the environment and no incentive to participate in mine rehabilitation.

The draft MMA does address rehabilitation and artisanal mining. However the issue needs further consideration, particularly from the viewpoint of:

* specific rehabilitation techniques,
* damage done by past operations,
* operators who elect to abandon a lease without rehabilitation,
* illegal mining,
* funding.

The most critical issue is funding. The best solution here would be to turn a substantial proportion of the funds generated by fees on artisanal mining back into rehabilitation.

To sum up:

* All diamond mining in Sierra Leone is artisanal on alluvial resources.

* Despite the Rebel War, production appears to be substantial and mostly illegal.

* An extreme range for illegal exports for 1992 is US$50,000,000 to US$400,000,000.

* The Government gets little or no return from this illegal trade.

* There is a danger that the participants in illegal mining will seek to disrupt the implementation of the MMA and even the return to democratic rule if they feel threatened.

* Thought needs to be given to schemes which will remove the elements of illegality. A possible solution may be to widen eligibility for those who can be involved in alluvial mining. Such schemes should also examine the possibility of a fiscal return to Government of what has been an illegal operation.

* Export provisions are too complex and costly. They must be simplified.

* There is a substantial environmental problem which must be addressed.

3. Gold

Alluvial gold was first noted in Sierra Leone in the late 1920's in streams draining the 130 kilometre long Kangari Hills/Sula Mountains greenstone belt (Figure 3). The first reported mining of alluvial resources occurred in 1930. The recorded production from 1926 to 1957 was 342,800 ounces (about 10.6 tons), mostly from alluvials.

With the introduction of the Alluvial Diamond Mining Scheme (ADMS) in 1956, gold mining activities tapered off. However, by the early 1980's recorded production began to increase and reached 10,800 ounces in 1984. Production has fluctuated in the intervening years.

Currently all gold mining in Sierra Leone is artisanal on alluvial/eluvial resources. Much is centred on the Sula Mountains and the Kangari Hills. Again much of the mining is illegal as is the associated gold export business.

The levels of activity are much lower than they are for diamonds and the Mission found it much more difficult to obtain information for gold than for diamonds. Production estimates put to the Mission ranged from virtually zero up to US$100,000,000/year.

Recorded production for 1990 was 12,900 ounces and the most creditable estimates obtained by the Mission for current illegal production were in the range 30,000 to 50,000 ounces per year (US$11,200,000 to US$18,700,000 at US$374/oz). Even here these estimates should be viewed as little more than a guess.

II. TECHNICAL POTENTIAL

A. Rutile/Mineral Sands

1. Exploration Potential

There is potential for further rutile resources along the whole length of the Kasila Gneiss, both to the north west and to the south east of Sierra Rutile's SEPL. Any such resources could be expected to have a similar paragenesis to the Sierra Rutile deposits.

One known prospect occurs in the vicinity of the villages of Bradford and Rotifunk (Figure 2) approximately 65km south east of Freetown and north west of Sierra Rutile's SEPL.

A German consortium, Bayer/Preussag, were granted SEPL 2070 over this prospect in 1970. Between 1972 and 1975 925 holes were drilled totalling 13,155m; with an average depth per hole of about 14m. This work defined a mineralised zone approximately 12km long with width varying from 0.5 to 2km. Using a cut-off grade of 0.4% rutile, a resource of about 150 million tonnes at about 0.43% rutile was estimated.

A pilot plant was set up to the north of the Bradford/Rotifunk road at about N 8° 17' 57", W 12° 43' 11". In excess of 20,000 tonnes of material from a number of locations was put through the pilot plant and the results compared with the heavy mineral assay data from the bore hole samples. It was found that the pilot plant recovered in the order of 33% more rutile than had been predicted from the drill hole assays.

On the basis of their exploration data and the existing mineral prices Bayer/Preussag determined that the project was not economic at that time.

In 1990 Pioneer Resources NL (Pioneer) of Perth, Western Australia, acquired the property. Pioneer purchased at least part of the Bayer/Preussag data and carried out a drilling programme of their

own. Pioneer are understood to be studying options for the project and carrying out feasibility studies.

A casual field examination indicates that the Rotifunk deposit may be less affected by laterite than Sierra Rutile's resource but may have a higher clay content.

It is of course possible that there are other, as yet undiscovered, rutile deposits apart from those of SRL and Pioneer, but in the same geological environment.

Another possibility is the Pleistocene to Recent formations associated with the present coastline between the Liberian border and the western end of Sherbro Island. Wave or Aeolian mineral concentrations could be expected in this environment. The Mission understands that some exploration work has been carried out on this target area with disappointing results. However it is a large target (170km long by up to 20km wide) and further exploration could be warranted.

2. Secondary Processing - Overcapacity and Feedstock Demand

Secondary Processing potential is dealt with in more detail in Part 2, Section IV A of this report. The intention here is simply to record background data which became available on Stitt's return to Australia. This data quantifies comments made elsewhere in regard to world pigment production overcapacity. It also quantifies titanium feedstock production over-capacity. Comment is made in respect to the effect of over-capacity on Technical Potential, at least in the short to medium term.

In 1993 world capacity utilisation for Sulphate Process titanium dioxide pigment plants was in the order of 71%, whilst for Chloride Process plants the figure was around 84%. As a first approximation, average capacity utilisation for both process routes on the world scene was about 76%.

For 1994 projections are 77% utilisation for Sulphate Process, 88% for Chloride Process with an overall average of 83% utilisation. Beyond 1994 utilisation could drop back as additional capacity

comes on line.

Looking at the global scene it appears likely that utilisation of titanium dioxide pigment production capacity will remain in the range 75-85% for some years.

Were a pigment plant to be built in Sierra Leone in this time frame, it would be a high cost producer in a very high tech industry plagued by 15% to 25% over-capacity.

In addition, newly emerging pigment production technologies are likely to place further pressures on the market place.

As regards titanium feedstock, for Sulphate Process demand for sulphateable ilmenite was about 73% of world production capacity in 1993 and for sulphateable slag about 55%. Projections for 1994 are 78% and 55% respectively. For Chloride Process feedstocks, 1993 demand for ilmenite was 96% of available capacity, slag 85% and rutile 79%. For 1994, the respective projections are 100%, 89% and 82%.

The data for chlorinateable ilmenite is somewhat misleading since only one manufacturer (Du Pont) uses ilmenite in Chloride Process. Moreover, most of this ilmenite is supplied from captive sources with the balance coming from Australia and Sierra Leone (Sierra Rutile Ltd). There is thus no real competition between pigment producers in respect to chlorinateable ilmenite and although the projected demand as a percentage of capacity appears to be high, this is expected to have little effect on chlorinateable ilmenite prices.

Rutile is the preferred feedstock for what is increasingly the preferred production route; that is Chloride Process. However there is considerable excess rutile/synthetic rutile production capacity and it does not appear likely in this environment that there will be any pressure to significantly increase the current very low prices for natural and synthetic rutile.

One aspect of interest is the increasing resistance which certain

synthetic rutiles are encountering by virtue of their relatively high radioactivity levels. Radioactivity is basically due to the presence of small amounts of uranium and thorium, referred to in the industry as U-Th. The US and Japanese pigment producers in particular are sensitive to U-Th contamination in synthetic rutile.

One Australian synthetic rutile producer, Renison Goldfields Consolidated Ltd (RGC), the world's largest producer of mineral sands products with 25% of the natural rutile market and 40% of the world's synthetic rutile, zircon and monazite production, have developed a process for leaching U-Th contamination from synthetic rutile. However operating costs are rumoured to be high.

Even so it is most unlikely that the U-Th content of certain synthetic rutiles will have any significant positive effect on natural rutile prices.

The prognosis then is that prices for titanium dioxide feedstock will remain at or near the current low levels, for some years to come. This will put considerable pressure on a high cost producer, such as Sierra Rutile, to maintain long-term financial viability. In addition it may well prove to be a negative factor in respect to attracting investment into mineral sands exploration in Sierra Leone; at least for the short (0 to 2 years) to medium (2 to 5 years) term.

B. Bauxite

Bauxite is formed from a variety of rock types when subject to intense tropical weathering. Given that these weathering conditions exist over much of Sierra Leone, bauxite occurrences are widely distributed. Consequently there is excellent potential for bauxite resources additional to those covered by SIEROMCO's tenement. As might be expected, many of these occurrences are related to the Kasila Gneisses.

The prospectivity of Sierra Leone for bauxite is good, however the current depressed commodity markets are such that it would be difficult to define an economically viable project.

It is unlikely then that investors would be interested in bauxite in Sierra Leone, at least in the short term.

C. Gold

From a geological point of view, Sierra Leone would appear to be highly prospective for gold. There are significant areas of Precambrian greenstone which elsewhere in the world host major gold deposits. The largest greenstone belt covers the Kangari Hills and the Sula Mountains in Central Sierra Leone. Smaller greenstone outcrops are in the Ninimi Hills and the Gori Hills in central east Sierra Leone and the Kamboui Hills in the south east (Figure 3).

The age of the Sierra Leonean greenstones are in the range 2.7 to 2.9 billion years. For the most part they are composed of metavolcanics and metasediments and tend to exhibit an arcuate plan form from within a granitic basement.

All greenstones are mineralised with major alluvial gold production from streams draining the Kangari Hills/Sula Mountains belt.

Currently the best primary gold prospect is Baomahun, approximately 50km NNE of Bo at the southern end of the Kangari Hills (Figure 3). The area has been prospected and mined in a limited way since the 1930's. It has relatively high relief, is forested and heavily weathered. Access over the last 15km is over a somewhat difficult gravel road.

The present tenement holder, Precious Stones - Sierra Leone (Baomahun) Inc (Precious Stones), has spent in the order of US$5,000,000 on exploration and pilot plant testing between 1987 and November 1993. As with most mining projects, not all of this money has been wisely spent. The heap leach pilot plant testwork in particular has probably absorbed a significant percentage of the budget, with little to show for that expenditure.

This work has shown the gold mineralisation to be both structurally and chemically controlled and to consist of auriferous quartz-sulphide ore bodies in a highly deformed and interbedded iron-

formation mica schist unit. This is overlain by a thick succession of meta-volcanics with pillow lava horizons.

The more significant gold bearing ore bodies are confined to shear zones within the iron-formation horizons. Particles of metallic gold occur and range in size from 0.5μm to 1.5mm.

A 250m adit and a 28 hole diamond drilling programme has delineated a resource (indicated plus probable) of about 883,000 tonnes at a weighted average head grade of 11.4g/tonne (Table 4).

TABLE 4
Baomahun Gold Resource Estimates

Classification	Tonnes	Grade g/t
Probable	384,000	7.4
Indicated	499,000	14.2
Totals	883,000	11.4

These are encouraging results but unfortunately the size and the status of the resource does not justify a company scale mining operation. However there appear to be good prospects for upgrading the resource to a stage where a mine would be justified.

At this stage Precious Stones are seeking a joint venture partner. Current thinking is to commence open cut mining with a leach plant (say 200 tonnes/day) so as to establish a cash flow and then to continue exploration. At a later date plant capacity might be increased to 600 tonnes/day.

Whilst Baomahun has been studied in the most detail there are other primary gold prospects in the greenstone belts which are worthy exploration targets.

Although alluvial resources have provided most of the gold production in Sierra Leone to date, it seems unlikely that there is a major resource left which would justify a company scale operation. If there is an alluvial deposit which would support a company operation it would probably be a deep gravel resource in a

major stream (eg the Pampana R.) draining the Sula Mountains/Kangari Hills.

To sum up there would appear to be excellent potential for primary gold in the greenstone belts and a much lesser chance of there being a large alluvial resource.

D. Diamonds

The best chance of getting another major mining project operational in Sierra Leone in the shortest time lies with diamondiferous kimberlites. Here again, the most obvious targets are Pipes 1 and 2 and the dyke enlargement at Koidu.

As previously noted it was SLST's intention that NDMC move into kimberlite mining. It is a matter of history that these plans never came to pass.

In more recent years a number of feasibility studies have been carried out based on the Koidu kimberlites. The Mission has not been privy to all of these studies, however we understand that, whilst none see the project as another Argyle (the mine on the AK pipe in Western Australia which, in carat terms, currently produces about 40% of the world's diamonds) all are favourable.

At this point in time the problems appear to be more political and bureaucratic than they are technical. For instance:

* Diamond mining in Sierra Leone has had a very sorry history over the last 23 years. Any prudent potential investor would proceed with great caution and would want assurances from GOSL that history would not be allowed to repeat itself in regard to a new diamond project.

* NDMC is now in liquidation and although this is probably the best and fastest way of tidying up the mess, it may take some time to resolve all the issues.

* If the NDMC infrastructure in the Kono District is disposed of piecemeal by the liquidator it will add to

costs and to delays.

We see an additional problem in a UNCTC document (Allan, 1989) titled:

"KIMBERLITE DIAMOND PROJECT
SIERRA LEONE
Recommended Fiscal Regime"

The Mission strongly agrees with much of Allan's philosophy. However we have some reservations as to how his objectives are to be met. Amongst the broad philosophical points with which we agree are:

* *"Equally it is disastrous for the economy if strongly economic projects are discouraged with a harsh fiscal regime. This is stupid ideology."*

* *"To summarise: each project must make strong economic sense. Unless this is tested the trade off between fair return to Government and 'incentive' for the investor becomes a difficult and dangerous muddle."*

* *"- builds in a fair share of revenue to Government at all stages of the project cycle and commodity price cycle. - does not instinctively repel investors - even prior to their investing any money in exploration."*

However Allan's proposed fiscal regime includes a 3.5% minimum income tax, a royalty and an Additional Profits Tax. We appreciate that in recent years Sierra Rutile and Sieromco have both agreed to such conditions. However both projects have been in production for some years, have repaid their capital and have been making a profit for some time. What Allan is proposing is that for a new project in a field (diamond mining) having a very poor history, the Government is not prepared to take any of the risks but wishes to participate very strongly in the upside potential.

In addition, we note that a discount rate of 15% has been applied. In our opinion serious investors will, again given the poor history of diamond mining in Sierra Leone, either apply a higher discount

rate to more realistically reflect the risks involved, use a discount rate based purely on financial considerations and then apply a separate discount multiplier to allow for risk. Whatever the approach the result would be to make the project much less attractive than Allan's analysis would indicate. In short, it is our opinion that Allan's *"Recommended Fiscal Regime"* would be a disincentive to the majority of serious investors. We fully concede that we may be wrong and, for Sierra Leone's sake, we hope we are.

Nonetheless we strongly recommend that an open, honest and flexible approach be taken to negotiating with any potential investor. Decisions will need to be given promptly and not subsequently reversed. In addition GOSL should be prepared to defer the full implementation of Allan's *"Recommended Fiscal Regime"* for say 5 or 10 years.

Beyond the known kimberlite resources at Koidu (Table 2) there is further potential to locate economic reserves at depths below those already tested in the dyke and pipe systems. Further, it appears that only relatively short lengths of the dykes have been sampled and tested, and there is a good chance of finding economic reserves within the untested dykes. Detailed examination of these dyke extensions may lead to the discovery of further pipes.

There appears to be very little in the literature in regard to the Tongo kimberlites. However Anon (1986?) comments that the Lando dyke has been surface sampled for *"... a grade in excess of 0.80 carats/tonne ...."*. It would appear that further detailed investigations is warranted at Tongo.

Hall (1968?) noted that there are diamondiferous alluvials up to 110km (70 miles) from the nearest known kimberlite. These alluvials have none of the accessory minerals associated with the Kono/Tongo kimberlites. The Geological Survey of Sierra Leone suspects that the absence of a kimberlite suite of indicator minerals may mean that these particular diamonds were shed from a different type of host rock.

Although the Survey does not speculate further on this point, an example would be the lamproite pipes in Australia. The fact that lamproites have a different suite of indicator minerals to kimberlites slowed diamond exploration in Australia for many years. Ultimately however the geological significance of lamproites were recognised and the AKI lamproite pipe at Argyle has proved to be by far the richest diamond pipe in the world.

The message is that for Sierra Leone there are known diamondiferous kimberlites PLUS an indication that diamonds may also be associated with other rock types. Any regional exploration programme should keep this point in mind.

E. Base Metals

The greenstone belts of Sierra Leone, namely the Sula Mountains, the Kangari Hills, the Kambui Hills, the Ninimi Hills and the Gori Hills (Figure 3) are prospective for copper, lead and zinc.

Stream sediment sampling has given anomalous values for all three metals, particularly in some streams draining the Ninimi Hills.

In addition copper sulphides have been discovered associated with the Freetown norite/gabbro complex (Figure 3). These sulphides are developed at the contact between Freetown Complex gabbro and the Kasila Gneiss.

F. Platinum

Most of the streams draining the Freetown Norite/Gabbro complex to the west contain alluvial platinum. The platinum is associated with ilmenite, magnetite and subsidiary chromite.

These streams were worked for platinum over a 20 year period commencing in 1929, for a total recorded production of 163kg.

The platinum occurred as coarse, angular fragments with the largest recorded nugget weighing 25g. A 1936 Imperial Institute assay for crude alluvial platinum is set out in Table 5.

TABLE 5
Assay for Alluvial Platinum from the Freetown Complex
Imperial Institute 1936

Metal	Wt%
Platinum	77.70
Palladium	11.45
Iridium	0.48
Osmiridium	2.35
Rhodium	1.08
Gold	0.07
Total	93.13

The streams carrying the best values had their source in or cut across an intrusion of coarse grained anorthosite or anorthositic gabbro. The Geological Survey of Sierra Leone postulated that there appeared to be geological similarities with the Stillwater Complex in Montana (USA).

In 1969 an offshore investigation for alluvial platinum was initiated to the west of the Freetown peninsula. This work indicated that the possibility of economic offshore deposits of platinum was unlikely.

Later geochemical studies of residual laterites showed a uniform distribution of platinum over the western part of the Freetown Complex.

G. Others

Sierra Leone is prospective for a range of metals and minerals beyond those discussed in A to F above. Chief among them are:

1. Chromite

Chromite was mined in the Kambui Hills near Bambawo in the Kenema District from 1937 to 1963. The resource comprised large chromite rich pods and lenses in ultrabasic rocks in the north of the Kambui greenstone belt.

2. Nickel

Nickel has been recorded for the Freetown Complex, the greenschist belts and the Mano-Moa granulites in the Gola Forest area of eastern Sierra Leone.

3. Nepheline Syenite

Nepheline syenite finds wide use in the ceramics industry as a fluxing agent and as a source of alumina in glass. Nepheline syenite is known to exist in commercial quantities at Bagbo, near Vaama village in south east Sierra Leone close to the Liberian border.

Testing of the deposit determined that after magnetic separation the quality of this deposit was virtually equivalent to the Canadian "A" grade nepheline syenite after magnetic separation.

4. Kaolin

Deposits have been identified in the Moyamba and Bonthe districts.

5. Talc

Talc was located prior to 1956 in the Mamansu area. The anthophyllite schists are often exceptionally rich in talc. No further investigation of these deposits seem to have been carried out since 1956.

III. DISCUSSION

The original objective set for the members of the Mission was to advise GOSL on means for expanding the revenue base of the country with especial reference to rutile mining and the secondary processing of rutile. It is the opinion of the Mission that the potential to expand Sierra Leone's revenue based solely from the operations of Sierra Rutile or Sierra Rutile plus Sieromco are strictly limited. The secondary processing of rutile to produce titanium dioxide pigments is also seen as not being an option in the short term.

However Sierra Leone is a mineral rich country such that taking a broad view, the prospects for expanding the revenue base from mining are excellent.

The three commodities/metals having the greatest chance of developing into a successful mining project, given current knowledge and current world commodities market, are, in priority order:

* Diamonds in kimberlites
* Primary gold
* Base metals

The two projects which appear to have the greatest potential to be brought into production in the shortest time are the mining of the kimberlites at Koidu and the Baomahun primary gold project. These two projects should be accorded maximum political support and be subject to the minimum bureaucratic interference.

The kimberlite project is more advanced and appears to have the greatest technical potential. However, its history and the liquidation of NDMC coupled with the current state of the international diamond market, are significant negative factors.

A realistic time to get either of these projects into production is two to five years; assuming adequate political support by GOSL and minimum Government interference.

In regard to secondary processing of minerals, the Mission is strongly of the opinion that the best area to try and encourage development would be a ceramic-based brick and roofing tile industry. This industry is more an area of expertise of Mr Graham Smith. However, the author of this section of the report (also with a background in glass and ceramics), endorses this approach. Mr J-P Viellard is also in agreement.

To attract foreign investment either directly into mining or into the development of a ceramics industry, will require the creation of a stable economic climate conducive to investment. In regard to the mining industry, in particular, this could involve:

* the adoption by Sierra Leone of a mining law familiar to western mining companies,

* minimal Government involvement,

* the adoption of adequate incentives to generate investor interest,

* the setting up of a one-stop shop investment advisory group attached to the Department of Mineral Resources,

* the preparation by the Geological Survey of:
  . an inventory of known mineral occurrences in a form suitable for presentation to exploration companies,
  . the preparation of a set of 1:250,000 geological maps,
  . the preparation of a geological data base.

* a strengthening of the Department of Mineral Resources and especially the Geological Survey by the addition of specialist staff; eg a legal expert, an environmental expert and a mineral economist.

The Mines and Minerals Act will have serious limitations unless it is accompanied by an appropriate set of regulations covering such matters as mining rights, application procedures and etc. Urgent attention needs to be given to this matter. The Mission is

strongly of the opinion that input to the drafting of the regulations should be sought from professionals who work with Mining Acts on a day to day basis. This does **NOT** necessarily mean lawyers exclusively.

It is the personal experience of the author of this section of the report, that in Australia the top mining title consultant firms are more familiar with the Mining Acts of the various States than are nearly all legal professionals. Many major legal firms in fact use the services of titles consultants on a regular basis.

It is the opinion of the author, that the involvement of a top firm of mining titles consultants would be a very cost-effective approach to the formulation of a set of regulations to accompany Sierra Leone's Minerals Act.

A final point. It sometimes happens that measures to attract mining investment to a developing country actually discourage investment on the part of nationals from that country. It is suggested that any initiatives to attract foreign investment to Sierra Leone not be formulated so as to discriminate against local investment. For Sierra Leone this could be particularly important. The evidence suggests that the illegal artisanal diamond mining sector could be substantial. It might be possible to gradually attract investment from this area into mining projects which are legal. This could act to the benefit of all Sierra Leoneans.

Both SRL and Sieromco were late in adopting rehabilitation practices commonly used elsewhere in the world. However since 1987 progress has been commendable, particularly for SRL. Notwithstanding, revegetation practices and the progress of revegetation programmes for both companies should be monitored. The objective of this monitoring should be to ensure that revegetation procedures are satisfactory in the long term and that large "backlogs" of unrevegetated land are not allowed to develop.

Artisanal alluvial mining is seen as by far the greatest environmental problem and the bulk of GOSL's efforts in regard to mining rehabilitation need to be directed into this sphere if the

development of major, and costly, environmental problems is to be avoided.

PART TWO

ECONOMIC ASPECTS AND OPPORTUNITIES FOR SECONDARY PROCESSING

IV. ECONOMIC ASPECTS

A. Current Situation

In December 1989 GOSL adopted a 3-year Structural Adjustment Programme, which was approved by the International Monetary Fund (IMF). The implementation was however delayed owing to the IMF's concern at the then Government's continued failure to reduce expenditure, or to control debt arrears. In 1990, according to estimates by the World Bank, Sierra Leone's Gross National Product (GNP) was US$981m, equivalent to US$240/head.

During 1980-90 GDP increased in real terms at an average annual rate of 0.9% but real GDP/head actually declined by 1.5% because over the same period the population increased by an average annual rate of 2.4%.

In 1991/92 the Rebel War impeded the Government's efforts to create economic stability and the disruption of agricultural production and trade resulted in a decline in real GDP, while the additional Government expenditure necessitated by the war increased the current account deficit to an exceptionally high level. In April 1992 the Government announced the adoption of an economic programme, monitored by the IMF, which was principally designed to increase monetary controls, to develop a foreign exchange market and to improve the management of the country's natural resources.

The Government also aimed to continue the implementation of structural reforms, including the reduction of civil service staff and privatisation. Under an agreement with the IMF Sierra Leone was able to accumulate "rights" through its progress during the economic programme, which would then be used as the first disbursement of debt arrears under a successor IMF-supported Structural Adjustment Programme.

The ratio of scheduled debt charges to exports of goods and services was only 18% in 1977/78, 26% in 1980/81 and 18% in 1990/91. As a result of its protracted foreign exchange crisis,

Sierra Leone has a poor record of servicing foreign debt and has therefore had little access to loans at concessionary rates.

At the outset of the IMF-supervised programme, Sierra Leone's outstanding financial obligations to the IMF totalled US$120m, compared with its existing quota of US$79m. The 1992/93 Rights Accumulation Programme (RAP) permits Sierra Leone to accumulate IMF repayment "credits" up to a maximum of its IMF liabilities during the period up to the end of February 1994. During this period it is expected that the country would require exceptional balance-of-payments support. Upon completion of the programme Sierra Leone will become eligible for further IMF loan support under a successor programme. In May 1992 the IMF released US$43m for the import of essential commodities, such as petroleum. An additional US$44m followed for expenditure on agriculture, health and education sectors. No support was apparently given to the industrial sector. In July 1992 international donors, including the EC and African Development Bank had begun to release additional funds for use in restructuring the economy.

The Structural Development Programme is being carried out in line with recommendations made by the World Bank and the IMF. Some improvements in the general economy are already apparent. A rapid fall in inflation from the 110.9% per year in 1990, 27.30% in the July-Sept 91 quarter to a much lower 6.9% in the April-June 1992 quarter with a further fall to 3.0% in the April-June 1993 quarter has led to a more stable Le/$ exchange rate in 1993.

Although it is still depreciating steadily, the rate of depreciation is slowing down. In Jan-Mar 1991 the rate was Le 191.00/$ but had risen to 461.00 in Jan-Mar 1992, 507.56 in April-June 1992, 561.94 in Jan-Mar 1993 and 562.0 in April-June 1993. During November 1993 the bureau exchange buying rate has been approximately 570 - 595.

With the establishment of foreign exchange bureaux competing with the commercial banks for foreign exchange in an open market, the unofficial parallel market has virtually ceased to exist, which has improved confidence in the banking system. This has had an effect

on increasing the demand for deposits, which mainly accounted for a 6.5% increase in the money supply to Le33 billion in the April-June 1993 quarter.

Savings deposits grew by 25% to Le8.9 billion in the April-June 1993 quarter, which not only reflects the increased confidence in the banking system but also and more importantly for investment purposes, the complete absence of any alternative assets with similar rates of return. With the fall in inflation, prime bank rates fell from 65% in Jan-Mar 1992 to 33.69% in Jan-Mar 1993. However during early November 1993 the commercial bank prime rate was still 40% despite an inflation rate, which reportedly had fallen to an annual rate of around 16-18%. Retail lending rates were up to 50%, a very serious constraint to any manufacturing business, as most must rely on some form of short-term finance or overdraft to finance working capital, especially in the early years of the business. On 15th November 1993 the major commercial banks reduced their prime rate to 35% with lending rates at 45% to 50%. The rates have to fall much further and remain low for some period to even begin to instil some confidence in the manufacturing sector.

The margin between the current yearly inflation of 16-18% and the 50% loan rates appears to be far too large and seems to be designed to attract deposits, rather than to support business activity in the manufacturing sector. These very high interest rates have caused many businesses to cease operations, either voluntarily, or through forced liquidation. The attrition rate has been highest amongst businesses requiring long-term finance, whilst those which only require short-term finance (such as trading) have exhibited a better survival rate. Further, these virtually penal interest rates make it almost impossible for any manufacturing or mining project to be viable unless the majority of funds are obtained externally. In most cases this is not a practical proposition.

Finance at reasonable rates of interest is one of the main enabling factors for meaningful industrial development, whether this be in a developed country or a developing country. If Sierra Leonean interest rates are too high entrepreneurs will not take the risk of

investing in industrial or mineral projects. New projects of this type would normally not have a positive cash flow for some time and would require some form of financing for working capital. At current bank rates, overdrafts and short-term loans would be ruinous. The alternative of bringing in more external equity financing is problematical, given overseas perceptions of Sierra Leone as a place to invest and the fact that many entrepreneurs would not accept a dilution of their equity and control.

In such a situation the entrepreneur is more likely to invest in trading or a service related business, which generally require much less capital than manufacturing or mining. Such an investment is therefore less of a risk as it is likely to be cash positive in a short time frame. The entrepreneur is then much less dependent on the banks for finance, especially for important working capital finance.

There currently appears to be a general feeling in the banking system that manufacturing is high risk. One major commercial bank in Sierra Leone stated that a loan facility would normally only be considered for a new building material ceramic manufacturing project after it had actually been established and had been in production for about six months. This means in effect that an entrepreneur has to basically find finance from his own resources, or perhaps from a development bank.

While trade and service businesses are a necessary and an important sector in any economy, manufacturing is also important. However in Sierra Leone, this sector currently barely exists. This includes minerals processing (a sub-set of manufacturing) even though Sierra Leone is a minerals rich country. Moreover this situation will not change significantly under the current financial regime. Interest rates must fall to much lower levels before investment in manufacturing and mineral processing can become attractive in Sierra Leone.

Quite apart from the interest rate factor any potential industrial investor requires a stable environment, which offers some security for his long-term investment. A stable investment environment

requires a firm and consistent commitment from the Government over a considerable period in order that confidence in the economy can develop. Only then will investors feel comfortable in investing in long-term industrial enterprises, rather than in short-term trading and service businesses. Hopefully banks will also begin to feel comfortable in supporting entrepreneurs interested in manufacturing.

B. Dependence of the Economy on Mining

The economy of Sierra Leone is heavily dependent on a few primary commodities, particularly rutile and bauxite. This was especially the case whilst alluvial diamond and gold mining were being disrupted by the Rebel War. There was no recorded production of diamonds and gold during the Jan-Mar 1993 and April- June 1993 quarters although data shown to the Mission indicated significant diamond sales to Belgium during the two periods. Table 6 sets out export data for Sierra Leone which shows just how dependent the country is on the mining sector.

TABLE 6
Export Statistics for Sierra Leone for the Period 1990 to June 1993

	Exports US$ million			
	1990	1991	1992	Jan/Jun 93
Total Exports	139.32	138.50	146.50	58.54
Agricultural	15.44	11.31	7.00	4.16
Coffee	7.62	3.02	2.60	1.97
Cocoa	6.06	6.27	2.20	1.45
Fish, shrimps	1.12	0.45	0.50	0.25
Tobacco	-	-	1.00	-
Mineral	121.47	131.52	137.00	51.25
Diamond	12.58	33.06	28.93	10.15
Bauxite	25.86	25.10	41.68	9.58
Rutile	78.67	70.76	51.50	29.16
Gold	0.16	0.70	1.50	0.94
Ilmenite	-	-	1.30	1.42

The rutile and ilmenite exports of Sierra Rutile account for a massive proportion of the total exports of the country, being 56.5% in 1990, 51.1% in 1991, 36% in 1992 and currently 49.8% to June 1993.

Similarly the bauxite exports of Sieromco are also a very significant proportion of the country's total exports, being 18.6% in 1990, 18.1% in 1991, 28.4% in 1992 and 16.4% to June 1993. Thus over this four year period Sierra Rutile and Sieromco have generated between 65% and 75% of Sierra Leone's export income.

With the country being dependent on only two mining companies to provide approximately two-thirds of its total export income and with all the minerals commodities of those companies currently subject to falling prices, the Government will find it increasingly difficult to finance its requirements. Diversification of the mining and industrial base is the obvious solution.

The establishment of more successful mining projects would greatly increase export income and expand GOSL's revenue base.

In addition utilisation of the non-metallic mineral resources of the country, such as clays, silica sand and nepheline syenite for building materials and ceramic products would further widen the tax revenue base, reduce the import requirements of the country and generate significant employment for both men and women. The Government should therefore encourage the development of this much ignored sector.

C. Sierra Rutile History

The history of Sierra Rutile Ltd is set out under Section 1A2 of this report.

D. Sierra Rutile Financial Overview

Sierra Rutile is a private company and hence detailed financial information is not available. This overview is based largely on publicly available information (e.g. audited accounts) and hearsay.

The turnover of the company has fallen progressively from $78.5 million in 1990, $75.8 million in 1991 and to $70.4 million in 1992. A further fall in turnover is expected in 1993 to approximately $62 million due to the much lower prices of rutile on the world market. The company did however have long-term contracts of three to five years duration in place prior to the downturn in prices. This has reduced the effect of lower world prices on SRL up to the present time. However with these long-term contracts nearing completion this protection will be removed.

The mechanism used in these long term contracts was to set base levels for the tonnage and the price and adjust these annually within pre-agreed limits, thereby protecting both Sierra Rutile and its customers from the wide price fluctuations which affect most mineral commodities. The long-term contracts provided the customer with a predictable cost for its principal raw material and at the same time gave Sierra Rutile a predictable revenue base on which to project the company's future mining plans.

Without these long-term contracts, which gave a premium on world prices in 1991 and 1992, average sales revenue would have been much lower in those years. As these long-term contracts end new contracts must be negotiated at lower prices. The world price reduction has been significant, falling from $595 per tonne in 1990 to approximately $400 per tonne in 1993.

The August 1993 prices of Australian rutile concentrate with 95% TiO_2 shows a further slight weakening of the price to

Bulk Pigment Grade	A$510-570, or US$342-382/tonne
Bagged (small parcels for welding rods)	A$ 550-600, or US$ 368-402/tonne

No capital-intensive company, such as Sierra Rutile can escape being placed under pressure when its profitability is progressively and significantly reduced. One effect of this has been a drastic reduction in capital expenditure from $23.48 million in 1990 to $12.67 million in 1991 and to $6.80 million in 1992.

However the company has recognized that the sales price of rutile is not likely to rise to previous levels again, at least in the next few years. On this assumption it has decided to invest in a new dredge and more efficient generating plant as part of a $71 million capital expenditure programme. This expansion programme, by both increasing production and by considerably reducing power costs, will significantly reduce the operating costs on a per tonne basis. This should then ensure that the company is profitable at current market price levels of around $400 per tonne. The breakdown of the investment is set out in Table 7.

TABLE 7
Breakdown of, and Funding for SRL's Current Capital Expenditure Programme

Item	US$m
Replacement of generators	25.3
Development of LANTI	10.2
Improvements to treatment plant	9.7
Site infrastructure	6.0
Port restoration	4.3
Various equipment and vehicles	3.3
	58.8
Working capital	12.2
Total	71.0

Long-term finance was provided by:

Source	US$m
SFI, Affiliate of Bank Mondiale	20.0
Bi-lateral agencies (CDC, OPEC, DEG, IFC)	28.0
Internal finance	23.0
Total	71.0

There is an aggressive repayment schedule for the $48m in external loans, which will be especially demanding, if the price of rutile falls much further.

Sierra Rutile is a high-cost producer in comparison with Australian and South African operators, chiefly due to the geological nature of the deposits which result in difficult mining conditions. Other factors are:

* Government Royalties

  In addition the royalty payments to the Government are from approximately 1.8 to 4.7 times higher than the royalties their competitors have to pay in Australia and elsewhere.

* Labour Costs

  Labour at first sight is a low cost item for Sierra Rutile, on the basis of competitive wage and salary levels in some overseas countries. However the advantage is far less than it seems since Sierra Rutile employs approximately 1,600 employees for its production of approximately 145,000 tons per year. An Australian company would employ approximately 400 to 500 for this output.

* Power Costs

  The cost of electricity is stated to be from 5 to 10 times the rate payable from the grid, hence the urgent need to replace the existing generator sets with more fuel efficient units.

* Spare Parts

  The cost of spare parts is high, as everything has to be imported from overseas. A large inventory of essential spares has to be carried because there are no local manufacturers. This increases the working capital requirements of the company. In comparison competing producers have local suppliers for much of their spares requirements. This reduces their costs and working capital requirements in comparison to Sierra Rutile.

As revenue has fallen during the past three years the cash surplus

on trading before payments of obligations to the Government has reduced from $39.5 million in 1990, to $25.0 million in 1991 and $27.6 million in 1992. However the obligations to the Government in the form of taxes, royalties, duties and community development have remained remarkably constant, being $10.7 million in 1990, $10.5 million in 1991 and $10.7 million in 1992. The effect of this is that the Government is now taking an increasing share of the company's cash surplus on trading. The Government share rose from 27% of the cash surplus on trading in 1990, to 42% in 1991 but fell back slightly to 39% in 1992.

This clearly indicates that Sierra Rutile is contributing substantially to the revenue of the country, even during a period of great difficulty for the company. The Government will also have the benefit of additional revenue from the company when the new dredge and wet plant becomes operational. This will lead to a 30% increase in rutile and ilmenite production with a consequent increase in royalty payments and minimum tax. There will also be import duties on equipment bought for the project upgrade.

The financial obligations, which the company has agreed to in the 1989 Sierra Rutile Agreement are as follows:

i) The rent payable by the company under each Prospecting Licence shall be US$20 a year for each square mile, or part thereof contained in a Prospecting Area payable to the Government in advance.

With mineral leases covering around 224 square miles, the annual payment amounts to less than $5,000.

ii) A mining rent of $400 in 1989 for each square mile within the Mining Lease Area. The payment escalates at a cumulative rate of 5% per annum.

iii) A surface rent for all land occupied at the rate of $4 per acre per annum.

This amounts to a payment of approximately $275,000 per

year, which is paid over to the Government in foreign exchange. The company receives the Leone equivalent, which is then paid to the three chieftains in the mining area. The payment is then channelled by them to the landowners. The company has received a bad press over these payments because although the company has met its contractual obligations in respect to these payments, much of the surface rent is not reaching the individual landowners. Currently the chieftains are in the process of coming to some agreement with the Government to ensure that 70% of the payments are reserved for the landowners and the remaining 30% is reserved for the chieftains and community.

iv) A Royalty is payable at the rate of 3.5% of the gross sales price free alongside Sierra Leone port. In respect to rutile only, the Royalty payment shall be increased from 3.5% to 4% of the amount by which the gross sales price exceeds $600 per ton (1989 base) with this base price for rutile increasing at the cumulative rate of 4% per annum.

The Royalty is allowable as an operating cost of the company, being deductible as an expense in the calculation of its income for income tax purposes.

Under the agreement the company paid an Advance Royalty to the Government on an interest-free basis. This Royalty Credit totalled US$2,040,000 over 1990 and 1991. Offsets against this Advance Royalty can only be applied when the aggregate of Royalty and Income Tax exceeds US$8.2 million in any financial year. Any excess over US$8.2 million can be used as an offset against the Royalty Credit.

v) Income Tax is payable at the rate of 37.5% from the financial year ending 31st December 1992.

A minimum Income Tax rate of 3.5% of turnover is however

payable, irrespective of the level of profitability. This must be paid even if the company makes a loss on the operations in any year.

vi) Capital allowances are deducted from chargeable earnings at 20% of the original US$ cost in the first year and 15% of the cost in subsequent years, until the whole of such cost is allowed.

vi) Additional Income Tax is payable by the company if the average gross sales price exceeds US$625 (1st Jan 1992 base). The additional increment of tax payable is as follows:

Price per ton (US$)	Rate of Tax on increment (%)
625 - 675	10
676 - 725	15
726 - 775	20
776 and up	25

The above rutile prices are increased by a cumulative rate of 4% per annum.

vii) A special Withholding Tax of 10% of dividends paid to shareholders will be payable by the company with effect from 1st January 2000 up to the date that the Government acquires a 47% shareholding in the company. Beyond that date no Withholding Tax will be payable.

viii) Under the agreement there is a Limitation of Charges on Imports, comprising all levies, duties, fees, taxes, surcharges and all other amounts levied on imports of mining machinery, plant and equipment and consumable mining stores. The charge will be an aggregate of 10% of the cost.

ix) The import duties on fuel imports were progressively raised from 4% of CIF in 1990 to 8% of CIF for the period 1992-97. After December 1997 the generally applicable

rate will be applied.

E. Current General Tax Regime

Comparing the current general taxation rates for other industries, service business etc and those applying to Sierra Rutile Limited, there are some significant differences.

The tax rate for companies is 45%, compared with a tax rate of 37.5% for Sierra Rutile, therefore in this respect the company has an advantage in comparison to other industries and businesses in Sierra Leone. In comparison with international rates however, the taxation rate is rather high. The effective corporation tax rates in both North America, most of Europe and Asia are lower than the 37.5% rate payable by Sierra Rutile.

Under the Income Tax Act 1992 only businesses with audited accounts will be not be subject to a "Minimum Chargeable Income" assessment, which is based on turnover. Businesses with no proper books are assessed at a minimum income of 15% of turnover, which is determined by the Commissioner, while those who maintain proper books with all supporting receipts and sales records are assessed at a minimum income of 10% of turnover. The minimum income is taxable, irrespective of whether the business is profitable or not. As Sierra Rutile provides audited accounts the fact that it has to pay a minimum tax based on turnover puts the company at a disadvantage, when compared to other Sierra Leonean businesses, which do not have this obligation.

Under the new tariff rates reported in the 1993/94 budget statement, there will now be only three tariff rates, 5%, 20% and 40%. The 5% rate is applicable on the raw material category, capital goods and spare parts. The 20% rate applies to an intermediate category of goods and the 40% rate will be levied on finished goods, which are produced locally. In comparison, Sierra Rutile Limited is charged an aggregate of 10% in import charges under the Agreement. As the normal rates in 1989 were 20-25%, a

situation where the company was originally treated preferentially has now changed to one, where it is paying more than other industries in import charges on its capital goods and spare parts.

In the 1992/93 budget statement the Government increased the capital depreciation allowances, in order to promote investment in the private sector. On plant and machinery the initial allowance has been raised to 40% and the annual allowance to 20%. On other assets the initial and annual allowances have been doubled. As Sierra Rutile can only apply a 20% initial allowance and a 15% annual allowance under the terms of its agreement, the company is now operating at a considerable disadvantage to the rest of the formal economy in Sierra Leone, in respect depreciation allowances.

Surtax is currently payable by all companies at the rate of 5% of the income tax charged. Within the Sierra Rutile agreement there is no specific mention of surtax but such payment would normally have to be made under the minor taxes clause, if the minor tax payments are below $100,000 per year, or $250,000 over a five-year period.

F. Existing Markets for Titanium Feedstocks

Nearly 95% of the world's production of titanium minerals goes into the manufacture of titanium dioxide pigments. The remaining 5% primarily goes to the production of titanium metal with chemicals, welding rod coatings and etc being minor uses. Titanium dioxide pigments are chiefly used in paint manufacture.

The titanium feedstock market worldwide is quite restricted, as it consists of a relatively few large chemical and industrial companies, which dominate pigment production. These companies include Du Pont, USA; Tioxide, UK; SCM (Hanson Plc Group), UK and Kronos, Netherlands. Some of these companies have captive ore supplies, which further restricts the market. The chemical and industrial companies buy their feedstock from a small number of suppliers and because of their size and financial strength they normally have great bargaining power. This is especially true in

the current weak market situation which has driven prices down substantially.

Long-term contracts are preferred by the suppliers to ensure a stable base-market for their operations and to avoid the wide price fluctuations, which are common on the spot market. However, while the chemical companies are willing to sign long-term contracts in a strong market to obtain a better price, in a weak market they revert to short-term contracts or buy more of their requirements on the spot market.

Production of titanium metal is also controlled by a few companies, mainly in the USA and Japan. The metal/sponge sector was the scene of fierce European Community and US trade actions in the 1980's.

Feedstocks for titanium dioxide pigment production are rutile, synthetic rutile, ilmenite and titanium dioxide slag. Synthetic rutile (synrutile) is manufactured from ilmenite whilst slag is commonly obtained as a by-product from the production of steel from titano-magnetites in electric arc furnaces.

TABLE 8
World Distribution of Titanium Minerals Production

	Production (tonnes)	%
i) Rutile		
Australia	260,000	50
Sierra Leone	120,000	23
South Africa	56,000	11
USA	26,000	5
India	19,000	4
Brazil	15,000	3
Sri Lanka	13,000	2
Russia & CIS	10,000	2
	520,000	100
ii) Synthetic Rutile		
Australia	250,000	43
India	138,000	24
USA	100,000	17
Japan	46,000	8
Malaysia	46,000	8
	580,000	100
iii) Ilmenite		
Australia	1,100,000	26
Canada	830,000	19
South Africa	640,000	15
Norway	450,000	11
Malaysia	275,000	6
Russia & CIS	250,000	6
USA	210,000	5
India	200,000	5
China	90,000	2
Brazil	83,000	2
Sri Lanka	80,000	2
	4,260,000	100

TABLE 9
World Distribution of Titanium Dioxide Slag Production

Company	Location	Capacity (1,000 tpa)	% TiO2
QIT-Fer et Titane	Quebec, Canada	1,300	80
		200	85
Richards Bay Minerals	Natal, S.Africa	650	85
K/S Ilmenittsmelteverket	Norway	200	75
	World Total	2,350	

Source: Industrial Minerals June 1986
Industrial Minerals Handybook

From Tables 8 and 9 above it is clear that Australia is by far the most important producer of all the sources of titanium, while Sierra Leone is the second most important source of natural rutile in the world. However this situation could change significantly in the future, as Brazil has huge reserves of rutile, amounting to 66 million tonnes of contained titanium, against 2 million tonnes of reserves in Sierra Leone. The current total world reserve base is 165 million tonnes, 52% of which is in Brazil and identified world resources of rutile total 200 million tonnes of contained titanium.

In the case of ilmenite the world base is estimated at 429 million tonnes and identified resources total about 1 billion tonnes of contained titanium. With such large reserves available there is no likelihood of serious shortages developing and as the Brazilian rutile deposits are developed the downward pressure on prices will continue. The high prices achieved in the mid to late eighties boom in demand for titanium minerals encouraged mining companies to expand their production and new producers to enter the market.

Around 1986 there were a number of corporate changes, including takeovers and restructuring. In addition new mineral projects came on-stream and producers tried to increase the value of their product by increasing the TiO_2 content. This reduced the availability of 54-60% TiO_2 ilmenite and increased the availability of 75 and plus 90% TiO_2 so as to augment dwindling reserves of high-grade natural rutile in the plus 95% TiO_2 category.

The situation in 1993 is that with a significant excess of capacity in the world the high prices of the eighties are not expected to recur. The general assessment is that prices will remain low until 1996, when perhaps a gentle recovery could be possible. However it is almost impossible to forecast future commodity prices with any certainty. Western world production and grades of various TiO2 feedstocks is set out in Table 10.

TABLE 10
Western World Production and Grades of TiO2 Feedstock

i) 44-45% TiO_2
Production: 1.0 million tonnes per year

Source: Ilmenite-magnetite or ilmenite-haematite hard rock deposits, such as Tellnes, Norway

Application: Sulphate-route pigment plants either directly or through conversion to 75% TiO_2 slag.

ii) 48-51% TiO_2
Production: 415,000 tonnes per year

Source: Ilmenite from heavy mineral beach sands, such as North Stradbroke Island, Queensland and Orissa, India.

Application: Blast furnace hearth linings, pigment and synthetic rutile manufacture.

iii) 54-59% TiO_2
Production: 1.5 million tonnes per year

Source: Ilmenite concentrates from heavy mineral beach deposits, such as Bunbury and Capel, Western Australia; Brazil; India; Sri Lanka; and Florida, USA. Some Indian and Malaysian grades approach up to 60% TiO_2.

Application: Sulphate-route pigment plants and synthetic rutile manufacture

iv) 60% plus TiO_2
Production: 540,000 tonnes per year

Source: Enriched altered ilmenite concentrates produced from heavy mineral beach sands, such as Eneabba, Western Australia and Green Cove Springs, Florida.

Application: Chloride-route pigment manufacture and synthetic rutile manufacture.

v) 65-92% TiO_2
Production: 44,000 tonnes per year

Source: Leucoxene varieties of altered ilmenite produced from heavy mineral sands, such as Capel and Bunbury, Western Australia and Florida, USA

Application: Chloride-route pigment manufacture and welding rod electrodes.

vi) 75-80% TiO_2

Production: 1.5 million tonnes per year

Source: Titania slag produced by smelting ilmenite from hard rock operations, such as Sorel, Quebec based on 32% TiO_2 ore feed and Tyssedal, Norway based on 18% TiO_2 ore feed.

Application: Sulphate-route pigment plants

vii) 85% TiO_2

Production: 840,000 - 860,000 tonnes per year

Source: Titania slag produced by smelting ilmenite from heavy mineral beach sands, such as Richards Bay, South Africa.

Application: Chloride and sulphate-route pigment plants.

viii) 90% TiO_2

Production: 400,000 tonnes per year

Source: Anatase from carbonatite hard rock deposits, such as Tapira, Minas Gerais, Brazil.

Application: Chloride-route pigment plants

ix) 92-95% TiO_2

Production: 570,500 tonnes per year

Source: Synthetic rutile produced by iron reduction and chemical leeching of ilmenite beach sands, such as Mobile, Alabama; Yokkaich, Japan; Tamil Nadu, India and Western Australia.

Application: Chloride-route titanium dioxide white pigment plants. Synthetic rutile is finding increasing usage in the process as a direct substitute for the naturally occurring rutile minerals, of which only limited supplies are currently available. The rutile reserves in Brazil could however change this equation.

x) 93-96% TiO_2

Production: 530,000 - 550,000 tonnes per year

Source: Natural rutile obtained from heavy mineral beach sand deposits, such as Eneabba, Western Australia; North Stradbroke Island, Queensland; Sierra Leone; South Africa; Florida, USA.

Application: Chloride-route pigment plants; welding rod electrodes and coatings and titanium metal.

Ilmenite concentrate for slag processing may be as low as 44% TiO_2. Feedstock for sulphate pigment use must be sulphateable and requires low Cr, P, V, Mn and S. In addition the chloride route ($TiCl_4$) feedstock also requires low Ca and Mg.

The TiO_2 pigment particle size (average 0.2 to 0.4 microns) is extremely important in both processes to obtain an optimum for light scattering in each particular application. The rutile grade has a higher refractive index, SG and chemical stability than the anatase grade, which has a bluer colour tone and is softer. The former is therefore used for outdoor paints, while the latter is used for indoor paints and paper.

It should be noted that due to environmental problems more titanium dioxide plants are likely to use chloride technology in the future, rather than the sulphate technology. Increasing amounts of synthetic rutile or slag made from ilmenite are likely to be used as feed, which will increase the competition for natural rutile and put increasing downward pressure on prices. At the same time there is a trend toward using higher grade titanium feedstocks to reduce waste disposal problems, therefore natural rutile, 95% TiO_2 has an advantage in this respect, so this should offset some of the downward pressure on prices, as environmental concern increases.

Projections for world demand for feedstocks for 1995 are estimated to be around 4.0 million tonnes per year against a supply of 4.5 million tonnes, ie: approximately 10% oversupply, therefore until this oversupply is eliminated prices generally are expected to be weak. Luckily for Sierra Rutile the demand for chlorinateable feedstocks is expected to continue to grow more strongly than for the sulphateable feedstocks, therefore the medium-term and long-term outlook for high TiO_2 feedstocks continues to remain favourable. The most favourable market position will be held by the established producers of high TiO_2 chlorinateable feedstocks with low-cost operations and state of the art upgrading technology, ie: Australia will be in a very strong position.

G. Conclusions

The wide range of TiO_2 feedstock materials means that although Sierra Rutile has an approximate 23% share of the world market in the high quality natural rutile sub-sector but only 4.2% of world production of TiO2 feedstocks. Moreover the company faces intense competition from lower-grade feedstocks and it is these lower grades which always fix the floor price for the entire TiO_2 feedstock market.

With only approximately 4.2% of the total world mine production (1990) Sierra Rutile cannot divorce itself from this international commodity market and therefore the company has to adjust its sales prices according to the world market price. There is no possible way that the company can dictate prices as it supplies only about 9% of the U.K.'s requirement of Ilmenite, rutile and slag against Australia's 65%. Within the EC Sierra Leone supplies only 4% of the total and in the USA 8% of the total.

The current assessment of the market for rutile and other titanium dioxide feedstock materials is continuing oversupply and weak markets for at least a few more years. The consequent low prices when considered against the fact that Sierra Rutile is a high-cost producer by virtue of the deposit's geological nature and the fact that the 1989 agreement has significant revenue-based taxes, rather than profit-based taxes means that the company will have a very difficult period until such time that the planned expansion comes on stream and reduces the high unit costs to improve profitability. Profitability will remain very low until prices recover, or volumes increase substantially. There is considerable risk in the expansion plan, in that if prices weaken further expected unit price reduction benefit of the expansion will be eroded away leaving the company with a much more highly capitalised plant and associated financing charges to service.

The 1993/94 budget statement of the Government of Sierra Leone shows that Sierra Rutile and Sieromco contribute approximately 15% to the total budget income of the country and are the country's main foreign exchange earners.

In view of this situation it would be counterproductive to try to increase the revenue for the Government from Sierra Rutile by a unilateral renegotiation of the 1989 Agreement. Not only would such a move send all the wrong signals to the international mining community but any further financial obligations could push the company into a loss-making situation and eventual failure. The mining operation has already failed twice before and note should be taken of that fact.

V. OPPORTUNITIES FOR SECONDARY PROCESSING

A. Pigment Production

The major market for processed rutile is the titanium dioxide pigment industry, which accounts for approximately 95% of total consumption. The 5% non-pigment uses of titanium feedstocks include:

i) titanium sponge for metal production (aerospace, chemical and desalination plants; marine applications) - major use;

ii) welding rod coatings to stabilize the electric arc, reduce the viscosity of the slag and decrease the surface tension of the metal droplets on the electrodes;

iii) ceramics and electro-ceramics;

iv) enamels and glazes;

v) glass and fibreglass;

vi) titanium carbide cutting tools;

Table 11 sets out titanium dioxide pigment consumption statistics for some of the major markets.

TABLE 11
Titanium Dioxide Pigment Consumption in a Number of Major Markets

	Aust %	USA %	UK %	Japan %
Paint, varnish, lacquer	48.1	64.8	54.0	78.1
Paper	24.2	7.3	10.0	5.4
Plastics	17.0	11.0	5.6	7.0
Rubber	1.7	2.2	4.0	1.5
Printing ink	1.7	3.1	13.5	1.7
Ceramics	0.4	1.8	-	1.5
Flooring		3.8	-	2.5
Fibres		3.4	4.2	-
Other	6.9	2.6	8.7	2.3
	100.0	100.0	100.0	100.0

From Table 11 it is apparent that surface coatings (paints) account for well over 50% of most markets followed by paper and plastics averaging about 10% each.

1. Pigment Production Processes

There are two technologies for producing titanium dioxide pigments from feedstock material. Details are summarised after Hamor (1986) and Towner (1990):

The Sulphate Process

- The process was developed in the United States in the 1920's.

- The feedstocks used are normally ilmenite or titanium slag.

- Feedstock material is finely ground and reacted with sulphuric acid. The resulting cake is dissolved in dilute sulphuric acid and reduced to convert any ferric ions to the ferrous state. Iron is removed by crystallising it out as ferrous sulphate heptahydrate and the resulting solution is then concentrated by evaporation and hydrolysed to give a titanium hydroxide precipitate. The precipitate is then calcined at 800-1,000°C to give titanium dioxide.

- About 85% of the titanium in the feedstock is recovered to titanium dioxide pigment.

- If ilmenite is the feedstock the production of 1.0 t of pigment requires 2.0 t of ilmenite and 4.5 t of sulphuric acid (6.47 t of waste per tonne of product).

- If slag is the feedstock the production of 1.0 t of pigment requires 1.5 t of slag and 2.5 to 3.0 t of sulphuric acid (3.5 to 4.1 t of waste per tonne of product).

The Chloride Process

- Developed by Du Pont in 1956

- Higher quality feedstocks are used; normally rutile or synthetic rutile.

- The feedstock is ground with high purity coke and then chlorinated at 950°C in a fluid bed reactor. The resulting titanium tetrachloride is purified and burnt in oxygen enriched air to produce titanium dioxide and chlorine. The chlorine is recycled to the chlorination stage.

- About 90% of the titanium in the feedstock is recovered to titanium dioxide pigment.

- 1.0t of pigment requires about 1.05t of natural rutile or 1.07t of synthetic rutile, 0.2t of chlorine, 0.4t of coke and 0.6t of oxygen (1.17t of 1.19t of waste per tonne of product).

Although the bulk of the world's capacity was Sulphate Process technology 7 to 10 years ago, there has been a major swing to the Chloride Process in the intervening years. The key factor in this change has been the question of waste disposal. As indicated above the Sulphate Process involves the generation of a much greater quantity of more hazardous wastes for a given plant capacity.

Energy and labour costs are also lower for the Chloride Process.

As Sierra Rutile is the largest single producer of natural rutile in the world; and this mineral is the favoured feedstock for pigment production by the Chloride Process, at first sight a Chloride Process pigment plant has attractions for Sierra Leone. This is particularly the case when the value-added implications of such a project are considered. Considering ilmenite as the feedstock Towner (1990) calculated a "Value-Added Coefficient" of 4 for synthetic rutile production and 20 for pigment production.

Australia has been an exporter of mineral sands for 60 years and the major world exporter for nearly 50 years and yet by 1990 only 20% of titanium minerals were exported in processed form. This 20% accounted for 60% of the value of all titanium exports. Despite the value-added implications and despite a good track record in regard to mining and minerals processing volume pigment production has taken a long time to come to Australia.

2. Local Market for Processed Rutile Products

The only major industrial operation in Sierra Leone, which uses titanium dioxide pigment is Rainbow Paint Company Limited, which is located on the Wellington industrial estate near Freetown. Small additional amounts are used by the toothpaste company and the soap company.

Paint was manufactured in the country for about 30 years by Sierra Paint Company but this operation went into liquidation a few years ago. Table 12 sets out paint production data for Sierra Leone over the period 1980/81 to 1991/92. These data indicate that production virtually collapsed in 1985.

regime in Sierra Leone (Part XIII of the draft MMA) is generally competitive with other tax schemes.

8. There are two areas which need clarification. The draft MMA does not make reference to Government participation in mining operations or to the Additional Profit Tax. However, the official policy in the past has been to negotiate a deferred option to acquire a 47% and a 49% interest in the rutile and bauxite operations and to require an Additional Profit Tax on windfalls profits. It is unclear if this is still the policy of GOSL.

9. Existing regulations and administrative procedures applicable to diamond exports through official channels are extremely burdensome and bureaucratic and account in part for the large amount of unregistered exports. The number of permits and authorizations should be reduced and the marketing of diamonds should be liberalized.

SI/SIL/93/801

LIST OF ANNEXES

ANNEX A

This is a trial draft of a promotional brochure prepared by J-P Viellard (Part 1) and Peter Stitt (Part 2).

MINING INVESTMENT OPPORTUNITIES IN SIERRA LEONE

I. FOREWORD

The principal objective of this brochure is to provide potential investors in Sierra Leone with basic information about the mining sector and the investment opportunities it may offer.

An investor deciding to further investigate the possibility of investing in the mining sector should contact the Department of Mineral Resources, the Bureau of Geological Survey and other mining organizations active in the country.

II. THE SIERRA LEONE MINING INDUSTRY

A. An Outline of the Mining Sector

Mining holds a significant position in the Sierra Leone economy and the country enjoys an abundance of mineral resources which offer tremendous investment opportunities for potential investors.

Sierra Leone is well endowed with mineral resources, especially rutile, bauxite, diamonds and gold. Industrial minerals include clays minerals, nepheline syenite, kaolin...

Mining in Sierra Leone is currently dominated by two major mining companies producing rutile and bauxite, both wholly-owned subsidiaries of foreign investors. SIERRA RUTILE LIMITED is owned by Nord Resources Corporation, based in Dayton, Ohio and Sierra Leone Ore and Metal Company (SIEROMCO) is controlled by the Swiss aluminium group ALUSUISSE.

A third operator, the National Diamond Mining Corporation (NDMC), owned by the Government, is currently in liquidation. Nonetheless, the country still has considerable potential for diamond production, especially for kimberlite.

The importance of the minerals sector to the economy is beyond question and the country is heavily dependent on mining, as shown by the following indicators:

Mining in the Sierra Leone Economy

Percentage of the country's GDP:	estimated at 20%
Share of registered exports:	92% (1992)
Value of registered exports:	$135 million (1992)
Share of fiscal revenues:	estimated at 20%

In 1992, total mineral exports amounted to $135 million, of which:

	(in million dollars)
Rutile:	61.5
Bauxite:	41.7

Diamond:	28.9
Gold:	1.5
Ilmenite:	1.3

The major part of the diamond and gold production is exported illegally and only registered exports are included in the above statistics. Total gold production is tentatively estimated as being in the range 40,000 to 60,000 ounces per year.

Sierra Leone is the second largest producer of natural rutile after Australia and accounts for about 30% of world production.
Bauxite production exceeds one million metric tons per year.

B. Legal Framework and Policy

There are currently three bodies of legislation that govern mining operations in Sierra Leone:

The Minerals Act of 1927

The Alluvial Diamond Mining Act of 1956

Agreements dated respectively 1989 and 1992 with SIERRA RUTILE LIMITED and SIEROMCO

One of the key elements of Sierra Leone's mining policy is to develop a new mining legislation that promotes both local and foreign investments. A new mining law has been prepared by the Government in consultation with the United Nations and the World Bank and is expected to be enacted shortly.

1. The new Mining Code

The draft Mining Code is based on Mining Codes enacted recently in Africa, such as the Botswana Mineral Act or the Ghana Mining Code of 1986. Its objective is to be as comprehensive as possible and reduce the negotiation of mineral rights and specific investment agreements to a limited number of issues such as work programmes and exploration expenditures.

There are four types of mineral rights:

	Initial term (in years)	Renewal
Non-Exclusive Prospecting Licence	1	1
Exclusive Prospecting Licence:	2	1
Exploration Licence:	up to 3	2+2
Mining Lease:	up to 25	up to 15

Non-Exclusive and Exclusive Prospecting Licences are reconnaissance permits and do not give the right to drill.

The Exploration Licence is exclusive for specific minerals but can be amended to include other minerals. Exploration Licences are a second-stage tenement used for more detailed exploration.

The procedures for granting the various types of mineral rights are based on criteria which are clearly defined in the Code. Applications to the Department of Mineral Resources will be granted by the Secretary of State on advice of the Minerals Advisory Board.

2. The Existing Mining Agreements

As is the case in many developing countries, major mining investments in Sierra Leone are generally made under special agreements ratified by an Act of Parliament and negotiated during the application for a Mining Lease or its renewal. Copies of the Mining Agreements signed respectively in 1989 and 1992 with SIERRA RUTILE and SIEROMCO are available at the Government bookshop in Freetown.

3. Environmental Regulations

The need for environmental protection is a major concern for the Government of Sierra Leone. A National Policy on the Environment was formulated in 1990. The draft Mining Code has specific provisions concerning the protection of the environment and the Mining Agreements referred to above contain specific provisions concerning the reclamation and rehabilitation of mined-out areas. The draft Mining Code requires environmental impact assessments as

a condition for granting a Mining Lease.

C. Current Mining Taxation in Sierra Leone

Sierra Leone's regime for investments in mining is defined in Part XIII of the new Mining Code and is similar to the fiscal provisions currently applicable to SIERRA RUTILE and SIEROMCO.

Government Equity:	? (this issue needs clarification)*
Income Tax:	37.5%
Depreciation:	50% in the first year and 25% thereafter
Royalties:	5% for precious stones 4% for precious metals 3% for all other minerals, except industrial minerals
Agricultural Development fund:	0.1% of the ex-mine value
Surface rentals:	to be negotiated
Withholding Tax:	10%
Loss carry-forward:	Six years
Import Duties:	5% on mining equipment 20% on imported diesel and fuel oil

Operators may elect to keep their accounts in dollars and all payments to the Government must be made in United States dollars.

* NOTE: The policy of government's participation in mining projects goes back to the early 70's. However, the draft Mining Code does not make reference to Government's

participation in mining projects which may indicate a change of policy. Nonetheless it should be noted that the Government has the option to buy respectively 47% and up to 49% of SIERRA RUTILE and SIEROMCO around the turn of the century.

D. Foreign Exchange Regime

Foreign exchange regulations have been abolished in recent years and there is a liberal foreign exchange regime. Section 110 of the draft mining code provides that the holders of mining tenements have the right to retain their foreign exchange receipts in overseas accounts.

II. MINING INVESTMENT OPPORTUNITIES

There has been little mining exploration in the past twenty or thirty years and Sierra Leones's potential concerning mining resources is high.

Available information indicates that many of the country's resources have not yet been fully explored and they offer attractive opportunities in areas such as rutile, diamonds, gold, industrial minerals or bauxite.

A. Rutile

The known economic rutile resources of Sierra Leone differ markedly from those elsewhere in the world. Elsewhere, commercial rutile resources are associated with present-day or fossil beach environments. By way of contrast, the Sierra Leonian deposits are alluvial/eluvial and result from the weathering of the rutile rich Precambrian Kasila gneisses.

Beyond Sierra Rutile's tenement, there is a known lower grade resource to the north west near the town of Rotifunk. This property was explored initially by the Bayer-Preussag mining group and is currently held by an Australian company.

There is potential for additional resources along the strike of the Kasila gneiss to the north west of Rotifunk and to the south east of the Sierra Rutile's tenement.

Although reconnaissance work has been carried out with limited success on the Pleistocene to Recent formations associated with the present-day coastline south of the Sherbro river, the area is large and may be worth more detailed exploration.

B. Diamonds

1. Alluvial Diamonds

About 70% of Sierra Leone alluvial diamonds are of gem quality. The stones have a good reputation in international markets. Sierra Leone Selection Trust began alluvial diamond mining in the Kono area in the 1930's and in the Tongo district in the 1950's. These operations became substantial and yielded 2,000,000 carats in the peak production year (1970). The industry was effectively nationalized by the formation of the National Diamond Mining Company (NDMC) in 1970. Production gradually fell and NDMC is currently in liquidation.

It is likely that the major easily accessible alluvial resources have been exhausted. However, there is a potential for large-scale operations on more inaccessible resources, e.g. deep alluvials.

Current operations are limited to artisanal and medium-scale mining, much of it illegal.

2. Kimberlite Diamonds

Diamondiferous kimberlite pipes and dykes were identified in the Kono region as far back as 1948. About 500 kilometres of dykes are known in the Koidu/Yemena area alone. Another dyke system was discovered in the Tongo district forty kilometres to the south of Koidu. In 1960, a third system of dykes was discovered approximately twenty kilometres to the south west of the town of Penguma.

It is likely that there are diamondiferous kimberlite pipes and dykes which remain to be discovered.

Feasibility studies were carried out in the late 70's and early 80's on two pipes at Koidu and a dyke at Tongo. These studies indicated the possibility of a viable project. Development was initially delayed due to bureaucratic hassles and changing economic conditions and was finally cancelled when Selection Trust decided to withdraw from Sierra Leone. Subsequent attempts to launch the project also failed for similar reasons. Between 1982 and 1986,

NDMC carried out limited mining on Pipes 1 and 2 near Koidu.

The imminent adoption of the new Mining Code provides a window of opportunities to launch this and other kimberlite-based projects.

C. Gold

From a geological point of view, Sierra Leone would appear to be highly prospective for gold. There are significant areas of Precambrian greenstones which elsewhere in the world host major gold deposits. The largest greenstone belt covers the Kangari Hills and the Sula Mountains in central Sierra Leone. Smaller greenstone outcrops are in the Nimini Hills and the Gori Hills in central east Sierra Leone and the Kamboui Hills in the south east.

All greenstones are mineralised with major alluvial gold production from streams draining the Kangari Hills/Sula Mountains belt. The first reported mining of alluvial resources occurred in 1930. The recorded production from 1926 to 1957 was 342,800 ounces (about 10.6 tons), mostly from alluvials.

With the introduction of the Alluvial Diamond Mining Scheme (A.D.M.S.) in 1956, gold mining activities tapered off. However, by the early 1980's recorded production began to increase and reached 20,800 ounces in 1984. Production has fluctuated in the intervening years. Total production is well in excess of recorded production and is currently estimated to be in the range of 40,000 to 60,000 ounces per year.

Currently the best primary gold prospect is Baomahun, approximately 50km NNE of Bo at the southern end of the Kangari Hills. The area has been prospected and mined in a limited way since the 1930's. The present tenement holder, Precious Stones - Sierra Leone (Baomahun) Inc (Precious Stones), is seeking a joint venture partner.

Whilst Baomahun has been studied in the most detail there are other primary gold prospects in the greenstone belts which are worthy

exploration targets.

Although alluvial resources have provided most of the gold production in Sierra Leone to date, it seems unlikely that there is a major resource left which would justify a company scale operation. If there is an alluvial deposit which would support a company operation it would probably be a deep gravel resource in a major stream (eg the Pampana R.) draining the Sula Mountains/Kangari Hills.

To sum up there would appear to be excellent potential for primary gold in the greenstone belts and a much lesser chance of there being a large alluvial resource.

D. Bauxite

Bauxite has been mined since 1963 by the Sierra Leone Ore and Metal Company, a wholly-owned subsidiary of ALUSUISSE. The company started mining in the Mokanji area and is currently mining the Gondama deposit located about 25 kilometres from Mokanji.

Bauxite is formed from a variety of rock types when subject to intense tropical weathering. Given that these weathering conditions exist over much of Sierra Leone, bauxite occurrences are widely distributed. Consequently there is excellent potential for bauxite resources additional to those covered by Sieromco's tenement. As might be expected, many of these occurrences are related to the Kasila Gneisses.

The prospectivity of Sierra Leone for bauxite is good, however the current depressed commodity markets are such that it may be difficult to define an economically viable project.

E. Iron Ore

Iron ore was mined at Marampa near Port Loko from 1933 to 1974. There is a low-grade magnetite ore deposit at Bagla Hills in the

south easter part of Sierra Leone.

F. Base Metals

The greenstone belts of Sierra Leone, namely the Sula Mountains, the Kangari Hills, the Kambui Hills, the Ninimi Hills and the Gori Hills are prospective for copper, lead and zinc.

Stream sediment sampling has given anomalous values for all three metals, particularly in some streams draining the Ninimi Hills.

In addition copper sulphides have been discovered associated with the Freetown norite/gabbro complex. These sulphides are developed at the contact between Freetown Complex gabbro and the Kasila Gneiss.

G. Platinum

Most of the streams draining the Freetown Norite/Gabbro complex to the west contain alluvial platinum. The platinum is associated with ilmenite, magnetite and subsidiary chromite.

These streams were worked for platinum over a 20 year period commencing in 1929, for a total recorded production of 163kg.

The platinum occurred as coarse, angular fragments with the largest recorded nugget weighing 25g.

In 1969 an offshore investigation for alluvial platinum was initiated to the west of the Freetown peninsula. This work indicated that the possibility of economic offshore deposits of platinum was unlikely.

Later geochemical studies of residual laterites showed a uniform distribution of platinum over the western part of the Freetown Complex.

H. Others

Sierra Leone is prospective for a range of metals and minerals beyond those discussed in A to F above. Chief among them are:

1. Chromite

Chromite was mined in the Kambui Hills near Bambawo in the Kenema District from 1937 to 1963. The resource comprised large chromite rich pods and lenses in ultrabasic rocks in the north of the Kambui greenstone belt.

2. Nickel

Nickel has been recorded for the Freetown Complex, the greenschist belts and the Mano-Moa granulites in the Gola Forest area of eastern Sierra Leone.

3. Nepheline Syenite

Nepheline syenite finds wide use in the ceramics industry as a fluxing agent and as a source of alumina in glass. Nepheline syenite is known to exist in commercial quantities at Bagbo, near Vaama village in south east Sierra Leone close to the Liberian border.

Testing of the deposit determined that after magnetic separation the quality of this deposit was virtually equivalent to the Canadian A grade nepheline syenite after magnetic separation.

4. Kaolin

Deposits have been identified in the Moyamba and Bonthe districts.

5. Talc

Talc was located prior to 1956 in the Mansu area. The anthophyllite schists are often exceptionally rich in talc. No further investigation of these deposits seem to have been carried out since 1956.

ANNEX B

THE OK TEDI ENVIRONMENTAL PROTECTION PROVISION

1. In this agreement

beneficial use means a use of the environment or any element or segment of the environment that is conducive to public benefit, welfare, safety or health and which requires protection from the effects of waste discharges, emissions and deposits.

environment means physical factors of the surroundings of human beings including land, water, atmosphere, climate, sound, odours, tastes, and biological factors of animal and plants and the social factor of aesthetics.

pollution means any direct or indirect alteration of the physical, chemical, thermal, biological, or radio-active properties of any part of the environment by discharging, emitting or disposing wastes so as to materially affect any beneficial use adversely or to cause a condition which is hazardous or potentially hazardous to public health, safety or welfare, or to animals, birds, wildlife, fish or aquatic life, or to plants, and pollute has a corresponding meaning.

waste includes any matter whether liquid, solid, gaseous or radioactive, which is discharged, emitted or deposited in the environment in such volume, consistency or manner as to cause an alteration of the environment.

2. The company shall implement all approved proposals relating to environmental management and protection and shall not dispose of any overburden, tailings or other waste otherwise than in a manner which is substantially as previously approved (by the government),

provided that if the company is of the opinion that the circumstances have changed so that previously approved plans and proposals are no longer applicable or desirable, it may give notice to the State of those circumstances, together with alternative or revised plans, and the State shall within two months of that notice

(a) approve the alternative or revised plans; or

(b) meet with the company to discuss the alternative or revised plans.

If the discussions under paragraph (b) do not lead to the approval of the alternative or revised plans by the State (which approval shall not be unreasonably withheld), the alternative or revised plans shall be treated as a new proposal (by the company and shall be formally submitted to the government for review).

3. The company shall install and maintain suitable equipment of a standard approved by the State for the purpose of measuring and analysing all waste discharges and deposits from the company's operations hereunder and shall forward regular reports to the government after the commencement of such operations on the quantity and quality of all wastes discharges and deposits so measured and analysed.

4. The company shall within a reasonable time after any dump ceases to be utilized, carry out experiments for the determination of whether it is reasonably practical that vegetation be established thereon and shall so far as is practical establish thereon vegetation of a type which can be so established.

5. The company shall when any dumps for the overburden, tailings or other wastes ceases to be utilized, ensure that, in order to facilitate the rapid regeneration of vegetation thereon, unless such regeneration is impracticable, such dump is left with a surface on which such regeneration can be carried out.

6. The company shall at all times endeavour to overcome and minimize any deleterious effects resulting from the company's

operations upon the physical environment, the streams and rivers, the inhabitants, and the biota of the mining area or the land, streams and rivers flowing therefrom.

7. If the company contravenes any of these provisions, the State may serve notice upon the company requiring it to take within the time specified in the notice such reasonable steps as are necessary (which steps may be specified by the State) to prevent the continued or repeated contravention of such provisions, and the company shall forthwith comply with such notice.

8. If the company fails to comply with such notice, the State may take such reasonable steps, including entering by its servants or agents upon any land occupied by the company as are necessary to prevent the continued or repeated contraventions of such provisions, and the company shall indemnify the State for all costs and expenses incurred in connection therewith.

9. If any segment or element of the environment is polluted as a result of a contravention of such provisions, the State may serve notice upon the company requiring it to take such reasonable steps as are necessary to remove, disperse, destroy or mitigate the pollution within the time specified in the notice, and the State may specify the particular method to be used to remove, disperse, destroy or mitigate the pollution. The company shall forthwith comply with any notice properly given by the State.

10. If the company fails to comply with such notice or if immediate action is necessary to remove, disperse, destroy or mitigate the pollution referred to in clause (9), the State may take such reasonable steps including entering by its servants or agents upon any land occupied by the company as are necessary to remove, disperse, destroy or mitigate the pollution, and the company shall indemnify the State for all costs and expenses incurred in connection therewith.

11. The State shall notify the company prior to taking any action under Clause (10).

12. Notwithstanding that a plan or proposal has been approved by the State, the company shall compensate for any loss suffered by any person or persons as a result of the company's operations resulting from any damage (whether to land, anything on land, water or otherwise), or interference with any right to use land or water existing prior to the date hereof caused by disposal by the company of the overburden, tailings or other waste.

13. Without in any way limiting the company's obligation to implement the approved proposals relating to environmental management and protection and the disposal of overburden, tailings and other waste in accordance with Clause (2), regard in determining the extent and limits of the company's obligations under this Clause shall be had to the limited present use of the area, to the need for its development, to the State's desire for the project to proceed and be economically viable, and to the effect that the project must necessarily have on the environment. The company's obligation will be to act reasonably to mitigate damage to the environment in these acknowledged circumstances.

ANNEX C

LIST OF CONTACTS

DEPARTMENT OF MINERAL RESOURCES
Youyi Building
Brookfields, Freetown

Mr. Pessima, Permanent Secretary (replaced early November)
Mr. Belewa, Director of Mines
Mr. A.C. Wurie, Director of Geological Survey, New England
Mr. Abdul Amara, Geological Chemist, Geological Survey

DEPARTMENT OF TRADE, INDUSTRY AND STATE ENTERPRISES
Ministerial Building, 3rd floor
George Street, Freetown

Dr. Fofana, Secretary of State
Mrs. Kochan Koroma, Permanent Secretary
Mr. Sila, Director of Industry
Mr. Muctaru Lewally, Acting Deputy Director

DEPARTMENT OF FINANCE, DEVELOPMENT AND ECONOMIC PLANNING
Youyi Building
Brookfields, Freetown

Mr. A.B. Momoh, Development Secretary
Mr. V.M. Sovola, Director of Planning

DEPARTMENT OF LAND, HOUSING AND ENVIRONMENT
Youyi Building
Brooksfield, Freetown

Mr. Joseph Muana, Department of Environment

SIERRA RUTILE
Guma Building

Lamina Sankoh Street
Freetown

Mr. Jackett Simpson, General Manager
Mr. Ian Melrose, Manager of Finance
Mr. Chris Boli, Chief geologist
Mr. Dereck Grost, Manager of Administration
Mr. Abdul Hassan King, Rehabilitation Manager

SIEROMCO
Mokanji

Mr. James V.B. Westwood, Managing Director
Mr. Paul Mc. Gaine, Acting Managing Director

UNDP
United Nations House
43, Siaka Stevens Street
P.O. Box 1011 Freetown

Mr. Joseph Kotta, Resident Representative
Mrs. Zahra Nuru, Deputy Resident Representative
Mr. Mika Vepsalainen, UNIDO Programme Officer
Mr. A. Santos Kamara, National Economist

WORLD BANK

Mr. Leo Maraboli, Chief Mining Engineer
Mr. John E. Strongman, Principal Minerals Economist
Mr. W. Paatii Ofosu-Amaah, Chief Counsel, Africa Division

OTHER ORGANIZATIONS

Mr. N.H.T. Boston, Executive officer
Sierra Leone Chamber of Mines

Mr. Richard R. Duncan, General manager
Mining & General Services Limited

Mr. S.W. Blunsdon, General manager
Bomahun Gold project

Mr. Mohammed Deen, Deputy Managing Director
National Diamond Mining Company (in liquidation)

Mr. Mus B. Turay, General Manager
Government Gold and Diamond Office (G.G.D.O.)

Mr. G.L. Thomas
K.P.M.G. Peat Marwick

Mr. M.A. Hassan, Corporate Banking Officer, Standard Chartered Bank

Mr. G.W. K. Mason, Director, National development Bank

Mr. Ian McCluney, British High Commissioner

Mr. Nasri Halloway, Managing director, and Mr. Aboko-Colo Production Manager, Rainbow Paint Company Limited

Mr. E.C. Anusiowu, Principal Economist, African Development Bank

Capt. (retd) H.N.M. Swaray, General Manager Sierra Leone Airports Authority

Mr. Olu Beckley, General Manager, Sierra Leone housing Corporation

Mr. Joel K. Kateragga, Chief Technical Advisor, Improving Affordability of Shelter. SIL/91/002.

Mr. Ibrahim N. Yilla, Architect and Managing Director
Realini Bader Associates Ltd.

Mr. Frank P. Karefa, LANGER (S-L), Freetown

Mr. Bassie Turay, Chief Store Supervisor, National Diamond Mining Company, Yengema.

Note: Due to reasons of confidentiality, this is an incomplete list.

ANNEX D

JOB DESCRIPTIONS

SI/SIL/93/801-11-01

SI/SIL/93/801 - 11-02

SI/SIL/93/801 - 11-03

ANNEX D

6.7.93

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

Job Description

SI/SIL/93/XXX - 11-01

Post title:	Expert on rutile production
Duration:	2 months
Date required:	August/September 1993
Duty Station:	Freetown, Sierra Leone, with extensive internal travel
Purpose of advisory assistance:	To enable the Government of Sierra Leone to formulate its programme and decide on the strategy for further development of the rutile mining and processing operations.
Duties:	The expert will closely cooperate with the other experts and the the national staff and will assess existing capacities and capabilities for rutile mining and processing.

In particular, the expert will:

1. Review and assess government policies, current plans and programmes related to rutile mining and processing.

2. Review and assess existing capacities and capabilities of rutile mining and processing in the country by making site-visits to rutile mines.

3. Assess the environmental degradation caused by rutile mining and review existing legislations and standards designed to mitigate such degradation.

4. Determine possibility of local processing of rutile mining using environmentally sustainable technologies for that purpose.

5. Suggest legislations to check environmental damage resulting from rutile mining.

6. In cooperation with the industrial economist, who will carry out marketing analysis and techno-economic study, prepare a comprehensive report, including recommendations to the Government on the development of rutile production for local and international markets.

Qualifications required: Industrial technologist with at least 10 years experience in the mining and processing of rutile and environmental issues.

Language requirements: English

Background information:

The mineral called rutile or titanium dioxide has very unique physical (electrophysical and optical) properties which make it highly valuable. Whether in the form of thin films for coatings as well as in bulk, it is widely used in the electronics industry (as microminiature capacitors), optoelectronics, medical technology, solar devices and space technology as antireflexion layer. Rutile is also used as an additive in advanced ceramics composites and in the fabrication of superalloys. In the home, it is the ingredient which makes frying pans non-stick and so it is finding an increasingly wide application in home appliances.

Sierra Leone is one of the few countries in the world where rutile is available. Indeed, after Australia, Sierra Leone is the world's largest producer but not correspondingly the biggest beneficiary from the mining of the mineral.

Production of rutile began near the Bonthe district in 1979 by Sierra Rutile, a company chiefly owned by a US conglomerate called Bethlehem Steel. Poor world demand in 1982 led to the suspension of production but with the take-over of the mines by another US company called Nord Resources, noticeable improvements are being recorded. Thus in 1988 production and exports exceeded 100,000 tons. For the first time, the Government earned as much as $580,000 in customs duty alone.

Sierra Leone is a mineral-based economy in which diamond, gold, rutile and bauxite together account for 80% of official receipts. But diamonds and gold are bedevilled with smuggling thus leaving rutile as the country's largest single source of foreign exchange. In 1988 the country earned $46.2 million and in 1989 some $66.5 million was earned through the exports of rutile. This has encouraged the Government to allow exploration in new sites at Bradford Fotifunk and Moyamba districts. The country hopes to make as much as $100 million per annum and to achieve this, negotiations have started with the World Bank for credits.

The Government is, however, concerned that the country is yet to maximize the benefits that should accrue to it from the export of this rare mineral. The country is therefore anxious to introduce measures which will promote rehabilitation of existing mines, new investments and maximum returns. For the moment, all the rutile that is mined are exported from Sierra Leone in an unprocessed form, without any value added.

Equally disturbing is the environmental degradation resulting from rutile mining. Apart from the deep open spaces which now form lakes in the Jagbahum and Mogbandi villages of the Bonthe district, there are reports about pollution of the drinking water and the frequent outbreak of dysentery. Furthermore indiscriminate mining is causing deforestation and subsequently may result in erosion and flooding of the mining areas.

More unfortunate, however, is the type of agreements under which the foreign companies are operating in the country. The agreements, because of some objectionable clauses, place the country at some disadvantage which leads to considerable loss in revenue.
In recognition of the need to rectify the anomalies, the Secretary of State (Minister), Department of Finance, during his 1992/93 budget, signaled the intention of the Government to renegotiate most agreements for the exploitation of the country's natural resources. This will be in keeping with the spirit of the new Economic Recovery Programme which inter alia places a lot of premium on measures to expand the revenue base of the country.

6.7.93

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

Job Description

SI/SIL/93/XXX - 11-02

Post title:	Expert/industrial economist
Duration:	1.5 months
Date required:	August/September 1993
Duty Station:	Freetown, Sierra Leone, with extensive internal travel
Purpose of advisory assistance:	To enable the Government of Sierra Leone to formulate its programme and decide on the strategy for further development of the rutile mining and processing operations.
Duties:	The expert will closely cooperate with the expert/ technologist in rutile production and national staff.

In particular, the expert will:

1. Hold consultations on the rutile mining and processing with the international expert on rutile production, national staff, government ministries and companies in Sierra Leone engaged in the rutile production.

2. Review and assess the financial and economic information on the mining and processing of rutile.

3. Based on the above, carry out economic estimation of viability of local rutile production market and financial analyses of rutile production.

4. Identify areas for investment activities relating to the development of rutile production.

5. In cooperation with expert/technologist and national staff, prepare a comprehensive report including recommendations to the Government on the development of rutile production for local and international markets.

Qualifications required: Industrial economist with at least 10 years experience in industrial development of local raw materials, market analyst.

Language requirements: English

Background information:

The mineral called rutile or titanium dioxide has very unique physical (electrophysical and optical) properties which make it highly valuable. Whether in the form of thin films for coatings as well as in bulk, it is widely used in the electronics industry (as microminiature capacitors), optoelectronics, medical technology, solar devices and space technology as antireflexion layer. Rutile is also used as an additive in advanced ceramics composites and in the fabrication of superalloys. In the home, it is the ingredient which makes frying pans non-stick and so it is finding an increasingly wide application in home appliances.

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Production of rutile began near the Bonthe district in 1979 by Sierra Rutile, a company chiefly owned by a US conglomerate called Bethlehem Steel. Poor world demand in 1982 led to the suspension of production but with the take-over of the mines by another US company called Nord Resources, noticeable improvements are being recorded. Thus in 1988 production and exports exceeded 100,000 tons. For the first time, the Government earned as much as $580,000 in customs duty alone.

Sierra Leone is a mineral-based economy in which diamond, gold, rutile and bauxite together account for 80% of official receipts. But diamonds and gold are bedevilled with smuggling thus leaving rutile as the country's largest single source of foreign exchange. In 1988 the country earned $46.2 million and in 1989 some $66.5 million was earned through the exports of rutile. This has encouraged the Government to allow exploration in new sites at Bradford Rotifunk and Moyamba districts. The country hopes to make as much as $100 million per annum and to achieve this, negotiations have started with the World Bank for credits.

The Government is, however, concerned that the country is yet to maximize the benefits that should accrue to it from the export of this rare mineral. The country is therefore anxious to introduce measures which will promote rehabilitation of existing mines, new investments and maximum returns. For the moment, all the rutile that is mined are exported from Sierra Leone in an unprocessed form, without any value added.

Equally disturbing is the environmental degradation resulting from rutile mining. Apart from the deep open spaces which now form lakes in the Jagbahum and Mogbandi villages of the Bonthe district, there are reports about pollution of the drinking water and the frequent outbreak of dysentery. Furthermore indiscriminate mining is causing deforestation and subsequently may result in erosion and flooding of the mining areas.

More unfortunate, however, is the type of agreements under which the foreign companies are operating in the country. The agreements, because of some objectionable clauses, place the country at some disadvantage which leads to considerable loss in revenue.
In recognition of the need to rectify the anomalies, the Secretary of State (Minister), Department of Finance, during his 1992/93 budget, signaled the intention of the Government to renegotiate most agreements for the exploitation of the country's natural resources. This will be in keeping with the spirit of the new Economic Recovery Programme which inter alia places a lot of premium on measures to expand the revenue base of the country.

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6.7.93

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

Job Description

SI/SIL/93/XXX - 11-03

Post title:	Legal expert in mining
Duration:	1.5 months
Date required:	August/September 1993
Duty Station:	Freetown, Sierra Leone, with extensive internal travel
Purpose of advisory assistance:	To enable the Government of Sierra Leone to formulate its programme and decide on the strategy for further development of the rutile mining and processing operations.
Duties:	The expert will closely cooperate with the international experts and the national staff and will assess agreements and contracts on rutile mining and processing in the country.

In particular, the expert will:

1. Hold consultations on agreements and contracts concerning the rutile mining and pdrocessing with Government authorities, companies and firms working on rutile exploitation.

2. Review and assess Government policies, current plans and programmes related to rutile exploitation, as well as all contracts and agreements on the same.

3. Elaborate practical recommendations to the Government on the improvement of existing agreements and contracts for rutile exploitation.

4. Brief national staff, industrialists and decision makers, on contract negotiations and conclusions of agreements/contracts.

Qualifications required: Lawyer with at least ten years experience in mining laws and contract negotiations for industry.

Language requirements: English

Background information:

The mineral called rutile or titanium dioxide has very unique physical (electrophysical and optical) properties which make it highly valuable. Whether in the form of thin films for coatings as well as in bulk, it is widely used in the electronics industry (as microminiature capacitors), optoelectronics, medical technology, solar devices and space technology as antireflexion layer. Rutile is also used as an additive in advanced ceramics composites and in the fabrication of superalloys. In the home, it is the ingredient which makes frying pans non-stick and so it is finding an increasingly wide application in home appliances.

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ANNEX E

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ANNEX F

UNIDO COMFAR FINANCIAL SCHEDULES
FINANCIAL ANALYSIS
FOR A
BRICK AND ROOF TILE PRODUCTION UNIT
IN
SIERRA LEONE

ANNEX F

COMFAR 2.1 UNIDO

COMFAR 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME.

Sierra Brick and Tile
30th November 1993
++++++++++

1 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = [illegible] units accounting currency
local currency 1 unit = [illegible] units accounting currency
accounting currency: US Dollars

Total initial investment during construction phase

fixed assets:	[illegible]	28.235 % foreign
current assets:	[illegible]	0.000 % foreign
total assets:	[illegible]	28.235 % foreign

Source of funds during construction phase

equity & grants:	[illegible]	17.775 % foreign
foreign loans :	[illegible]	
local loans :	[illegible]	
total funds :	[illegible]	28.235 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	[illegible]	56723.00	56729.00
depreciation :	[illegible]	36013.80	35019.80
interest :	[illegible]	5596.50	5022.50
production costs	[illegible]	99345.30	97771.30
thereof foreign	[illegible] %	31.32 %	30.9[illegible] %
total sales :	[illegible]	356200.00	356200.00
gross income :	[illegible]	257834.70	258408.70
net income :	[illegible]	141809.10	142124.[illegible]
cash balance :	[illegible]	159994.10	153364.60
net cashflow :	[illegible]	182530.60	163187.10

Net Present Value at [illegible] % = [illegible]
Internal Rate of Return: [illegible] %
Return on equity1: [illegible]
Return on equity2: [illegible] %

Index of Schedules produced by COMFAR

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance

COMFAR 2.1 UNIDO

COMFAR 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME

otal Initial Investment in US Dollars

r	[illegible]
ed investment costs	
and, site preparation, development	570[illegible]
uildings and civil works	3300[illegible]
uxiliary and service facilities .	440[illegible]
ncorporated fixed assets	[illegible]
lant machinery and equipment . . .	2060[illegible]
tal fixed investment costs	637[illegible]
e-production capital expenditures.	[illegible]
t working capital	[illegible]
tal initial investment costs . . .	6445[illegible]
f it foreign, in %	[illegible]

COMFAR 2.1 UNIDO

COMFAR 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME

tal Current Investment in US Dollars

. . . . .	1994	1995
d investment costs		
d, site preparation, development	0.000	0.000
ldings and civil works	0.000	0.000
illiary and service facilities .	0.000	0.000
orporated fixed assets	0.000	0.000
nt, machinery and equipment . .	0.000	0.000
l fixed investment costs	0.000	0.000
production capitals expenditures.	0.000	0.000
king capital	5166.670	551.111
l current investment costs . . .	5166.670	551.111
it foreign, %	25.347	45 . .

Sierra Brick and Tile --- 30th November 1993

Total Production Costs in US Dollars

Year	1994	1995	1996	1997	1998
% of nom. capacity (single product)	76.923	100.000	100.000	100.000	100.000
Raw material 1	0.000	0.000	0.000	0.000	0.000
Other raw materials	0.000	0.000	0.000	0.000	0.000
Utilities	1611.554	2034.000	2034.000	2034.000	2034.000
Energy	6780.000	8814.000	8814.000	8814.000	8814.000
Labour, direct	18398.550	19525.000	19525.000	19525.000	19525.000
Repair, maintenance	0.000	0.000	0.000	0.000	0.000
Spares	8798.308	10356.000	10356.000	10356.000	10356.000
Factory overheads	15251.540	16000.000	16000.000	16000.000	16000.000
Factory costs	50949.950	56729.000	56729.000	56729.000	56729.000
Administrative overheads	0.000	0.000	0.000	0.000	0.000
Indir. costs, sales and distribution	0.000	0.000	0.000	0.000	0.000
Direct costs, sales and distribution	0.000	0.000	0.000	0.000	0.000
Depreciation	36019.800	36019.800	36019.800	36019.800	36019.800
Financial costs	5740.000	5096.500	5022.500	4948.500	3874.500
Total production costs	92809.770	98845.300	97771.300	97697.300	96623.300
Costs per unit (single product)	0.093	0.078	0.075	0.075	0.074
Of it foreign, %	31.729	31.317	30.912	30.562	30.093
Of it variable,%	21.161	25.904	26.057	26.211	26.366
Total labour	18398.550	19525.000	19525.000	19525.000	19525.000

COMFAR

COMFAR 3.1 - UNITED NATIONS DEVELOPMENT PROGRAMME

Total Production Costs in US Dollars

Year	1999	2000	2001	2002	2003
% of nom. capacity (single product).	100.000	100.000	100.000	[illegible]	[illegible]
Raw material 1	0.000	0.000	0.000	[illegible]	[illegible]
Other raw materials	0.000	0.000	0.000	[illegible]	[illegible]
Utilities	2034.000	2034.000	2034.000	[illegible]	[illegible]
Energy	9814.000	9814.000	9814.000	[illegible]	[illegible]
Labour, direct	19525.000	19525.000	19525.000	[illegible]	[illegible]
Repair, maintenance	0.000	0.000	0.000	[illegible]	[illegible]
Spares	10356.000	10356.000	10356.000	[illegible]	[illegible]
Factory overheads	15000.000	15000.000	15000.000	[illegible]	[illegible]
Factory costs	56729.000	56729.000	56729.000	[illegible]	[illegible]
Administrative overheads	0.000	0.000	0.000	[illegible]	[illegible]
Indir. costs, sales and distribution	0.000	0.000	0.000	[illegible]	[illegible]
Direct costs, sales and distribution	0.000	0.000	0.000	[illegible]	[illegible]
Depreciation	38019.800	38019.800	38019.800	[illegible]	[illegible]
Financial costs	3544.500	2729.500	2150.500	[illegible]	[illegible]
Total production costs	98293.300	97478.300	96901.300	[illegible]	[illegible]
Costs per unit (single product)	0.074	0.073	0.073	[illegible]	[illegible]
Of it foreign, %	23.578	23.331	23.824	[illegible]	[illegible]
Of it variable,%	26.524	26.691	26.845	[illegible]	[illegible]
Total labour	19525.000	19525.000	19525.000	[illegible]	[illegible]

COMFAR 2.1 UNIDO

COMFAR 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME,

Net Working Capital in US Dollars

Year			1994	1995	1996-2008
Coverage	mds	coto			
Current assets &					
Accounts receivable	30	12.0	3617.994	3977.417	3977.417
Inventory and materials	30	12.0	134.296	169.500	169.500
Energy	30	12.0	555.000	734.500	734.500
Spares	56	6.4	1353.385	1613.000	1613.000
Work in progress	9	42.0	1226.441	1350.805	1350.805
Finished products	6	59.5	864.711	953.064	953.064
Cash in hand	10	29.9	1479.657	1561.708	1561.708
Total current assets			9240.814	10359.990	10359.990
Current liabilities and					
Accounts payable	35	14.2	3637.973	4002.417	4002.417
Net working capital			5602.837	6357.573	6357.573
Increase in working capital			5602.837	754.740	0.000
Net working capital, local			4321.113	4807.573	4807.573
Net working capital, foreign			1281.731	1550.000	1550.000

Note: mds = minimum days of coverage ; coto = coefficient of turnover .

Sierra Brick and Tile --- 30th November 1992

COMFAR UNIDO

COMFAR 3.1 - UNITED NATIONS DEVELOPMENT PROGRAMME

Source of Finance, construction in US Dollars

Year	1993
Equity, ordinary ..	5626...000
Equity, preference.	...000
Subsidies, grants .	1.000
Loan A, foreign .	8000.000
Loan B, foreign..	1.000
Loan C, foreign .	1.000
Loan A, local....	1.000
Loan B, local....	1.000
Loan C, local....	1.000
Total loan	8001.000
Current liabilities	1.000
Bank overdraft	1.000
Total funds	5--8 1.000

Sierra Brick and Tile --- 30th November 1990

COMFAR UNIDO

COMFAR 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME .

Source of Finance, production in US Dollars

Year	1994	1995	1996-2004
Equity, ordinary ..	0.000	[illegible]	0.000
Equity, preference.	0.000	[illegible]	0.000
Subsidies, grants .	0.000	[illegible]	0.000
Loan A, foreign .	0.000	[illegible]	-8200.000
Loan B, foreign..	0.000	[illegible]	0.000
Loan C, foreign .	0.000	[illegible]	0.000
Loan A, local....	0.000	[illegible]	0.000
Loan B, local....	0.000	[illegible]	0.000
Loan C, local....	0.000	[illegible]	0.000
Total loan	0.000	[illegible]	-8200.000
Current liabilities	[illegible]	[illegible]	0.000
Bank overdraft	[illegible]	[illegible]	0.000
Total funds	[illegible]	[illegible]	-8200.000

Sierra Brick and Tile --- 30th November 1993

COMFAR 2.1 UNIDO

COMFAR 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME

Cashflow Tables, construction in US Dollars

Year	1990
Total cash inflow . .	[illegible]
Financial resources .	[illegible]
Sales, net of ta- . .	[illegible]
Total cash outflow .	[illegible]
Total assets	[illegible]
Operating costs . .	[illegible]
Cost of finance . .	[illegible]
Repayment	[illegible]
Corporate ta- . . .	[illegible]
Dividends paid . .	[illegible]
Surplus (deficit)	[illegible]
Cumulated cash balance	[illegible]
Inflow, local . . .	[illegible]
Outflow, local	[illegible]
Surplus (deficit)	[illegible]
Inflow, foreign . .	[illegible]
Outflow, foreign . .	[illegible]
Surplus (deficit)	[illegible]
Net cashflow	[illegible]
Cumulated net cashflow	[illegible]

Sierra Brick and Tile --- 30th November 1990

COMFAR 2.1 UNIDO

COMFAR 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME

Cashflow tables, production in US Dollars

Year	1994	1995	1996	1997	1998	1999
Total cash inflow	277638.000	355564.400	[illegible]	356200.000	[illegible]	356200.000
Financial resources	3637.978	364.438	0.000	0.000	[illegible]	0.000
Sales, net of tax	274000.000	355200.000	[illegible]	356200.000	[illegible]	356200.000
Total cash outflow	147438.400	187670.300	[illegible]	185213.700	[illegible]	185297.300
Total assets	9240.814	1119.180	0.000	0.000	[illegible]	0.000
Operating costs	50849.980	56729.000	[illegible]	56729.000	[illegible]	56729.000
Cost of finance	5740.000	5596.500	[illegible]	4483.500	[illegible]	3300.500
Repayment	0.000	8200.000	[illegible]	8200.000	[illegible]	8200.000
Corporate tax	81907.500	116025.800	[illegible]	115831.200	[illegible]	117067.800
Dividends paid	0.000	0.000	0.000	0.000	[illegible]	0.000
Surplus (deficit)	130199.600	168894.100	[illegible]	171281.300	[illegible]	170902.700
Cumulated cash balance	130199.600	299093.800	[illegible]	639319.600	[illegible]	980828.300
Inflow, local	277517.300	355560.100	[illegible]	356201.000	[illegible]	356200.000
Outflow, local	132553.700	184601.200	[illegible]	184171.200	[illegible]	184796.800
Surplus (deficit)	144663.600	170958.900	[illegible]	172029.800	[illegible]	171403.200
Inflow, foreign	20.673	4.327	0.000	0.000	[illegible]	0.000
Outflow, foreign	14484.710	23069.100	[illegible]	21048.500	[illegible]	20500.500
Surplus (deficit)	-14464.040	-23064.770	[illegible]	-21048.500	[illegible]	-20500.500
Net cashflow	130199.600	182690.600	[illegible]	182233.800	[illegible]	182403.200
Cumulated net cashflow	-508660.400	-325969.800	[illegible]	40145.080	[illegible]	405210.900

Sierra Brick and Tile --- 30th November 1993

Cashflow tables, production in US Dollars

Year	2000	2001	2002	2003	2004	2005
Total cash inflow	356200.000	356200.000	356200.000	356200.000	356200.000	356200.000
Financial resources	0.000	0.000	0.000	0.000	0.000	0.000
Sales, net of tax	356200.000	356200.000	356200.000	356200.000	356200.000	356200.000
Total cash outflow	184981.500	184685.900	184777.700	184462.800	184118.500	182723.500
Total assets	0.000	0.000	0.000	0.000	0.000	0.000
Operating costs	56729.000	56729.000	56729.000	56729.000	56729.000	56729.000
Cost of finance	2726.500	2152.500	1578.500	1004.500	430.500	0.000
Repayment	8200.000	8200.000	8200.000	8200.000	8200.000	8200.000
Corporate tax	117026.100	117554.400	118270.200	118528.500	118758.500	117293.500
Dividends paid	0.000	0.000	0.000	0.000	0.000	0.000
Surplus (deficit)	171218.500	171514.100	171422.300	171738.200	172081.500	173476.500
Cumulated cash balance	1152987.000	1323581.000	1495003.000	1666741.000	1838822.000	2012298.000
Inflow, total	356200.000	356200.000	356200.000	356200.000	356200.000	356200.000
Outflow, total	185029.100	185313.900	185999.200	186257.500	186723.500	186723.500
Surplus (deficit)	171144.300	170886.100	170200.800	169942.500	169476.500	169476.500
Inflow, foreign	0.000	0.000	0.000	0.000	0.000	0.000
Outflow, foreign	19828.500	19352.500	18778.500	18204.500	17630.000	17056.000
Surplus (deficit)	-19828.500	-19352.500	-18778.500	-18204.500	-17630.000	-17056.000
Net cashflow	151144.300	151886.600	151200.800	150942.500	151776.500	152476.500
Cumulated net cashflow	587355.000	769242.200	950443.000	1131386.000	1313155.000	1478817.000

COMFAR 2.1 UNIDO

COMFAR 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME

Cashflow tables, production in US Dollars

Year	2006	2007	2008
Total cash inflow	356200.000	356200.000	356200.000
Financial resources	0.000	0.000	0.000
Sales, net of tax	356200.000	356200.000	356200.000
Total cash outflow	182729.500	182729.500	182750.719
Total assets	0.000	0.000	0.000
Operating costs	56729.000	56729.000	56729.000
Cost of finance	0.000	0.000	0.000
Repayment	0.000	0.000	0.000
Corporate tax	126000.500	126000.500	126021.719
Dividends paid	0.000	0.000	0.000
Surplus (deficit)	173470.500	173470.500	173449.281
Cumulated cash balance	1198353.000	1325823.000	1525872.000
Inflow, local	356200.000	356200.000	356200.000
Outflow, local	173729.500	173729.500	173750.719
Surplus (deficit)	182470.500	182470.500	182449.281
Inflow, foreign	0.000	0.000	0.000
Outflow, foreign	9000.000	9000.000	9000.000
Surplus (deficit)	-9000.000	-9000.000	-9000.000
Net cashflow	173470.500	173470.500	173449.281
Cumulated net cashflow	1351737.000	1525208.000	1698657.000

Sierra Brick and Tile --- 30th November 1993

Cashflow Discounting:

a) Equity paid versus Net income flow:

Net present value ..... 395115.69 at 11.0 %

Internal Rate of Return (IRRE) .. 22.95 %

b) Net Worth versus Net cash return:

Net present value ..... 595593.38 at 11.0 %

Internal Rate of Return (IRRES) .. 28.13 %

c) Internal Rate of Return on total investment:

Net present value ..... 577755.50 at 11.0 %

Internal Rate of Return (IRR) .. 26.05 %

Net Worth = Equity paid plus reserves

COMFAR 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME

Net Income Statement in US Dollars

Year	1994	1995	1996	1997	1998
Total sales, incl. sales tax	374966.700	356200.000	356200.000	356200.000	356200.000
less: variable costs, incl. sales tax.	19596.850	25475.850	25475.850	25475.850	25475.850
Variable margin	354469.200	330724.200	330724.200	330724.200	330724.200
as % of total sales	92.848	92.849	92.849	92.849	92.849
Non-variable costs, incl. depreciation	67312.350	67292.950	67292.950	67292.950	67292.950
Operational margin	287038.200	263431.200	263431.200	263431.200	263431.200
as % of total sales	76.555	73.956	73.956	73.956	73.956
Cost of finance	5740.000	5598.500	5022.500	4448.500	3874.500
Gross profit	281350.200	257834.700	258408.700	258982.700	259556.700
Allowances	0.000	0.000	0.000	0.000	0.000
Taxable profit	281350.200	257834.700	258408.700	258982.700	259556.700
Tax	81617.550	116025.600	116283.900	116541.200	116800.500
Net profit	99732.650	141809.100	142124.800	142440.500	142756.200
Dividends paid	0.000	0.000	0.000	0.000	0.000
Undistributed profit	99732.650	141809.100	142124.800	142440.500	142756.200
Accumulated undistributed profit	99732.800	241551.700	383676.500	526117.000	668873.200
Gross profit, % of total sales	75.035	72.385	72.546	72.707	72.868
Net profit, % of total sales	26.601	39.812	39.901	39.989	40.078
ROI, Net profit, % of equity	17.733	25.209	25.261	25.313	25.365
ROI, Net profit+interest, % of invest.	16.221	22.644	22.695	22.745	22.795

COMFAR 2.1 UNIDO

COMFAR 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME

Net Income Statement in US Dollars

Year	1999	[illegible]	2001	2002	2003
Total sales, incl. sales tax	356200.000	[illegible]	356200.000	356200.000	356200.000
Less: variable costs, incl. sales tax.	25475.850	[illegible]	25475.850	25475.850	25475.850
Variable margin	330724.200	[illegible]	330724.200	330724.200	330724.200
As % of total sales	92.848	[illegible]	92.848	92.848	92.848
Non-variable costs, incl. depreciation	67272.850	[illegible]	67272.850	66322.850	66322.850
Operational margin	263451.200	[illegible]	263451.200	264401.200	264401.200
As % of total sales	73.962	[illegible]	73.962	74.228	74.228
Cost of finance	3300.500	[illegible]	2152.500	1578.500	1004.500
Gross profit	260150.700	[illegible]	261298.700	262822.700	263396.700
Allowances	0.000	[illegible]	0.000	0.000	0.000
Taxable profit	260150.700	[illegible]	261298.700	262822.700	263396.700
Tax	117067.800	[illegible]	117584.400	118270.200	118528.500
Net profit	143082.900	[illegible]	143714.300	144552.500	144868.200
Dividends paid	0.000	[illegible]	0.000	0.000	0.000
Undistributed profit	143082.900	[illegible]	143714.300	144552.500	144868.200
Accumulated undistributed profit	811957.100	[illegible]	1099080.000	1243632.000	1388501.000
Gross profit, % of total sales	73.035	[illegible]	73.357	73.785	73.945
Net profit, % of total sales	40.169	[illegible]	40.347	40.582	40.670
ROE, Net profit, % of equity	35.432	[illegible]	35.545	35.534	35.756
ROI, Net profit+interest, % of invest.	22.487	[illegible]	22.408	22.449	22.469

Sierra Brick and Tile --- 30th November 1993

COMFAR 2.1 UNIDO

COMFAR 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME

Net Income Statement in US Dollars

Year	2004	2005	2006	2007	2008
Total sales, incl. sales tax	356200.000	356200.000	356200.000	356200.000	356200.000
Less: variable costs, incl. sales tax.	25475.850	25475.850	25475.850	25475.850	25475.850
Variable margin	330724.200	330724.200	330724.200	330724.200	330724.200
As % of total sales	92.848	92.848	92.848	92.848	92.848
Non-variable costs, incl. depreciation	50722.950	50722.950	50722.950	50722.950	50675.950
Operational margin	280001.200	280001.200	280001.200	280001.200	280048.200
As % of total sales	78.608	78.608	78.608	78.608	78.621
Cost of finance	0.000	0.000	0.000	0.000	0.000
Gross profit	280001.200	280001.200	280001.200	280001.200	280048.200
Allowances	0.000	0.000	0.000	0.000	0.000
Taxable profit	280001.200	280001.200	280001.200	280001.200	280048.200
Tax	126000.500	126000.500	126000.500	126000.500	126021.700
Net profit	154000.700	154000.700	154000.700	154000.700	154026.500
Dividends paid	0.000	0.000	0.000	0.000	0.000
Undistributed profit	154000.700	154000.700	154000.700	154000.700	154026.500
Accumulated undistributed profit	1542501.000	1696502.000	1850502.000	2004503.000	2158530.000
Gross profit, % of total sales	78.608	78.608	78.608	78.608	78.621
Net profit, % of total sales	43.234	43.234	43.234	43.234	43.242
FID: Net profit, % of equity	27.373	27.373	27.373	27.373	27.378
FII: Net profit+interest, % of invest.	23.658	23.658	23.658	23.658	23.662

Sierra Brick and Tile --- 30th November 1993

Projected Balance Sheets, construction : US Dollars

Year	1993
Total assets	644600.000
Fixed assets, net of depreciation	0.000
Construction in progress	644600.000
Current assets	0.000
Cash, bank	0.000
Cash surplus, finance available	0.000
Loss carried forward	0.000
Loss	0.000
Total liabilities	644600.000
Equity capital	562600.000
Reserves, retained profit	0.000
Profit	0.000
Long and medium term debt	82000.000
Current liabilities	0.000
Bank overdraft, finance required	0.000
Total debt	82000.000
Equity, % of liabilities	87.279

Sierra Brick and Tile --- 30th November 1993

COMFAR 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME

Projected Balance Sheets, Production in US Dollars

Year	1994	1995	1996	1997	1998
Total assets	747580.600	881954.200	1015879.000	1150119.000	1284687.000
Fixed assets, net of depreciation	608540.200	572500.400	536460.600	500420.800	454400.900
Construction in progress	0.000	0.000	0.000	0.000	0.000
Current assets	7751.137	8738.286	8738.286	8738.286	8738.286
Cash, bank	1479.977	1561.709	1561.708	1561.709	1561.708
Cash surplus, finance available	130139.600	299093.800	469058.400	639338.600	809925.700
Loss carried forward	0.000	0.000	0.000	0.000	0.000
Loss	0.000	0.000	0.000	0.000	0.000
Total liabilities	747580.600	881954.200	1015879.000	1150119.000	1284687.000
Equity capital	562600.000	562600.000	562600.000	562600.000	562600.000
Reserves, retained profit	0.000	23742.600	241551.700	383676.500	523117.000
Profit	99742.600	141509.100	142124.800	142440.500	142787.200
Long and medium term debt	82000.000	73800.000	65600.000	57400.000	49200.000
Current liabilities	3837.972	4002.417	4002.417	4002.417	4002.417
Bank overdraft, finance required.	0.000	0.000	0.000	0.000	0.000
Total debt	85837.980	77802.418	69602.419	61402.420	53202.420
Equity, % of liabilities	75.215	63.790	55.381	48.917	43.799

Sierra Brick and Tile --- 30th November 1993

COMFAR 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME

Projected Balance Sheets, Production in US Dollars

Year	1999	2000	2001	2002	2003
Total assets	1419571.000	1554788.000	1690282.000	1826635.000	1963303.000
Fixed assets, net of depreciation	428361.100	392361.300	356341.500	321271.700	286201.900
Construction in progress	0.000	0.000	0.000	0.000	0.000
Current assets	8738.286	8738.286	8738.286	8738.286	8738.286
Cash, bank	1561.708	1561.709	1561.708	1561.708	1561.709
Cash surplus, finance available	980926.400	1152147.000	1323661.000	1495003.000	1666741.000
Loss carried forward	0.000	0.000	0.000	0.000	0.000
Loss	0.000	0.000	0.000	0.000	0.000
Total liabilities	1419571.000	1554788.000	1690282.000	1826635.000	1963303.000
Equity capital	562600.000	562600.000	562600.000	562600.000	562600.000
Reserves, retained profit	665334.200	811867.100	955965.000	1093080.000	1243631.000
Profit	142082.900	143398.800	143714.300	144552.500	144868.200
Long and medium term debt	41000.000	32800.000	24600.000	16400.000	8200.000
Current liabilities	4002.417	4002.417	4002.417	4002.417	4002.417
Bank overdraft, finance required.	0.000	0.000	0.000	0.000	0.000
Total debt	45002.420	36802.420	28602.420	20402.420	12202.420

COMFAR

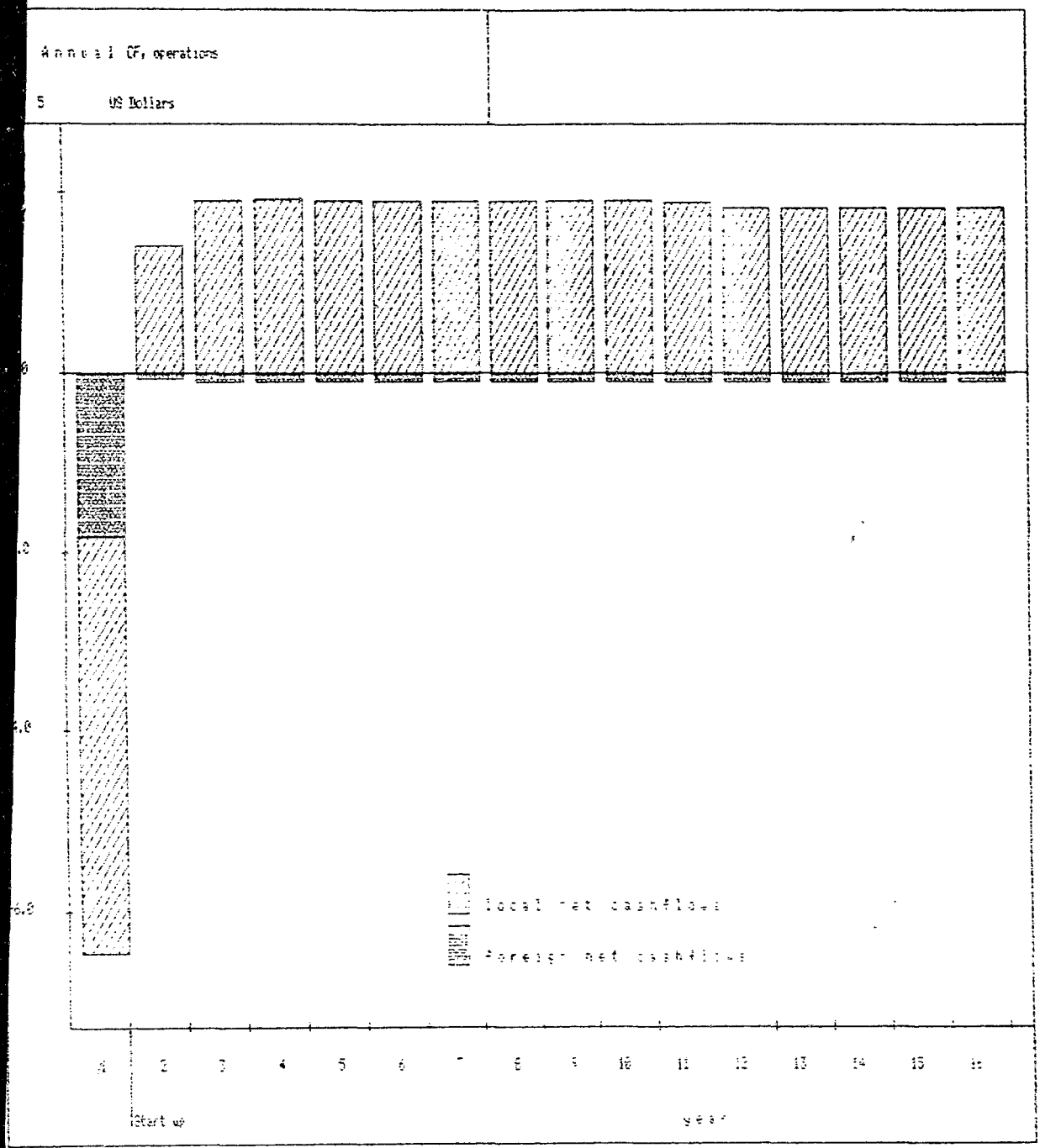
COMFAR 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME

Projected Balance Sheets, Production in US Dollars

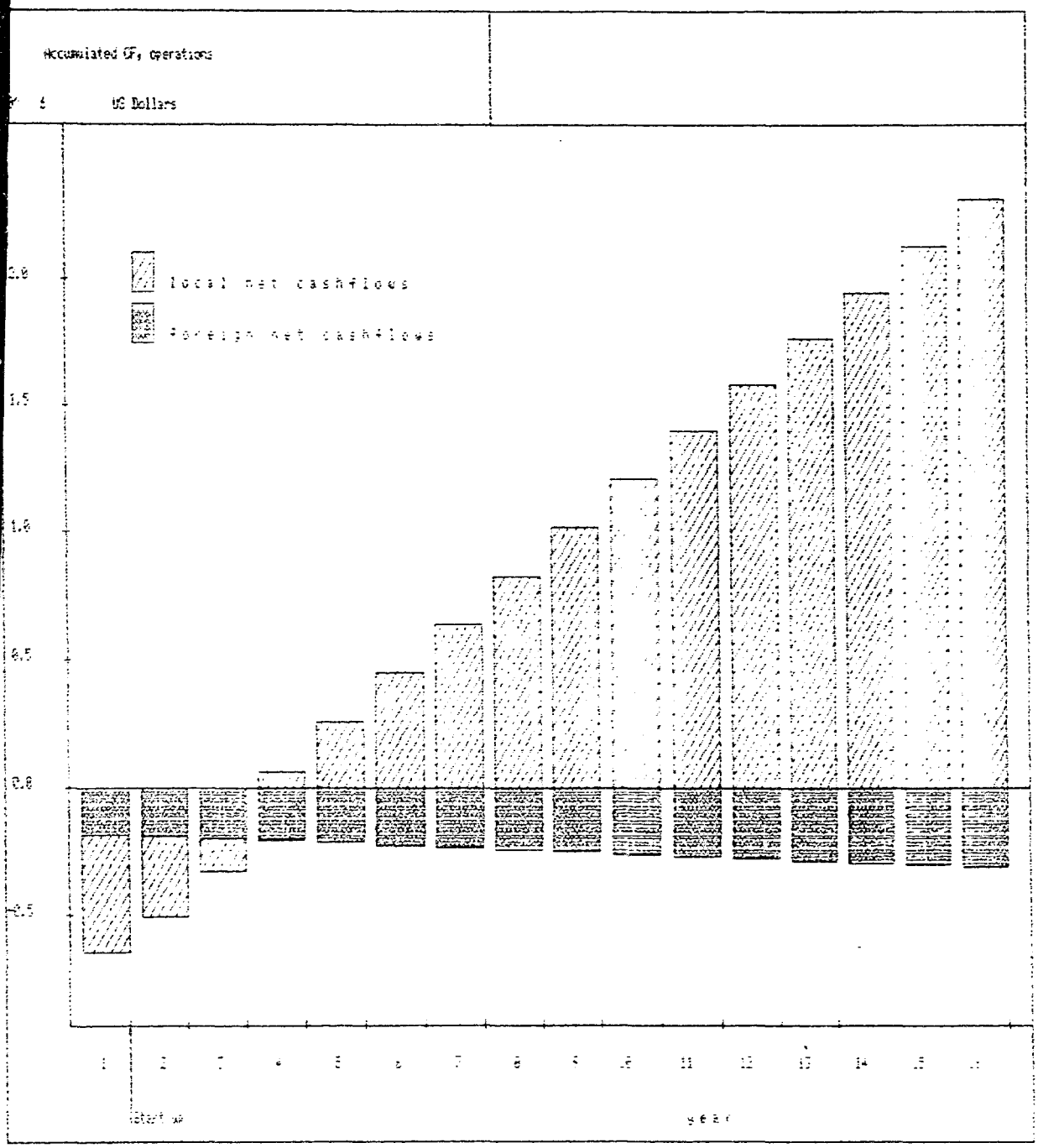
Year	2004	2005	2006	2007	2008
Total assets	2109104.000	2263104.000	2417105.000	2571106.000	2725107.000
Fixed assets, net of depreciation	155732.100	247282.900	227782.500	208132.700	188333.800
Construction in progress	0.000	0.000	0.000	0.000	0.000
Current assets	8738.280	8738.285	8738.285	8738.285	8738.285
Cash, bank	1561.708	1561.708	1561.708	1561.708	1561.708
Cash surplus, finance available	1938012.000	2005492.000	2178953.000	2353433.000	2528933.000
Loss carried forward	0.000	0.000	0.000	0.000	0.000
Loss	0.000	0.000	0.000	0.000	0.000
Total liabilities	2109104.000	2263104.000	2417105.000	2571106.000	2725107.000
Equity capital	582600.000	582600.000	582600.000	582600.000	582600.000
Reserves, retained profit	1385501.000	1542501.000	1696502.000	1851502.000	2006502.000
Profit	154000.700	154000.700	154000.700	154000.700	154004.000
Long and medium term debt	0.000	0.000	0.000	0.000	0.000
Current liabilities	4002.417	4002.417	4002.417	4002.417	4002.417
Bank overdraft, finance received	0.000	0.000	0.000	0.000	0.000
Total debt	4002.417	4002.417	4002.417	4002.417	4002.417
Equity, % of liabilities	26.875	24.859	23.276	21.882	21.045

Sierra Brick and Tile --- 21st November 1991

COMFAR 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME,



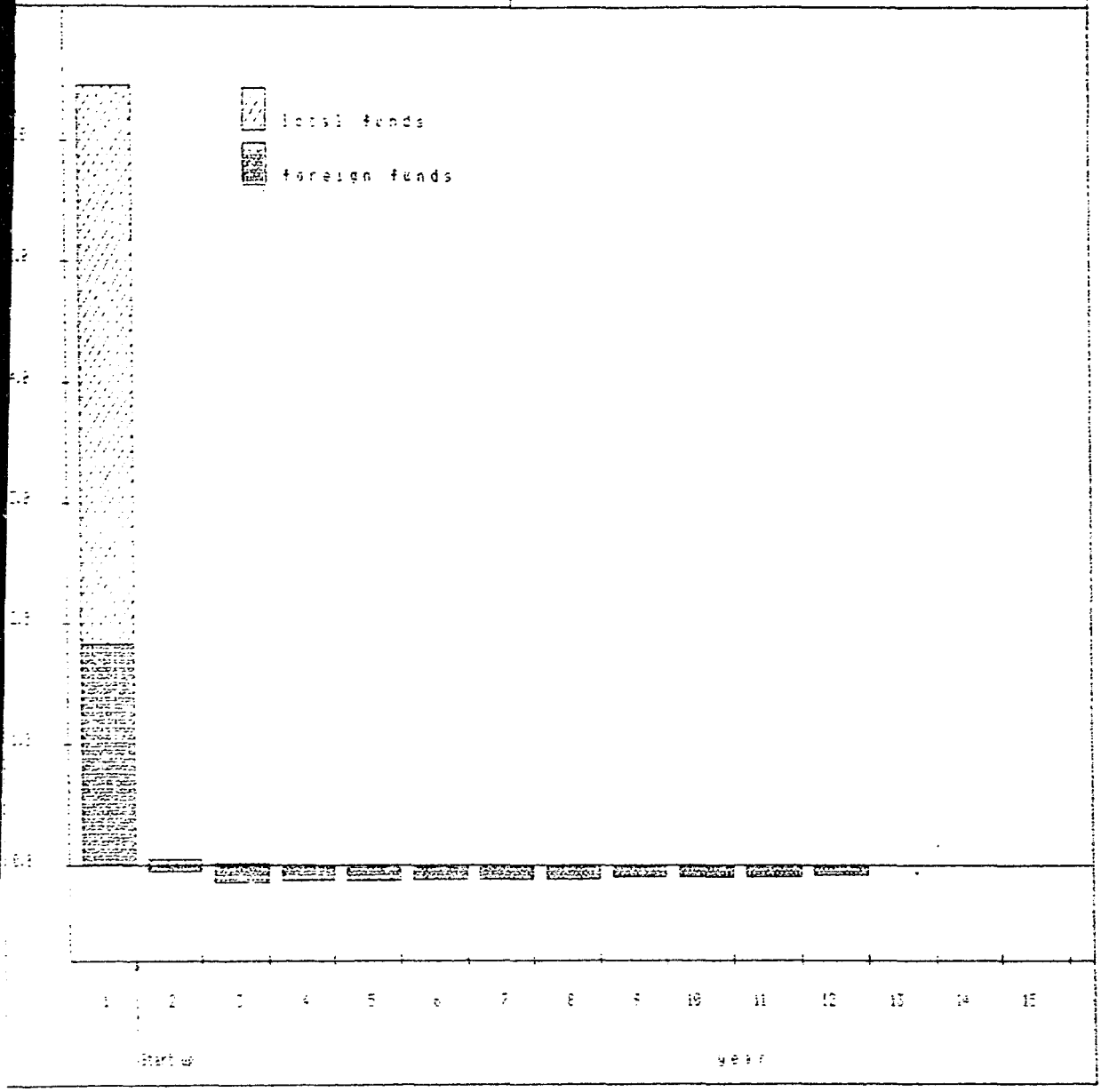
----------CHART 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME.



COPAS 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME

Annual flow of funds (finance)

US dollars

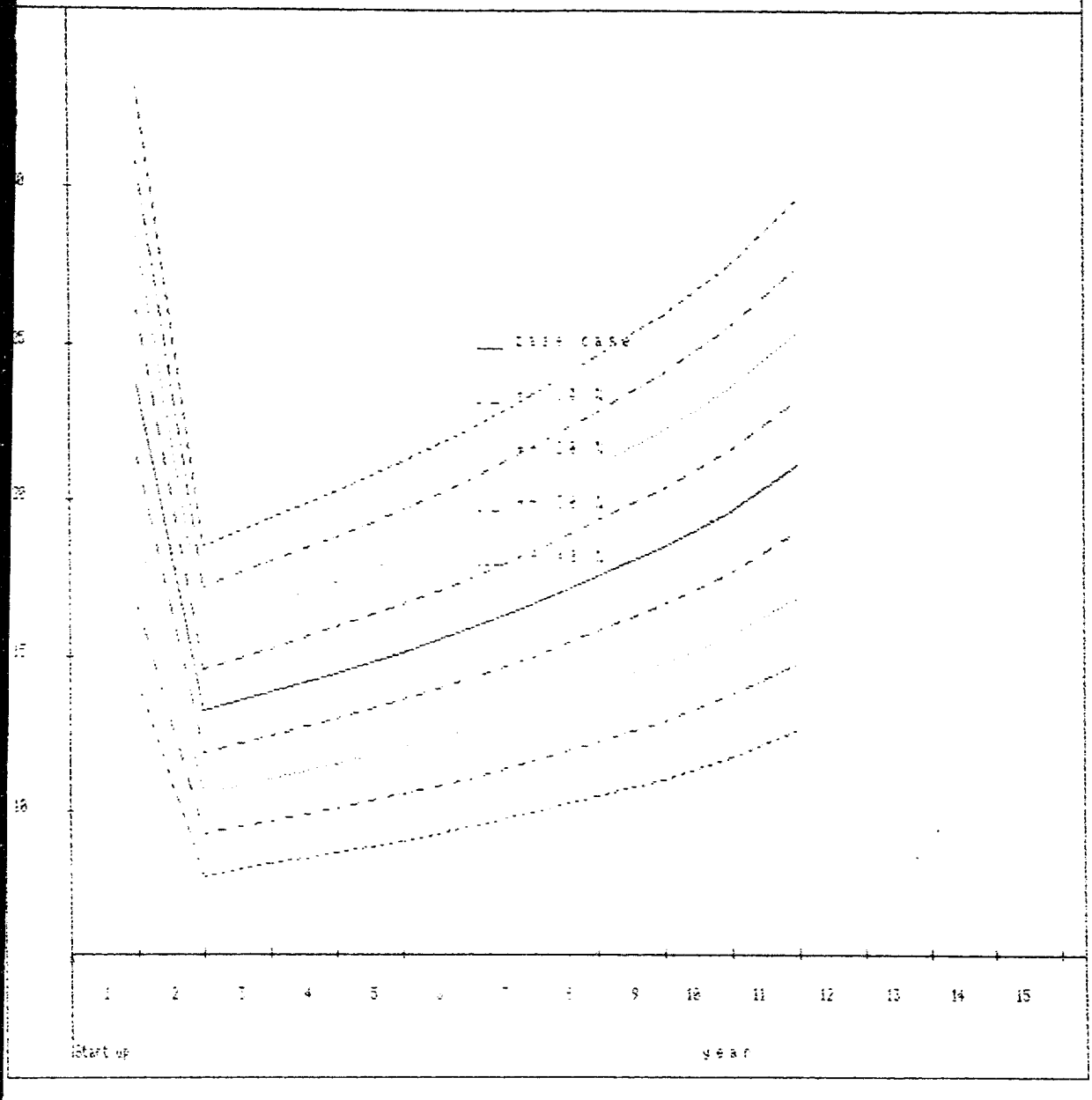


----------CONFER 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME.

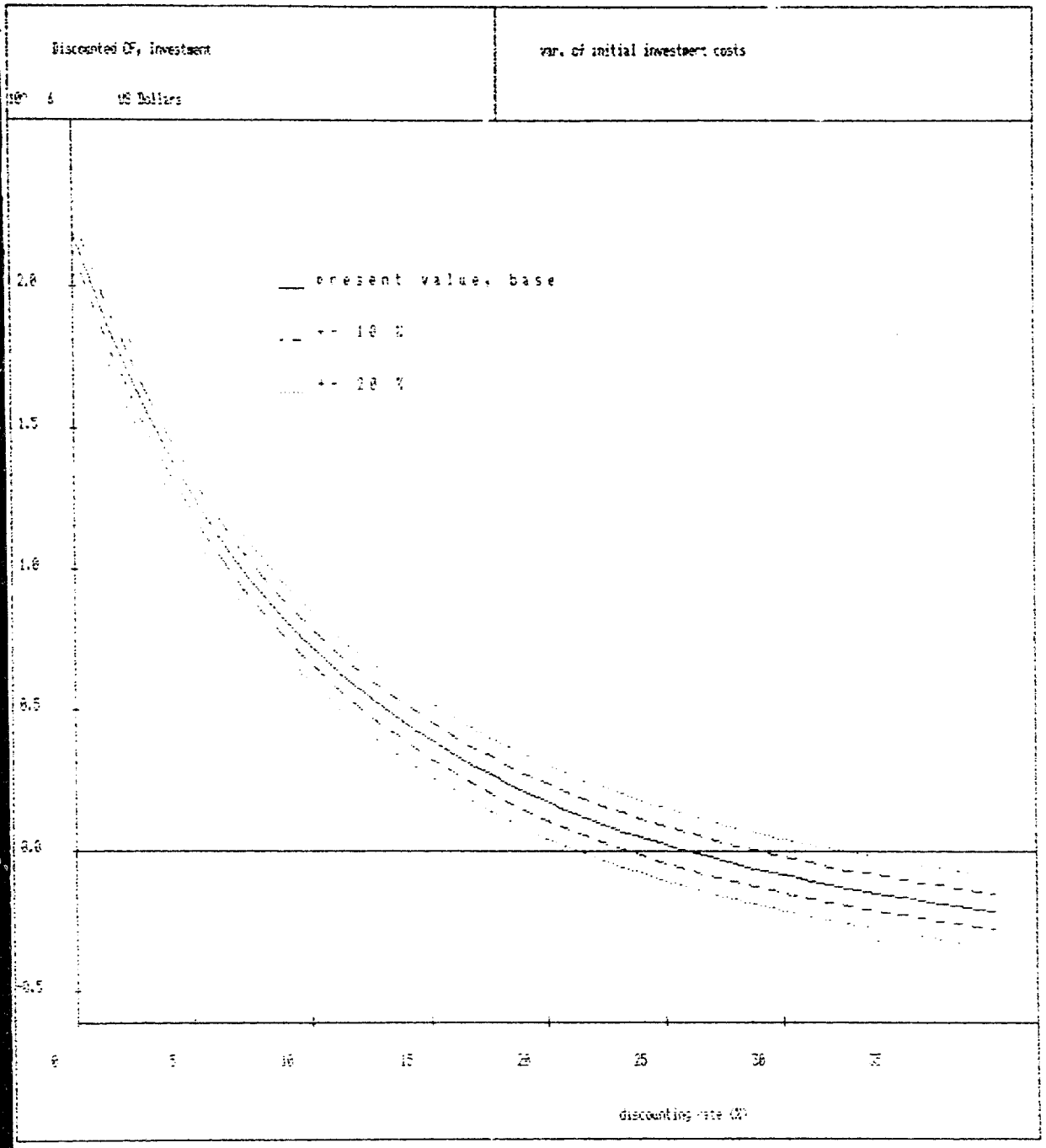
Debt Service Ratio, by year

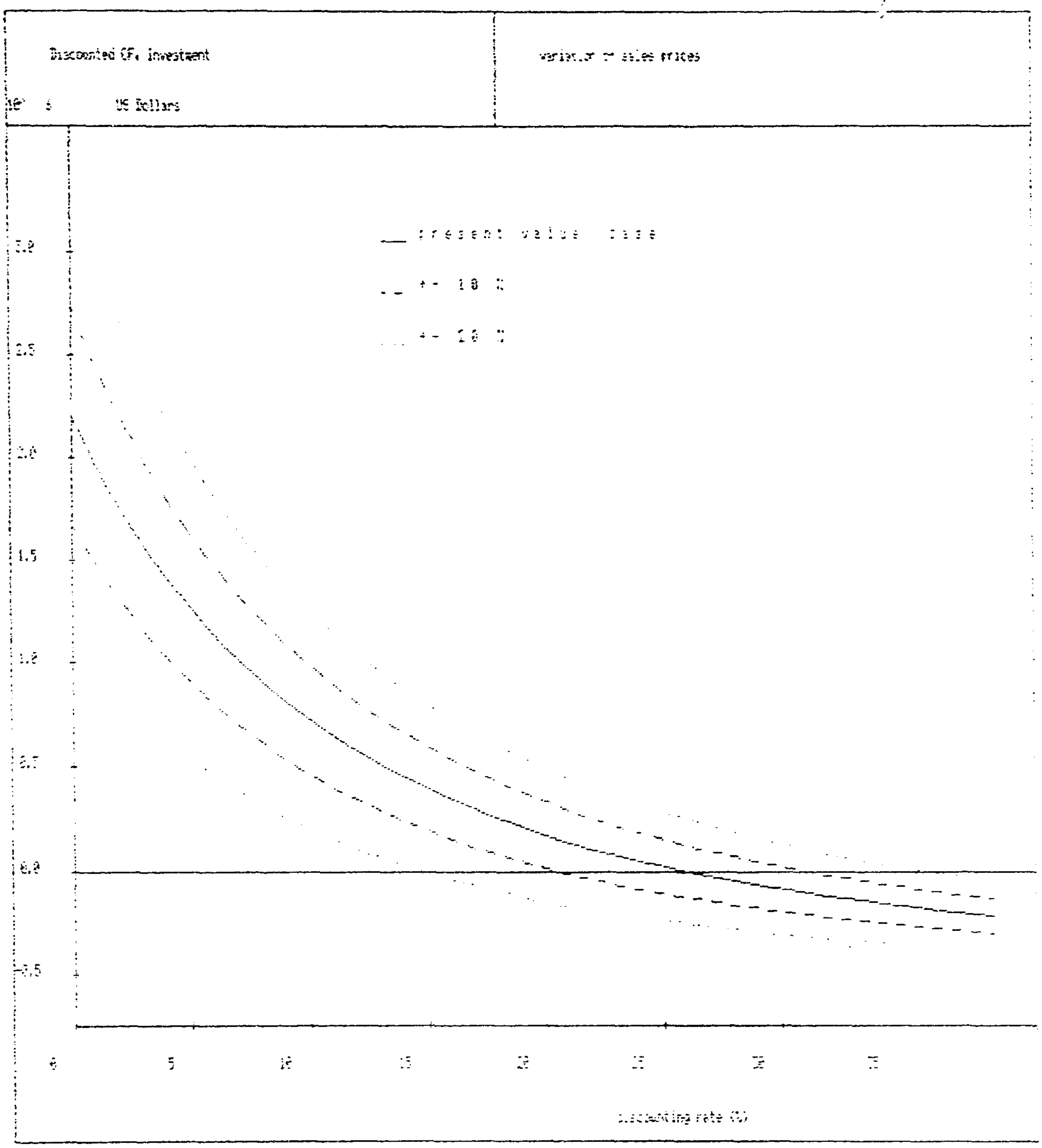
net cashflow/debt service

Variation of the net cashflow



CONFAR 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME.



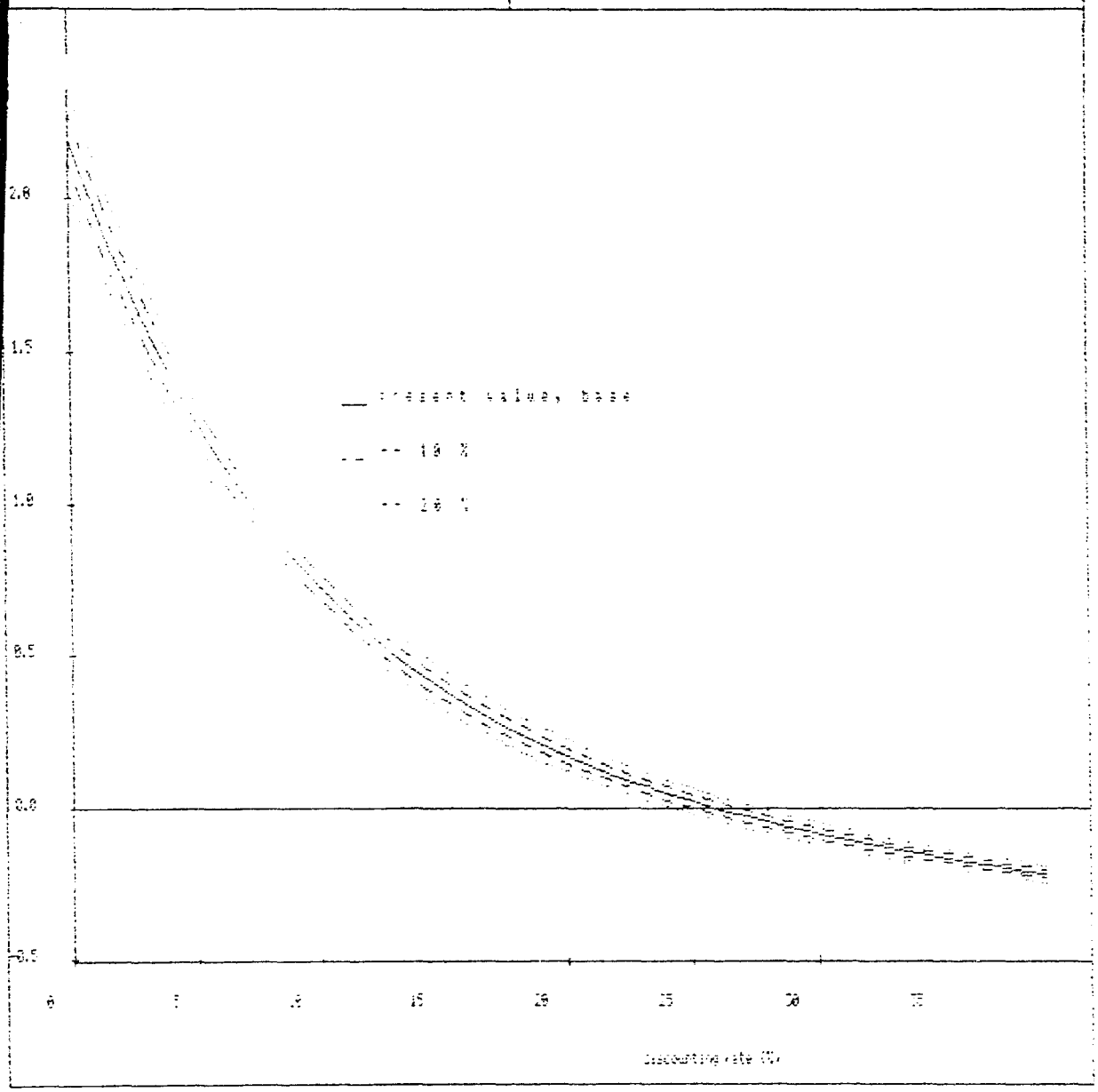

Discounted CF, Investment
variation of sales prices
US Dollars
present value base
+- 10 %
+- 20 %
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
0
5
10
15
20
25
30
35
discounting rate (%)

CONFAR 0.1 - UNITED NATIONS DEVELOPMENT PROGRAMME

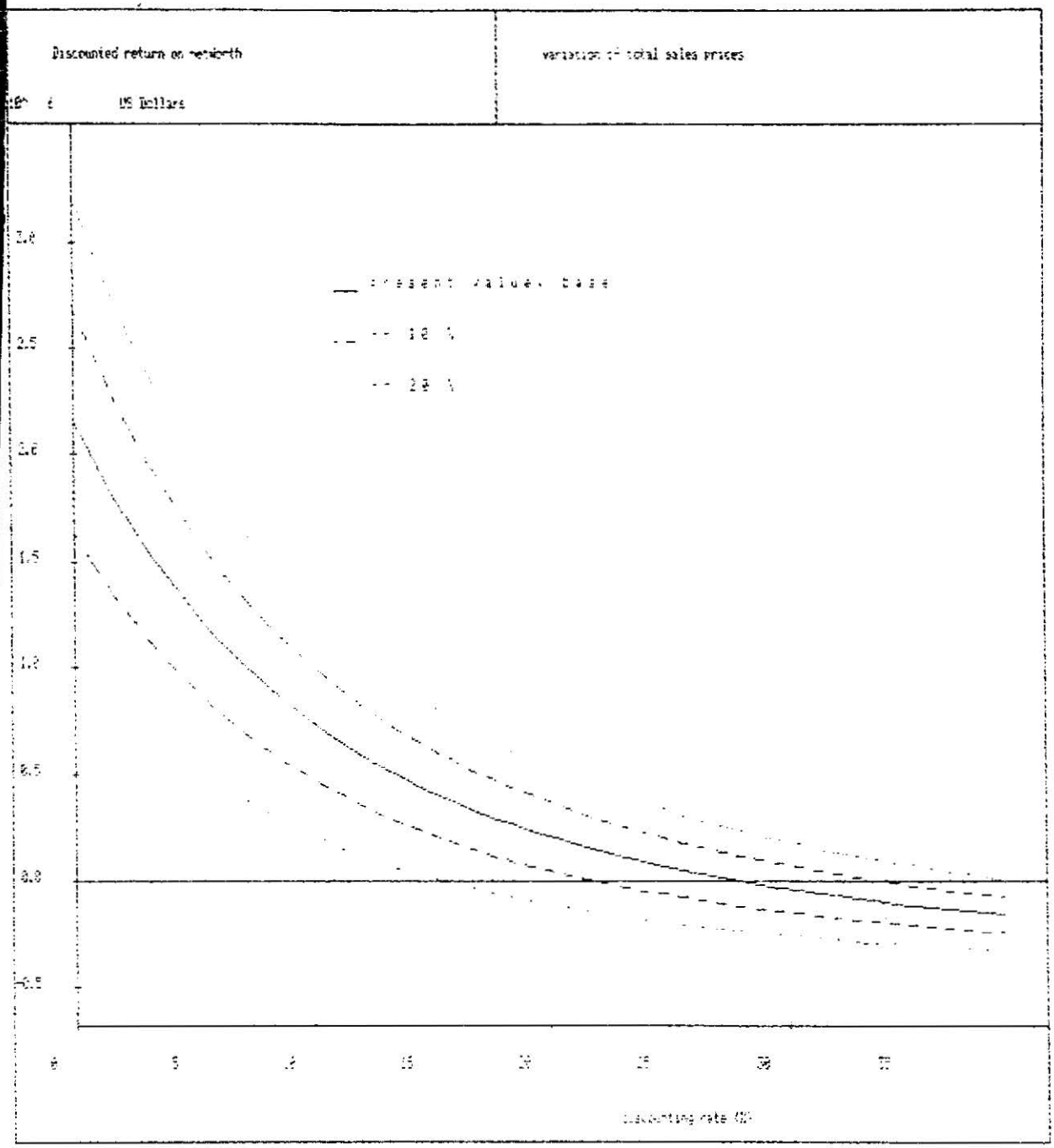
Discounted CF. Investment

US Dollars

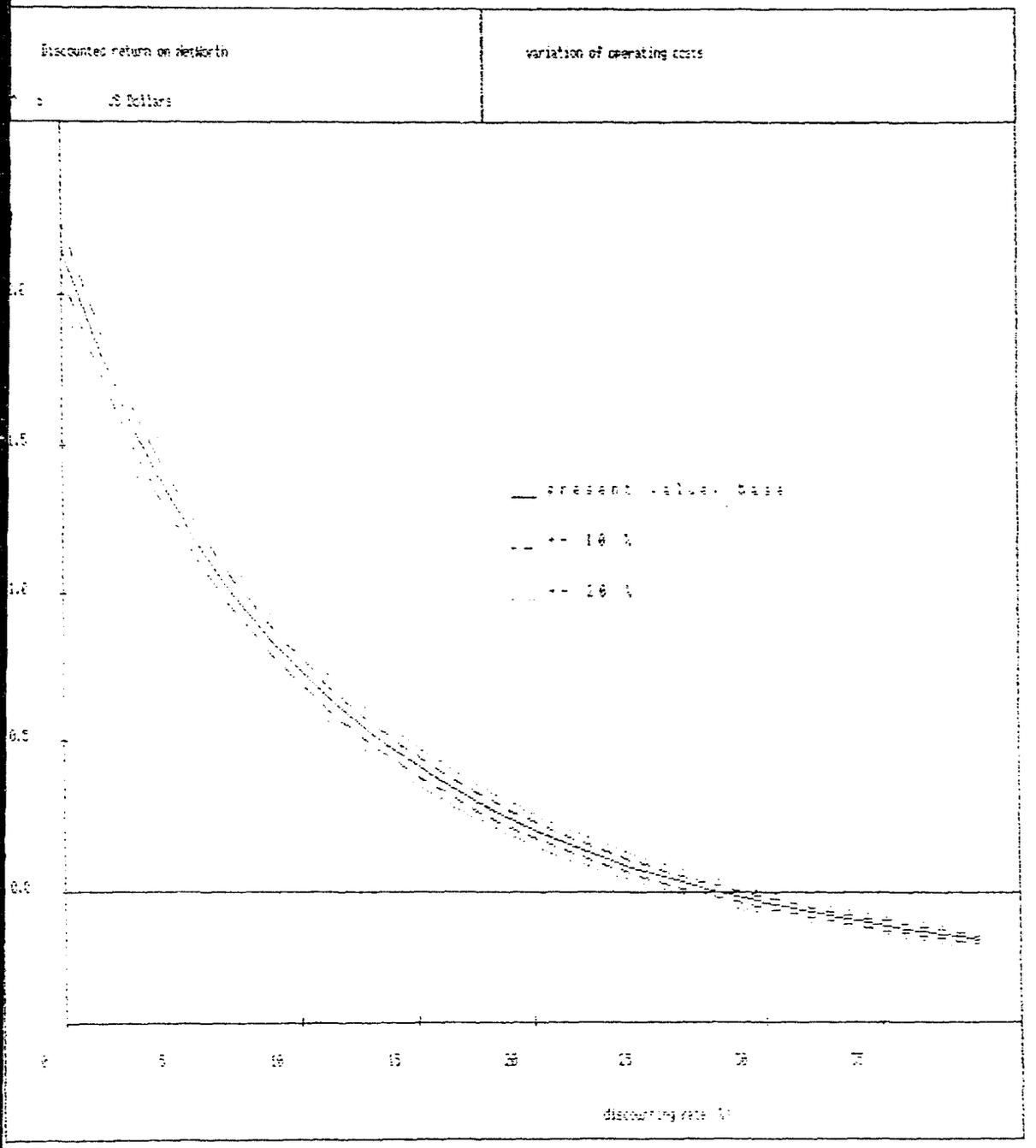
variation of operating costs

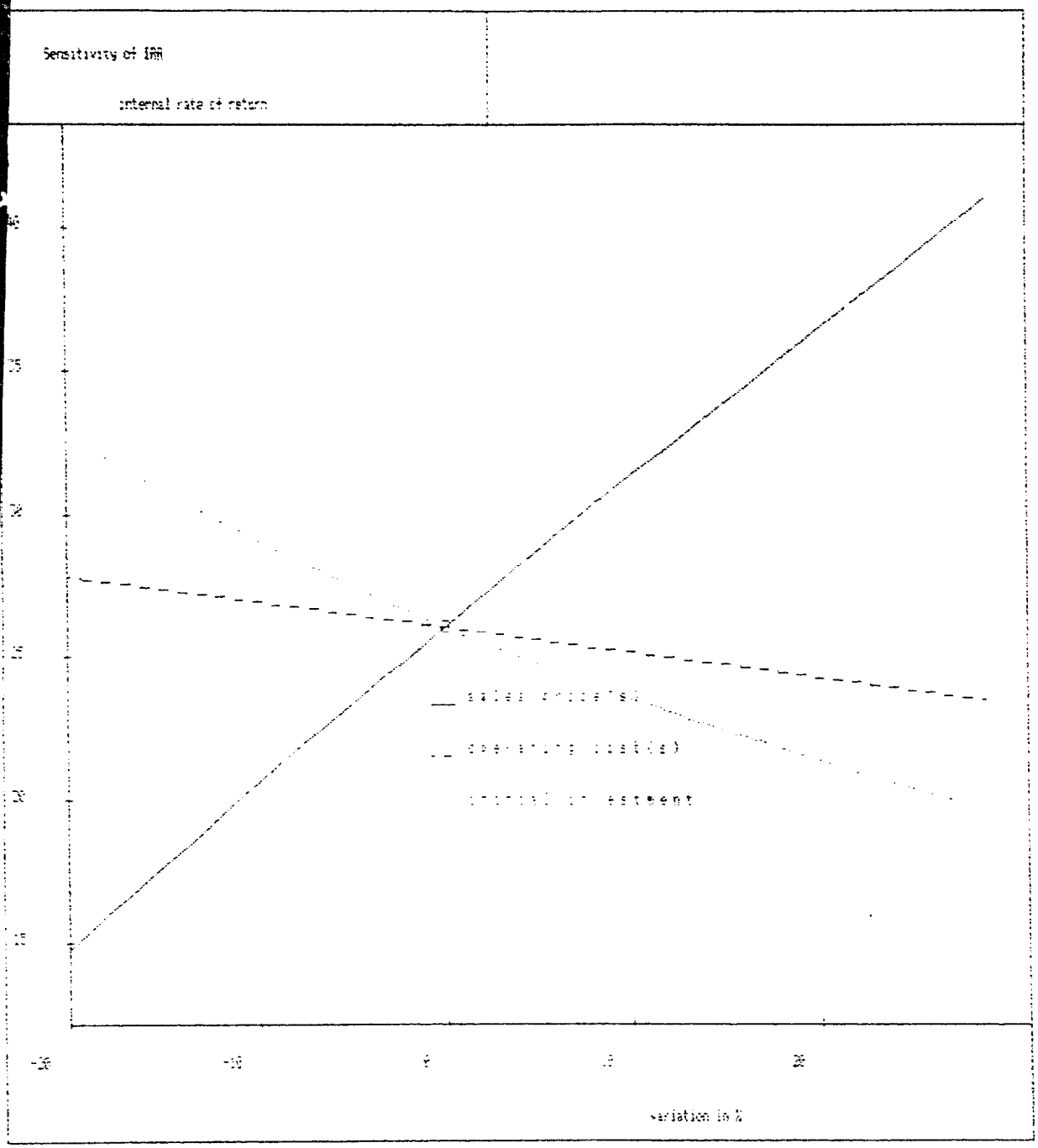


GRAPH 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME.

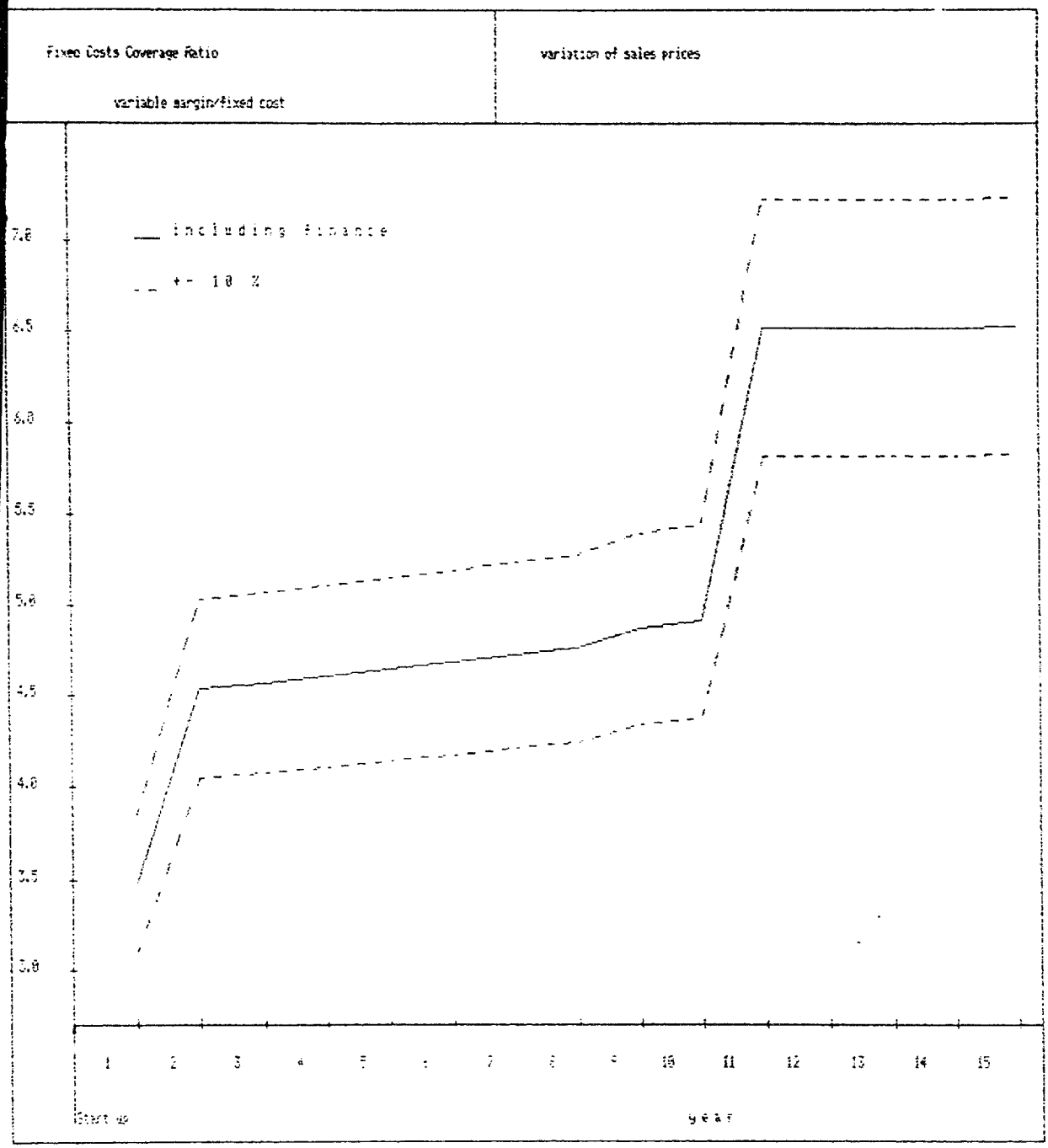


COPAS 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME

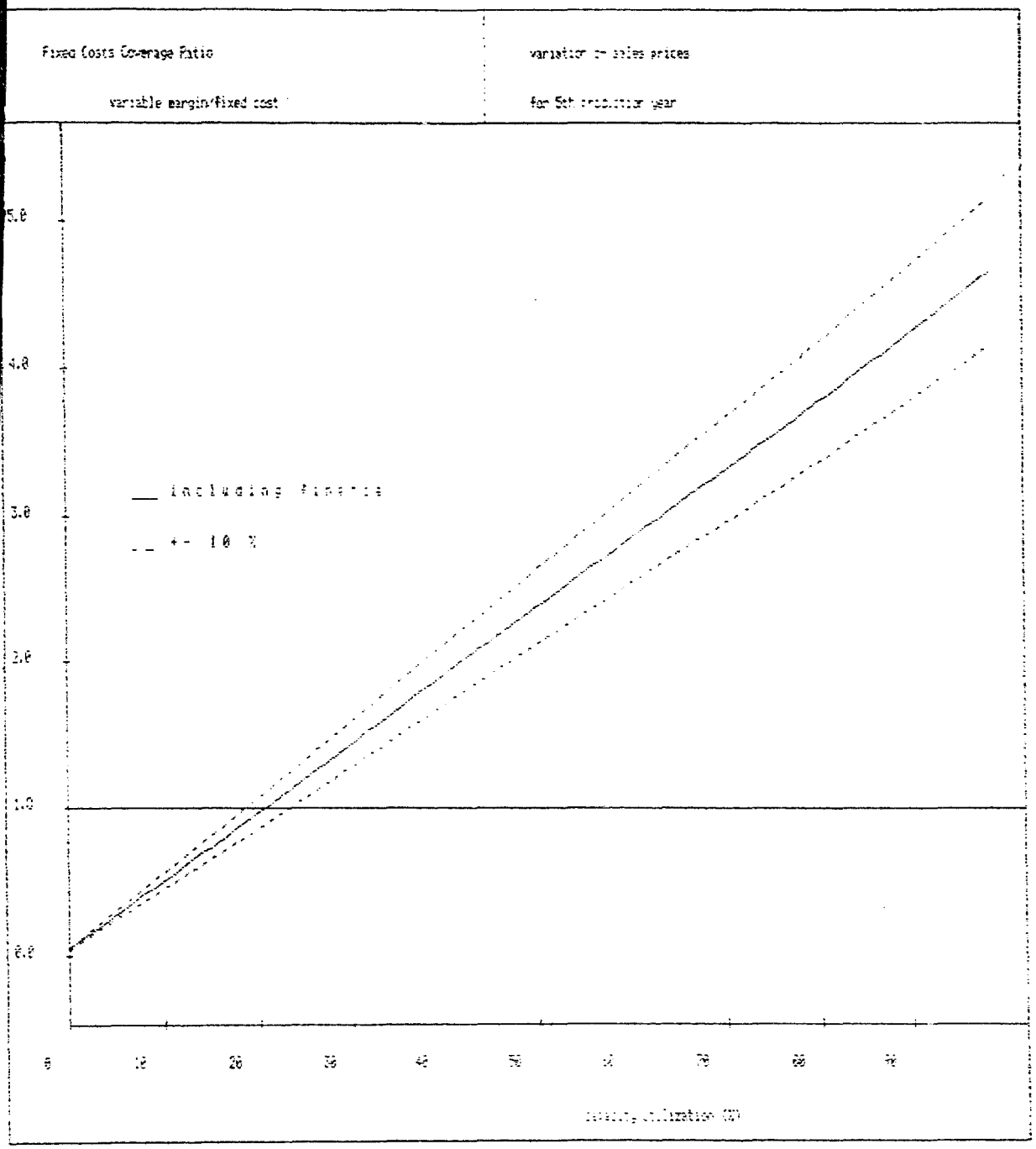


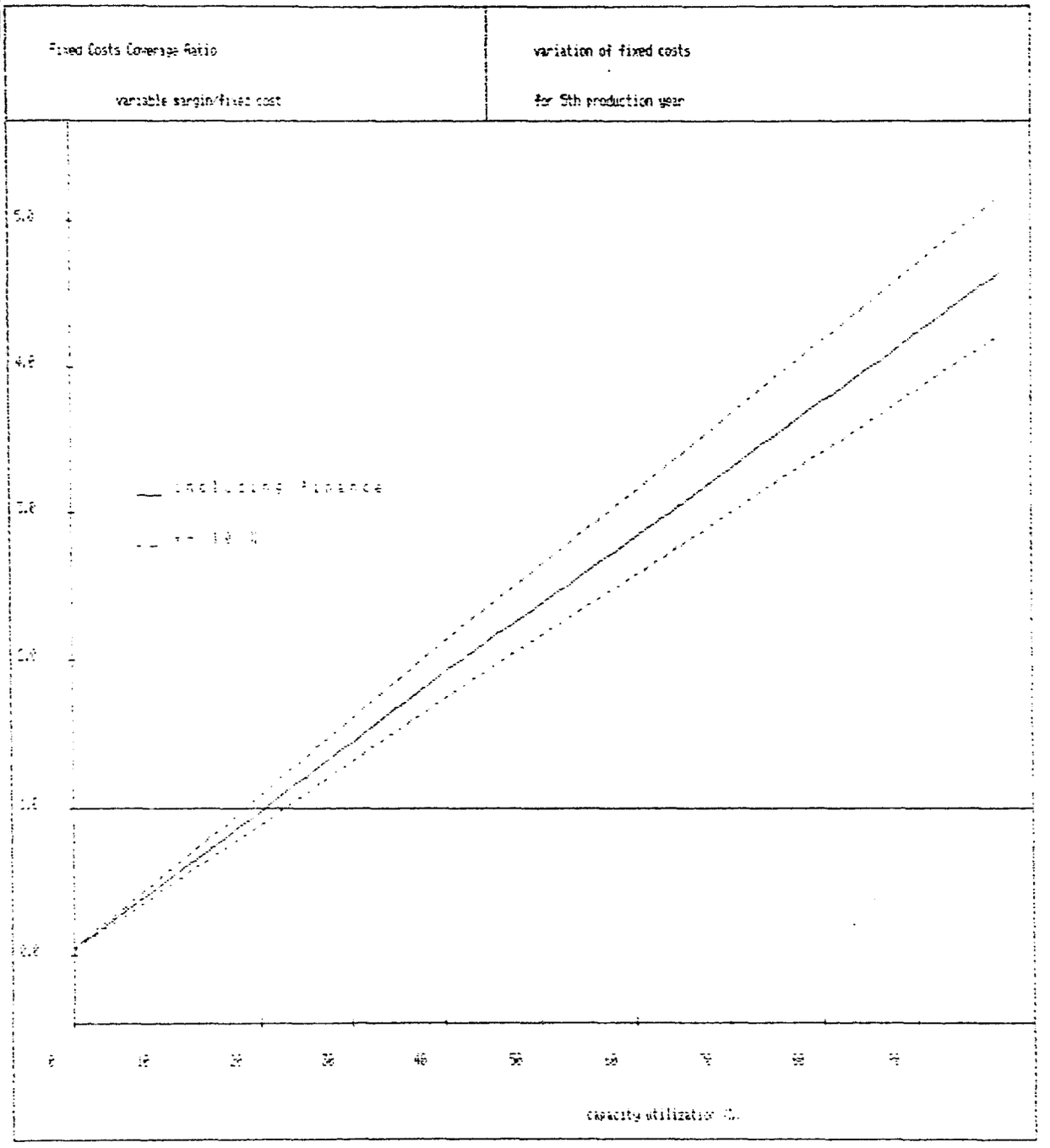

Sensitivity of IRR
internal rate of return
25
20
15
-20
-10
0
10
20
variation in %

----------COPLAN 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME.



CONFIG 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME.



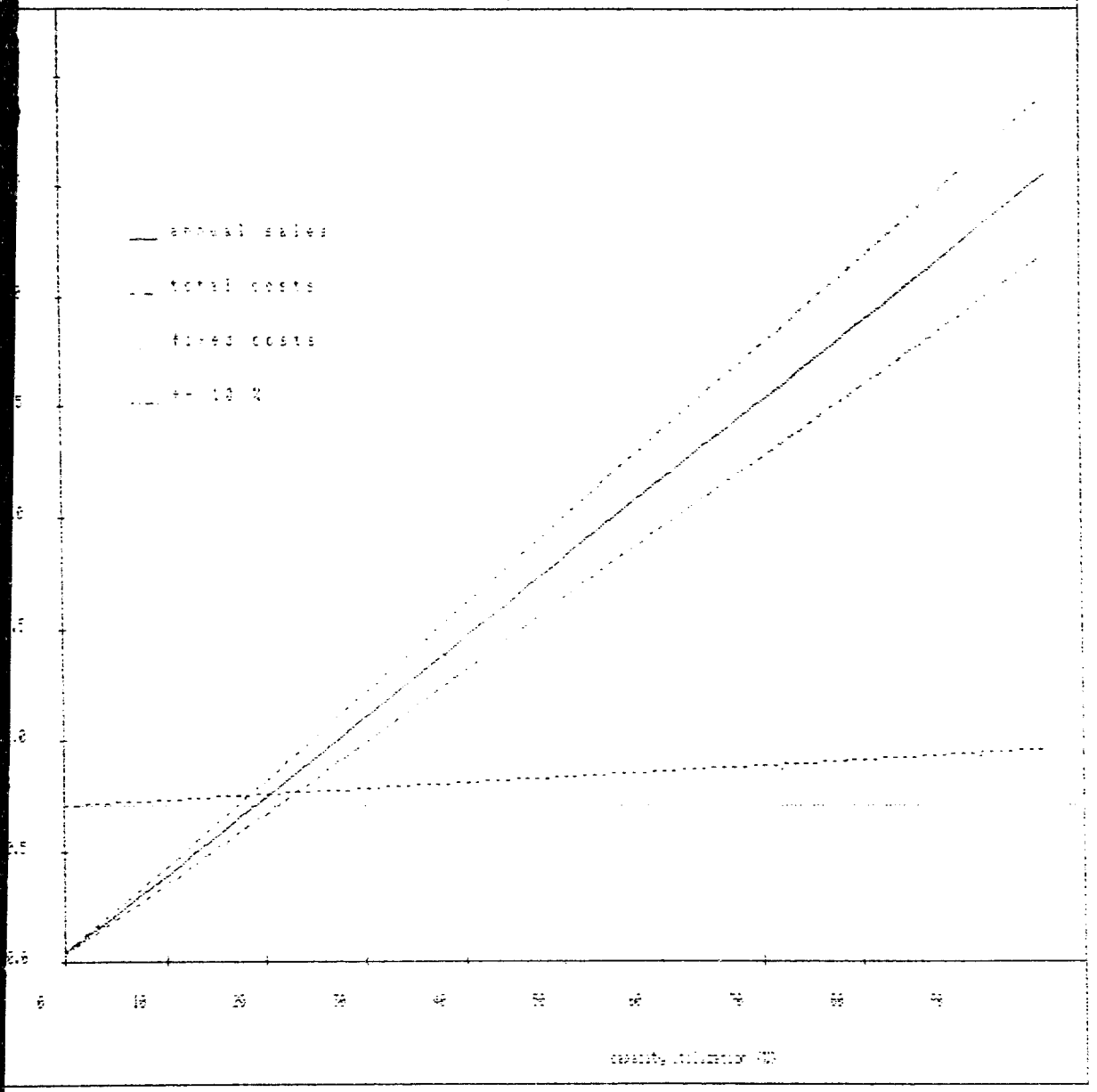

Fixed Costs Coverage Ratio
variable margin/fixed cost
variation of fixed costs
for 5th production year
5.0
4.0
3.0
2.0
1.0
0.0
0
10
20
30
40
50
60
70
80
90
capacity utilization %

Break even chart incl. finance

variation of sales prices

$ US Dollars

for 5th production year



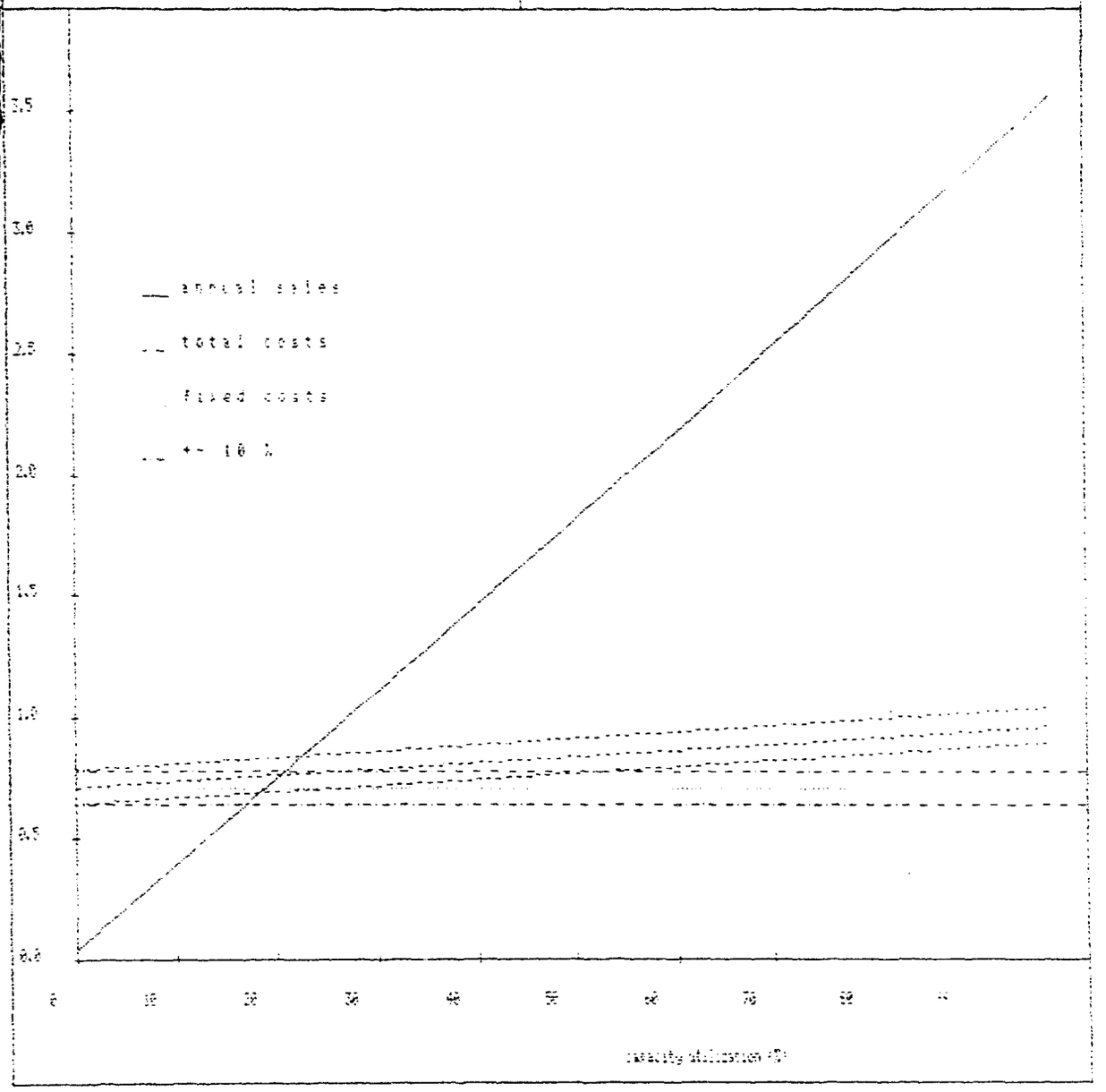
ANNEX 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME

Break even chart incl. finance

Variation of fixed costs

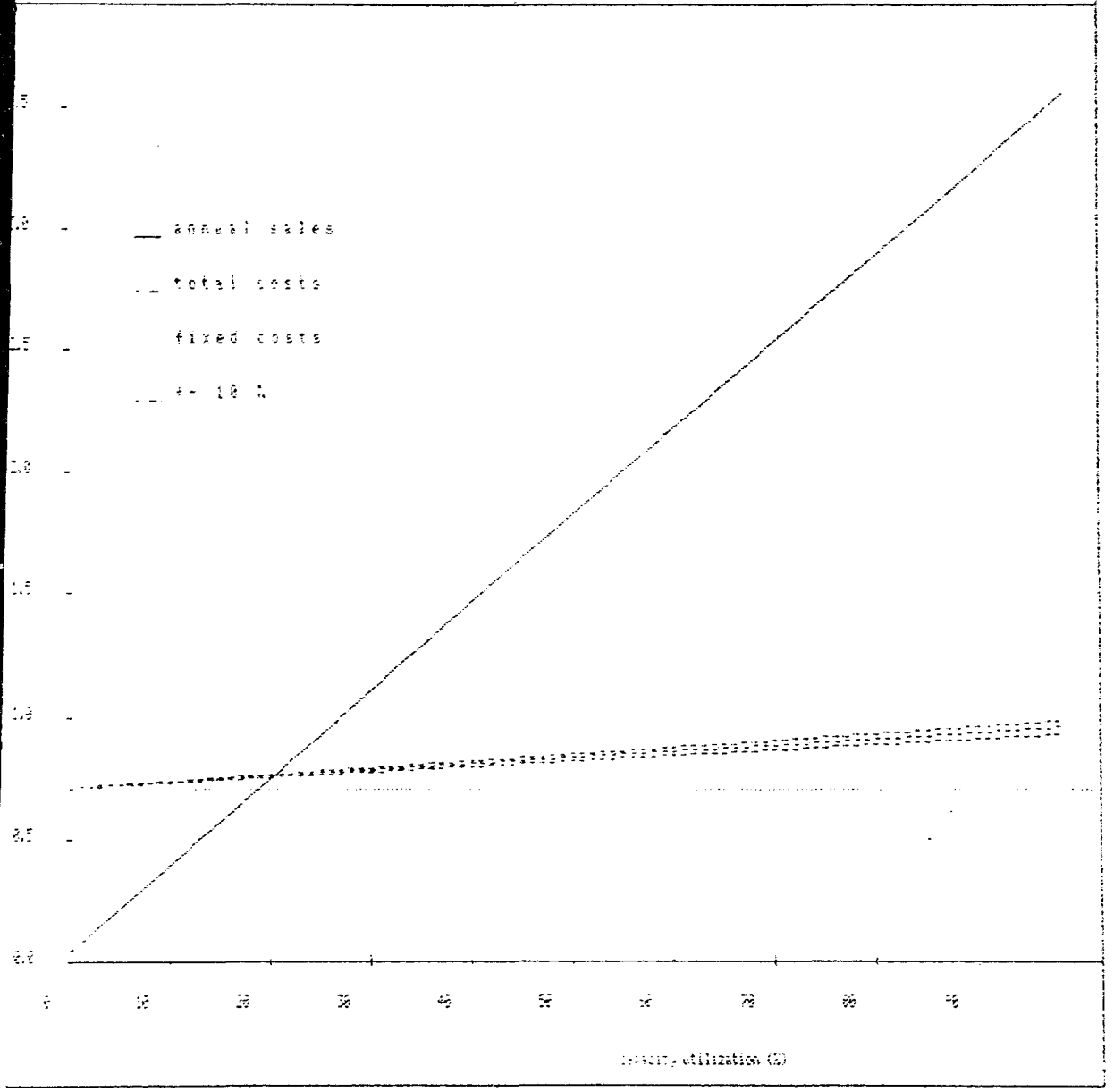
10^ $ US Dollars

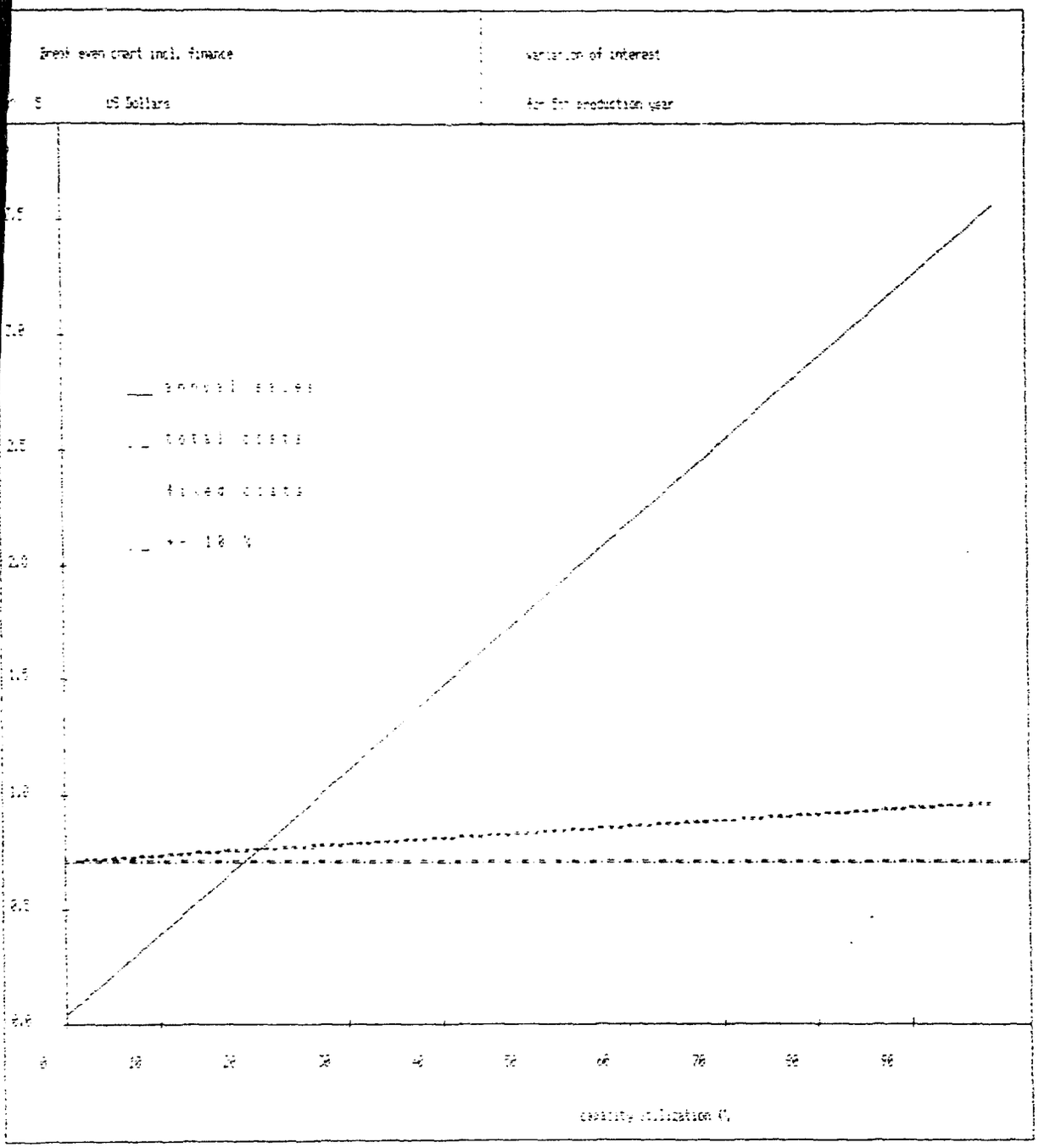
For 5th production year



COMFAR 2.1 - UNITED NATIONS DEVELOPMENT PROGRAMME.

Break even chart incl. finance	variation of variable costs
$ US Dollars	for 5th production year




Break even chart incl. finance
$ US Dollars
Variation of interest
As for production year
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
10
20
30
40
50
60
70
80
90
100
capacity utilization (%

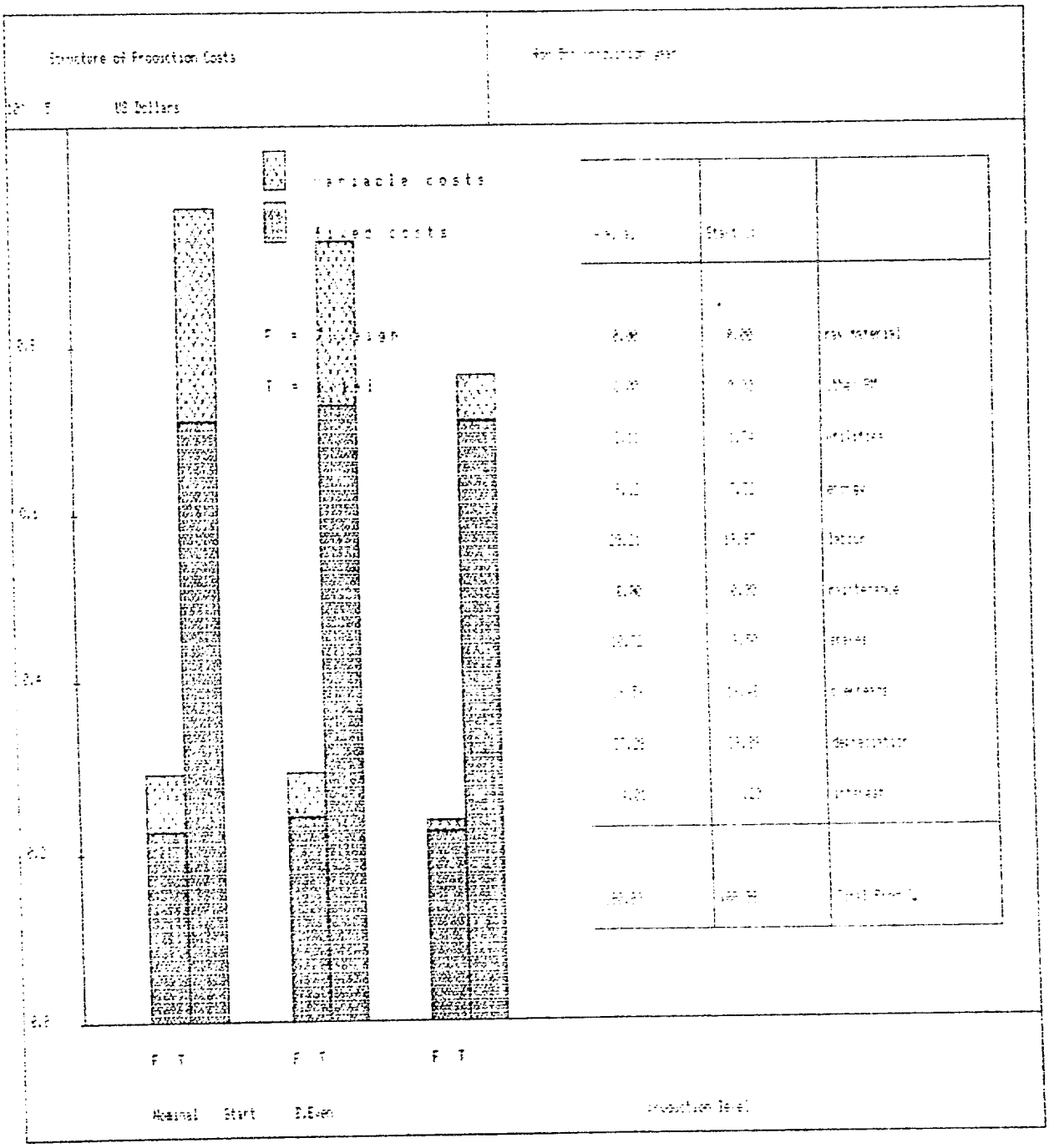

Structure of Production Costs
US Dollars
Variable costs
Fixed costs
F = Design
T = Total
F T
F T
F T
Nominal Start
B.Even
Production level

TABLE 12
Paint Production Statistics for Sierra Leone
1980/81 to 1991/92

YearPaint	(thousand litres)
1980/81	401
1981/82	360
1982/83	310
1983/84	170
1984/85	401
1985/86	98
1986/87	91
1987/88	25
1988/89	7
1989/90	4
1990/91	NIL
1991/92	27

Rainbow Paint Company Ltd (Rainbow), a private company, then re-started the production of emulsion-based paints, oil-based paints and wood varnish in 1991, using imported titanium dioxide powder from Tioxide, U.K. for their opacifier ingredient. A total of approximately 65 imported chemicals are used for the production of the paint and various other products, such as putty and polyfiller. The company has its own canning section, which produces cans from imported flat plate in 1 gallon (US), 1 litre, 0.5 litre and 0.25 litre sizes.

At full capacity the company can produce 2,000 gallons (US) of paint per day, or 672,000 gallons per year (48 weeks), or 2,553,600 litres. With a specific gravity of 1.37g/cc for the white emulsion, 0.87g/cc for the black emulsion and 1.07g/cc and 0.89g/cc for the white and black oil-based paints respectively, the average specific gravity is approximately 1.05g/cc, assuming an equal proportion of each product type. On this basis the total designed capacity is 2,681 tonnes/year.

In the main white emulsion product a 1,400kg mix contains 231kg of titanium dioxide powder, ie: 16.5% of the mix, by weight. Using this as a basis, the annual usage of titanium dioxide powder at maximum capacity would therefore be approximately 442 tonnes.

Unfortunately the plant is operating at approximately 22 to 23% of its design capacity. At this rate of production the usage of titanium dioxide pigment by Rainbow would be approximately 100 tonnes per year. However from the historical record of paint production in Sierra Leone the maximum quantity manufactured in one year has been 401,000 litres, (this level of production is 15.7% of Rainbow's current stated capacity) and this was only achieved twice. The titanium dioxide usage for this level of paint production amounts to about 70 tonnes; considerably less than the 100 tonnes/year requirement for Rainbow's current level of production.

The difficulties being experienced by the company include a continuing poor market for its products, caused by a combination of the very low purchasing power of the average citizen and the fact that imported paints from Brazil are less expensive than the locally produced Rainbow paints. Even paints from the U.K. can be sold at approximately the same price as the local product.

With its small output the paint factory is a high-cost producer, despite low labour costs. All inputs are imported and problems with the electricity supply and high interest rates cause increased production costs. Frequent power outages disrupt production and the use of stand by power plants increases electricity costs. The factory, and in fact the entire industrial estate, had been forced to generate 100% of its own electricity for a month (October/November 1993) because of a fault in the supply line. The expectation is that it will take at least another month to solve the problem. As the factory's motor generator set is over capacity for the installed equipment, much fuel is wasted, further increasing production costs.

The factory is not expected to achieve anything close to designed capacity in the near future, therefore the local market for titanium dioxide powder can be expected not to exceed 100 tonnes per year for some time.

This quantity is therefore insignificant in terms of planning for secondary processing of rutile in Sierra Leone to produce pigment,

as a typical plant would produce in the region of 70,000 tonnes per year. Virtually all production from such a plant would have to be exported to the major pigment markets, which are in Europe, Japan and North America and would have to compete with the existing large pigment plants in those areas.

TABLE 13
Titanium Dioxide Pigment Production and Exports from Major Producing Countries/Trade Blocks

	Titanium Dioxide Pigment production, 1990 ('000 tonnes)	Titanium oxides Net exports, 1990 ('000 tonnes)
UK	270	144.7
EC (12)	1,050	270.8
Japan	250	91.0
USA	979	270.4

From Table 13 it is apparent that the plants in these four countries/communities supply their own domestic requirements and are also net exporters to the rest of the world.

3. Pigment Plant Considerations

The obvious opening, at first sight, for secondary processing of rutile in Sierra Leone would be to establish a plant to produce titanium dioxide pigment from the country's natural rutile. However quite apart from the fact that many of the major inputs, including chlorine and coke, would have to be imported and there is virtually no domestic market, the entry costs into the industry would be high because of poor infrastructure considerations. For instance the oxygen manufacturing capacity of Sierra Leone is currently only 900,000 to 1.0 million cubic feet per year. A 70,000 tonnes per year pigment plant would require 42,000 tonnes of oxygen and necessitate a vast increase in oxygen manufacturing capacity.

A typical pigment manufacturing plant, including necessary infrastructure, would cost from US$200 million to US$250 million for production of 70,000 tonnes of pigment per year. Such plants are highly complex, especially the chloride plants.

The technical expertise required in both operational procedures and avoidance of pollution is high. Pigment plants also require large amounts of power with consistent supplies. In view of the high capital expenditure requirements, the lack of infrastructure, the complex technology involved, and a world scene characterised by increasing over capacity, a pigment plant would not be viable in Sierra Leone at the present time.

It should be noted that an additional 850,000 tonnes of pigment production capacity was planned to be installed both by expansion of existing plants and the building of completely new plants in Taiwan, Korea, Brazil, Saudi Arabia, USA, Australia and Singapore during the years 1990 to 1995, of which 83% (710,000 tonnes was planned for the chloride process).

For the large investment needed for a pigment plant, a foreign investor would have to be attracted to Sierra Leone. The current adverse investment climate for industrial manufacturing operations in Sierra Leone, in comparison to the above countries, would make an investment of this magnitude very unlikely at the present time.

In the short-term therefore the establishment of a pigment production plant in the country does not seem very likely. However the situation could change in the longer term, as the countries now in recession recover. There is also the possibility that some sulphate plants in the EC could close down due to environmental and waste disposal problems in future years. In this context a watching brief should be established and maintained. The Mission notes that the Sierra Rutile Agreement, (1989) (Ratification) 1989 in clause 10 states in part:

> *" The Company shall conduct feasibility studies on the local production of paint pigments and other products from rutile produced in Sierra Leone ... "*

This clause may provide a mechanism for conducting such a watching brief.

4. Other Downstream Products

The secondary processing of rutile for minor uses (in volume terms), such as titanium metal (sponge) production, welding rods, advanced coatings and micro-electronics are judged by the Mission to be even less viable secondary processing options for Sierra Leone. Similar considerations prevail, extremely advanced scientific requirements, the lack of any significant local market and the fact that adequate capacity for these items already exists in North America and Japan.

B. Building Materials, Ceramics and Refractories

1. Building Materials

Despite the fact that there are clay supplies in most parts of the country, which are suitable (either alone or as clay/sand/grog mixes) for the manufacture of fired clay bricks, floor tiles and clay roofing tiles, there are almost no commercial production facilities for these basic building products in Sierra Leone. One exception is Ceratec, a small ceramic plant in Mokanji. This operation has a capacity of 10,000 bricks and 5,000 roofing tiles per month plus a range of pottery items, such as ceramic stoves, flower vases and ashtrays. Ceratec markets all the brick and tile products in the Mokanji area, mainly to Sieromco and apparently has no problem in selling all of its production. The majority of new houses being built by both Sieromco employees and other people in the Mokanji area are now of fired clay bricks.

As Ceratec has no trucks and local transport contractors are difficult to find the company does not try to market its brick and tile products in Freetown.

The company wishes to expand but apparently has insufficient financial resources for the capital investment requirements involved in larger-scale brick and tile production.

Apart from Ceratec the only other producer of fired clay bricks is the Baptist Mission in Lunsar, which primarily produces bricks for its own buildings but does sometimes sell to other people. The

operation is however on a very small-scale and is seasonal, production only being carried out for about five months per year from February to May.

At one time a clay brick factory did exist in Freetown but this appears to have been poorly planned from the outset, took far too long to build and commission and was poorly managed. Construction of the factory commenced in 1976 under a contract with a Belgian company, which provided poor quality second-hand machinery and engineering. Their contract was terminated in 1978. A British company then took over in late 1978, supplied new machines and the factory was commissioned in 1979. This company then managed the factory for one year.

In 1981 a Lebanese investor bought a 75% shareholding of the project. The Government held the remaining 25% and it was incorporated as the Sierra Leone Bricks and Clay Industries Ltd (SLBCIL). The factory closed down in 1987 due to power shortages, lack of foreign exchange (which made it impossible to maintain the factory) and dubious accounting procedures. The majority shareholder/owner left the country for personal reasons.

The clay deposit used by SLBCIL is located ≤200m from the sea and is heavily contaminated with salts, which cause massive efflorescence in the fired products. This clay is clearly unsuitable for quality production but apparently none of the many better quality inland clay deposits were properly tested. Negotiations with local chieftains to use clay deposits in a number of different areas also proved unsuccessful.

Fuel was also a problem and the original oil-fired kiln was replaced by two small wood-fired down draught kilns. The source of the wood was 18km from the factory, therefore transportation was always a problem and was also expensive. No replacement planting of trees was undertaken by the company, leading to progressive depletion of the fuel source.

The only other attempt to manufacture clay bricks in Sierra Leone was in Kenema but the project was unsuccessful due to the lack of

technical knowledge on the part of the entrepreneur.

The resulting situation in Sierra Leone is that new buildings in the urban areas are now constructed of concrete blocks made from imported cement and roofs are invariably corrugated steel or aluminium sheets, which are also imported.

From the point of view of the country's economy it seems unreasonable to continue importing such building materials, when products of superior technical performance can be manufactured from readily available local clays and sands. Concrete blocks are more prone to causing condensation problems within buildings than fired clay bricks and clay tile roofs provide a cooler environment within the building than that which is possible with the corrugated steel sheets. In the West African environment, especially close to the coast, where there is a higher concentration of atmospheric salt, the steel sheets only last a few years before rusting and then have to be replaced. In the case of clay roofing tiles, they can last for the life of the building and in most cases can then be recycled by being re-used on other buildings.

A local brick and tile industry would therefore save a considerable amount of valuable foreign exchange each year, which would reduce the burden of imports on the economy.

As most of the facilities for manufacturing clay bricks are already available at the old Sierra Brick site, it is highly recommended that serious consideration be given to restarting production of bricks and roof tiles. This would be done with the existing SLBICL machinery relocated at a more suitable site.

The costs involved would be much lower than buying new machinery because even though the machinery is approximately 13 years old, it is from a reliable U.K. manufacturer and only has to be refurbished with the required spare parts to give many years of useful service.

If, for any reason the factory cannot be rehabilitated, due to the difficulties caused by the proprietor currently being overseas, a new facility must be considered. The technology for a small or

medium-scale brick and tile factory can be planned to use the local mineral resources close to Freetown, the major urban market area, using well proven basic machines, which can easily be maintained locally. Such plants are significant generators of employment, employing typically 50 to 100 personnel on small to medium-sized plants respectively. This, in turn, increases the revenue base of the Government by the generation of Pay-As-You-Earn (PAYE) employees' income tax, company tax, sales tax and customs duties on manufacturing inputs, such as spare parts and fuel.

A typical medium-scale brick factory manufacturing approximately 5 to 10 million bricks per year, or equivalent in roofing tiles and floor tiles, using soft surface clays and suitable for the Sierra Leone environment would require the following equipment:

a) Box-feeders, normally two are required.

b) Primary grinding equipment, ie: toothed roller crusher.

c) Secondary grinding equipment, ie: wet pan with water addition. With some very soft clays this stage can sometimes be omitted.

d) Tertiary grinding equipment, ie: one, or two sets of high speed differential grinding rolls, dependent on the type of clays being used.

e) Double-shafted mixer with final water addition.

f) De-airing extruder with selection of brick and tile dies.

g) Brick cutter, normally automatic side-cutter or in-line reel cutter, or harp cutter but can be manual on low output plants.

h) Manual off-bearing conveyor for manual setting onto wooden pallets.

i) Chamber drying system.

j) Hoffmann-type continuous kiln, or rectangular down-draught

kilns built in series, dependent on the production required.

k) Oil storage with electric heaters and pumping system suitable for Bunker C residual oil, as this is the most economical fuel in Sierra Leone. Partial wood firing could also be considered if a renewable source of wood-fuel trees is planted.

l) Back-up generator for kiln(s).

For the Freetown area, with a population of about 500,000 only one such plant would be required to meet the requirements of the city.

In the more rural areas outside of Freetown the most appropriate type of brickmaking production unit would be a basic small-scale low technology, labour intensive plant, which could produce up to 5,000 to 6,000 bricks, or tiles per day using soft surface clays. Firing of the products would in this case be in intermittent down-draught kilns, which could be fired with wood or waste agricultural fibre material, such as that produced in oil palm mills. Wood firing has the serious disadvantage of de-afforestation. In all cases where wood-fired kilns are judged to be the only possibility, regular continuous planting of fast-growing trees suitable for wood fuel, such as eucalyptus, should be carried out as part of the brick-making operation. This has been highly successful in Ethiopia, for instance, where there are many brick and tile production units and potteries using wood produced from planted eucalyptus trees.

2. Refractories

Low grade firebrick and medium-duty alumino-silicate refractories are used in a number of industries in Sierra Leone, such as oil-fired power plants, bakeries, wood processing and all plants having oil-fired boiler systems, such as breweries, bottling plants, chemical plants etc. However the annual consumption of refractories in all of these industries is quite small. Major industries, which consume large amounts of refractories are the steel, cement and glass industries but Sierra Leone has none of these industries. Because of this fact it would not be economic to establish even a small plant specifically for refractories because

the local market is far below the minimum economic size.

However consideration could be given to producing low-grade firebrick and medium-grade alumino-silicate refractories as an additional product line in any brick factory, which is established or rehabilitated, as most of the same machine line could be used. An additional press and high temperature intermittent kiln, capable of firing to a minimum of 1,250°C, would however be necessary. Even this level of investment would require locating markets outside of Sierra Leone and realistically the possibilities are limited to the neighbouring countries of Liberia and Guinea.

The production of alumino-silicate refractories requires good quality fireclays or kaolins for firebricks and in addition a refractory grade low iron content bauxite to upgrade the production mix by increasing the Al_2O_3 content. This can also be done by the addition of sillimanite, andalusite or kyanite.

Unfortunately the Sierra Leone Geological Survey Department has not yet identified any substantial deposits of kaolin, although kaolin has been reported to occur in very small amounts beneath the bauxite deposits. There are no known deposits of fireclay in Sierra Leone. However a pinkish-white firing plastic kaolinitic clay with an alumina (Al_2O_3) content of 33.3% and an iron oxide (Fe_2O_3) content of 4.49% has been found at Paloko, 40km from Freetown and 5km from Waterloo. This clay could form the basis of a low-grade firebrick mix.

Within many bauxite deposits areas can often be found, which contain a high Al_2O_3 content, eg 65-70% and low Fe_2O_3 content, eg 1.0-2.0% and such material can be used as the additive to kaolin for refractory manufacture. This is certainly the case in Ghana, for instance. In Sierra Leone no work has been carried out specifically to identify any refractory-grade bauxite areas. This would be a useful exercise for the Geological Survey whenever bauxite deposits are examined. Njala University has had the greatest involvement in ceramics but has no testing facilities. Thus there is no centre in the country, where testing work may be carried out to develop local ceramics and building material raw

material resources.

3. Other Ceramic Products

There are no commercial potteries on an industrial scale in Sierra Leone, therefore almost all tableware products have to be imported. There are currently three areas, where village potteries are active, these being in Mambolo, Kambia District; Niagorehun, Bo District and Mabettor, Portloko District.

In Mambolo the pottery is made by males only at two main locations, the Bangura workshop and the Scaries Secondary School. In both Niagorehun and Mabettor all pottery is normally made by the older women of the village using traditional hand-made techniques. Quality is very poor due to the lack of any proper clay processing facilities and to very low firing temperatures. Even though the clays used are quite refractory, open-fire methods are used with top temperatures of around 400°C. Mambola clay for instance is only fired well at a temperature of approximately 1,100°C, Niagorehun clay can be fired to 1,350°C and Mabettor clay to 1,200°C. Examination of the pottery storage jars on sale in the markets of Freetown confirmed that all products are under-fired with no real vitrification and with high porosity and low strength. The potters therefore have to accept very low prices for their products and in addition there is wastage in production.

In Mabettor, the main pottery village in the country, is the Ceratec Development Project, a non-Government organization, which is training potters in the use of firing in wood-fired kilns. Unfortunately the village potters resist using kilns because of the higher cost involved, even though wastage would be reduced, wood fuel would be used more efficiently and quality of the products would be improved. Increased quality would, in turn, allow sale at much higher prices.

Clays

Although eight different clays in Sierra Leone have been tested for their basic properties by Ceratec there is the requirement for the testing of additional clays and other minerals, such as nepheline syenite, feldspars, talc, bauxites. In all cases the determination

of suitable ceramic body formulations and glaze formulations are required, so that higher value products can be produced for the market.

Ceratec tested clays in Paloko, Mokanji, Mabettor, Niagorehun, Kenema, Mambolo, Makeni and Yengema for both pottery and brick production, using mixture of these clays with other clays, sand and grog.

Other clays, which could possibly be utilised for brick or ceramic production are located in Taiama, Pujehun flood plains, Lunga, Mambole area, Port Loko area and Masingbi area.

Nepheline Syenite

Nepheline syenite, which is an important fluxing mineral used in many ceramic products, such as tableware, sanitary ware and insulators, is known to exist in commercial quantities at Bagbo, near Vaama village, Maho in S.E. Sierra Leone, close to the Liberian border. It is located 51 miles from the port of Sulima and 3.5 miles from the railhead of the old Mano iron ore mine in Liberia. Prior to 1965 a quarry site had already been identified covering 63,000 sq yards; approximately 1,000 yards NE of Vaama village. Pitting determined that 30,000 tonnes were available above Maho river level and 40,000 tons per foot depth were available below the river level. Testing of the deposit determined that after magnetic separation the quality of this deposit was virtually equivalent to the Canadian "A" grade nepheline syenite.

The Sierra Leone deposit actually has more fluxing alkalis with 10.31% Na_2O and 5.40% K_2O compared with 9.8% and 4.6% respectively for Canadian nepheline syenite. However the Sierra Leone material has slightly more Fe_2O_3 after magnetic separation, 0.09% compared with 0.08% for the Canadian material. Ninety two percent of the original 2.84% Fe_2O_3 content of the nepheline syenite was removed by magnetic separation. In the past 30 years improvements have been made to separation systems, therefore a lower Fe_2O_3 content could be possible today. However, even at the indicated iron oxide figure the material is suitable for ceramic production in Sierra Leone. Unfortunately the deposit is not currently accessible due to the

Rebel War; but once this is resolved further investigations should be carried out by the Geological Survey.

Further deposits of nepheline syenite were located prior to 1957 in the ijolites near Sango, 23 miles ESE of Freetown. These have an average of 53% by volume of nepheline syenite, comprising a light layer with 61.7%, an intermediate layer with 55% and a dark layer with 46.9%. The characteristics of this deposit are similar to deposits in Norway. No further investigations seem to have been carried out since that time. Neither of these deposits has ever been used for the production of any ceramic product.

The current August 1993 price of 200 mesh ceramic grade nepheline syenite (bagged 1 tonne lots) is C$78.00 FOB Canada and 325 mesh (Tyler) ceramic grade, FOB UK, £75.00/tonne bulk and £101.00/tonne bagged. As fluxing materials such as nepheline syenite constitute 23-28% of some porcelain bodies and 20-25% of some earthenware bodies, substantial foreign exchange savings could be made by any local ceramics company, if the local materials were used instead of imported materials.

Talc

Talc, a mineral used in the production of wall tiles, was located prior to 1956 in the Mamansu district. The anthophyllite schists of the area are often exceptionally rich in talc and small areas may consist solely of talc. No further investigations of these deposits seem to have been carried out since the 1956 discovery.

Talc is also reported from the various schist belts but it has never really been explored in detail. Deposits occur at:

i) Masumbiri, SE of Mabonte. The talc schist is impure having MgO 26.72% and SiO_2 33.70%.

ii) Grima in Kenema. Exposures of massive talc or soapstone are seen in this area. The rock is a cream-white colour with MgO 28.94%, SiO_2 57.97% and H_2O 5.5%.

iii) Gola Forest area has a lens of soapstone about 2 miles

long.

C. Proposed Regulations for Building and Industrial Minerals

Currently in Sierra Leone there are no quarrying regulations covering the extraction of industrial minerals. As a result the responsibilities of the quarry owner regarding environmental and safety aspects of his operation and also site rehabilitation after use, are not defined. Informal arrangements are normally made with the chieftain of the particular area.

Under the proposed mining act "building and industrial minerals" means barite, basalt, clay, dolomite, feldspar, gabbro, granite, gravel, gypsum, laterite, limestone, mica, magnesite, marble, phosphate, rock, sand, sandstone, slate and talc. Other minerals can also be designated by special notice. All of the raw materials, which are required for building material and ceramic production therefore come under this definition, except for nepheline syenite, which presumably could be designated by the special notice procedure.

Under the proposed new mining act, the following provisions will apply:

a) The area for which a Mineral Right is granted shall not be more than five square miles ($\approx 13 km^2$).

b) A mining lease will not be granted unless capital expenditure on plant, equipment and industrial buildings is at least US $250,000, or some other sum that may be prescribed by the Secretary of State.

c) The mining lease shall not exceed 15 years and shall be renewable at the discretion of the Secretary of State.

For medium-scale brick and tile factories, or ceramic factories the above provisions will not cause any undue problems in the planning of a project, as the financial assessments of such plants are

normally made on a life of 15 years, for which period a secure source of raw material is required.

Artisinal mining operations mean operations carried out in the course of mining that do not involve capital expenditure in excess of US$500,000, or the use of specialised equipment.

For artisanal mining the following provisions will apply:

a) The area for a Mining Licence is limited to a maximum of 5 acres (≈2ha).

b) An application for an artisanal mining license in respect to building and industrial minerals shall be accompanied by evidence of consent of the surface landowner.

c) An artisanal mining licence in respect to building and industrial minerals may be granted over an area forming part of any exploration or mining area, which is subject to a licence or lease, the holder of which is not the applicant, if the Secretary of State is satisfied that such holder will not be prejudiced by the grant of a mining licence in respect of building and industrial minerals.

d) An artisanal mining licence may be granted to a non-citizen, if the Secretary of State is satisfied that it is in the public interest.

e) The term of an artisanal mining licence shall not exceed 5 years.

For most small-scale brick and ceramic operations, using the artisanal mining provisions to obtain their raw materials, should not cause too many problems. However the fact that a mining lease is limited to five years could cause a problem in arranging funding for a new project because even small-scale building and ceramic manufacturing operations are planned on periods longer than five years. Banks would therefore take this risk into consideration,

when discussing loan agreements.

D. Investment Opportunities

Although there is no investment opportunity for the secondary processing of rutile in Sierra Leone due to the reasons set out in Section VA, a number of specific investment opportunities in the processing of industrial minerals have been identified. The best of these concerns brick and roof tile manufacture.

1. Rehabilitation of Sierra Brick and Ceramic Factory

The production facilities of this factory consist of:

One Excavator, Liebherr type 921
One Box-feeder, 0.8m x 4m
One Craven Fawcett wet pan-mill, 2.2m diameter with slotted grates, 10-12mm
One 600mm feed conveyor (steep incline of approx 40°)
One Craven Fawcett fine-roller set, approx 500mm wide
One Transfer conveyor
One Craven Fawcett Centim 350 De-airing extruder (no.4545 1980), capacity approximately 5,000 standard bricks (215 x 102.5 x 65mm) per hour
One Reel cutter
One Elevator
One Transfer car and finger car
Twelve Double chamber dryers, approx 3.5m high
One Unloading frame
One Off-loading conveyor
One Hand-operated roofing tile press - Marseille tile type
One Revolver press for roofing tiles, Gamini (Sri Lanka) type GRTF 6
Two Rectangular down draught kilns, capacity 9 - 10,000 standard bricks
One Partially destroyed continuous kiln
One Caterpillar generator, 275kW, model 504, generator no: 584. Motor dismantled, some parts missing.

The excavator appears in very poor condition and a new machine would be the best solution for this item. The generator, which is absolutely essential, is partially dismantled and requires a number of spare parts.

The basic brick manufacturing line consists of machinery from Craven Fawcett, a recognized quality manufacturer. However the equipment appears to have been somewhat abused and shows sign of poor maintenance. For instance the gear box of the extruder has been dismantled and one gear has been damaged. Nonetheless it is certainly possible to refurbish the line at a reasonable price with the correct spare parts. It would be necessary for an engineer from the machinery company to come to the site for approximately 5 days to inspect each machine and electrical control panel in detail, so that an accurate costing could be obtained.

The two roofing tile presses appear to be in working order and should not require much refurbishment beyond replacement of normal wearing parts.

The chamber drier has no burner system and no hot air intake from the kilns. For an initial start-up a burner and fan unit would definitely be required and at a later stage, if larger kilns were constructed, these could be sited close to the drier, on the site of the original kiln, so that waste heat from the kilns could be utilised.

The original continuous kiln is beyond economical repair and has been partially dismantled. The rest of the kiln should therefore be demolished.

The two small rectangular down draught kilns would be suitable for a start-up based on small-scale production but could not cope with the output from the machine line and the drier.

While technically it is possible to rehabilitate the factory, there are certain definite risks, which do not make this particular site a good one from the point of view of efficient production. These risks are:

Power Supply

The Wellington industrial estate has always had problems with its power supply. From October through November 1993 the entire estate had no power and all factories had to rely totally on generators. The existing Caterpillar 275kW generator would be fully utilised, therefore good maintenance would be vital to avoid down time.

Clay Supply

The clay being used at the time of the shut-down was from a mangrove swamp 12 miles from the factory site located ≤200m from the sea. The clay contains a large amount of salt and bricks made with this clay show some of the worst efflorescence the consultants have seen. It is clearly a material that should be avoided and other sources of clay would have to be found. Apparently good clay sites could not be used due to disputes with the chieftains of the various areas. This problem should be capable of resolution by a new investor, providing that reasonable royalty arrangement could be made for the clay extraction. However the known deposits are more distant from the present factory site, ie: 25 - 30 miles. A haulage distance of this magnitude would add somewhat to production cost, although product quality would improve.

Fuel Supply

The original fuel used by the factory was the heavy Bunker C oil, which was purchased from the power company on an ad-hoc unofficial basis. The two small kilns were fired with wood, which was brought from Ochre Hill, a site 17 miles from the factory. No planting of fuel wood trees was ever undertaken by the company, therefore deforestation would eventually have been a problem.

Market

The main market for building materials, such as bricks and roofing materials, is in the area of Freetown but to quantify that market with any degree of certainty under present conditions is almost impossible. The Central Statistics Office has no up-to-date figures which are readily available, and published statistics are some years out of date.

As regards the first three serious risk areas (power, clay and

fuel), it would be sensible to look for a suitable plant site close to a good clay supply and fuel supply. Power supplies in most of the country are currently unreliable but in 1994, when the Bumbuna dam is completed, more electricity will be available and power shortages should be less of a problem. The basic brickmaking line up to and including the cutter and off-bearing conveyor would be easy to move to any new location. A simpler chamber drying system based on standard pallets being moved by fork lift truck would reduce maintenance costs. Such dryers can also be fitted with programmable temperature and humidity controls at low cost. As regards the fourth risk area, market size, more accurate information would be essential prior to project development.

The Sierra Leone Housing Corporation is planning to build up to 6,000 houses over a three-year period, ie: 2,000 houses per year but resources will probably not be available to actually build them. The actual number of houses built by the Corporation over the past few years has been very small. Much of the building by private individuals is not recorded and they currently tend to make their own concrete blocks on site, therefore the precise market for building materials is very uncertain.

There is no doubt that there is a huge demand for new housing in the country but the affordability of building materials is a critical factor. Most people are earning such low salaries that although they want to build a house, there is no practical way of doing so. Borrowing money at the current very high rates of 45-50% interest per year is out of the question for almost all the population.

Because of the great uncertainty about the market any large investment in a building materials factory would be seen to be a high-risk venture. This was confirmed in discussion with the commercial banks.

There is therefore little alternative but to commence any rehabilitation of the Sierra Brick operation on a small-scale to begin with. This dictates that small intermittent down draught kilns should be used initially, rather than one large Hoffmann-type

continuous kiln. This will give more flexibility in production, albeit at a slightly higher fuel cost.

2. Establishment of a New Small-scale Brick and Tile Operation

A local entrepreneur, Mr Manju Kalley, has proposed the establishment of a brick and tile unit to produce 3 million clay bricks, 2 million clay tiles and 4 million clay roof tiles per year at Royeima, Port Loko. Although the entrepreneur, together with 7 partners, can provide the necessary land, the building and some existing trucks and trailers for the project, no capital is available for the machinery, especially at the production rates proposed. The entrepreneur was unrealistically hoping that an aid organization would provide all of the machinery for the project.

However the site chosen near to Port Loko does have the advantage of a good clay supply, which the local chieftain has already agreed can be used by the company. The area also has a good wood supply and waste material from palm oil plantations and coconut plantations is readily available for the cost of labour for collection and transport to the site. The entrepreneur has already made a provisional arrangement for the collection of waste material from these plantations. Port Loko has easy access to Freetown, which is the major urban market for all building materials.

No power will be available on site until 1994. Nonetheless there seems to be some justification for examining the possibility of initially establishing a small-scale operation at this site, using less sophisticated manual systems and intermittent down draught kilns, until such time that the market can be evaluated with greater certainty.

This type of project, with a production capacity of approximately 1.3 million bricks/year, or equivalent in roof tiles, will be much more affordable for the entrepreneur and his partners. It would reduce the need for large loans, which would probably be very difficult to obtain anyway. As the economy improves and power is provided at the site, the possibility of adding larger output machines and kilns could then be considered. An added advantage is that the operation would already have a regular cash flow from the

existing small-scale units. A financial analysis of a small-scale brick and tile unit located at the site near Port Loko is therefore detailed in Appendix 3.

3. Establishment of a Commercial Ceramic Manufacturing Unit

As no commercial pottery exists in Sierra Leone to provide normal low-cost ceramic tableware items, all such tableware is imported, mainly from Europe. All the necessary raw materials for the production of earthenware, including kaolinitic clays, plastic clays, silica sand and nepheline syenite are to be found in the country and there would seem to be a good opportunity for a small-scale production unit using hand-operated jigger and jolly machines to manufacture flat-ware and hollow-ware for the local market. Hand-thrown items for the tourist trade could also be made.

Due to the low earnings of most of the population a medium-scale factory would not be justifiable but a small-scale unit could be established at a modest capital cost which could easily be expanded in the future, if the market expands. Such a unit would require the following basic pieces of equipment:

- One ball mill for raw materials, 500 kg capacity
- one mixing tank
- one slip storage tank
- one slip working tank
- one filter press
- one de-airing pug mill
- one jiggering machine
- one jollying machine
- various moulds for other items (tea & coffee pots, ashtrays)
- one ware drier
- two electric kilns, one for biscuit firing and another for glost and decoration firing
- two glaze booths
- one small ball mill for glaze preparation

E. Recommendation

The clear requirement in Sierra Leone for the development of any sound commercial brick, tile, and/or ceramic industry is to obtain a more comprehensive knowledge of the ceramic resources of the country. This includes the known resources such as kaolinitic clays, plastic ball clays, bauxitic clays, nepheline syenite, silica sand and talc as well as exploring for other useful ceramic and refractory minerals such as feldspars (soda and potash), andalusite or sillimanite. Without such basic technical knowledge it is not possible to plan brick, tile or ceramic projects properly.

It is therefore highly recommended that a ceramic testing laboratory and pilot-plant production facilities be established at the Njala University College. Njala U.C. is suggested since it has had prior involvement with ceramics technology. Such a facility would provide the necessary training courses for technicians and entrepreneurs interested in developing ceramic and building material production units. Overseas training courses in ceramic technology, including raw materials testing, drying and firing of ceramic products could be provided under UNIDO study tour and fellowship programmes to complement university courses.

In parallel with this development, it is recommended that additional resources be provided to the Geological Survey, so that field work can be undertaken to investigate the industrial minerals of the country in greater detail. Whilst the exportable mineral sector of Sierra Leone is very strong, some of these earnings should be utilised to diversify into the manufacturing sector by using the country's industrial minerals. This would help to raise the living standards of the population by supplying basic building materials and household ceramics at reasonable prices and at the same time reduce the country's dependence on imported building materials.

Unfortunately in the search for glamorous exportable minerals, the more mundane but still very useful industrial minerals, which produce low-cost useful products, are often forgotten and ignored,

especially as many banks and international funding agencies are not really interested in relatively small projects. The fact that such projects provide badly needed employment and introduce new skills into the country should also not be ignored.

For the brick industry it would also be necessary to train bricklayers in the proper use of fired clay bricks, which takes some skill. There is currently no trained pool of bricklayers as all building work in Sierra Leone is with large cement blocks, the laying of which requires little or no skill. Vocational courses in bricklaying would therefore be a useful addition to the courses on offer at colleges in the country once plans for a brick factory are finalised. A similar situation applies to fired clay roofing tiles because most roofing is currently in corrugated steel sheets, which require less skill to install.

VI. CREATION OF A FAVOURABLE INVESTMENT ENVIRONMENT

To contemplate any industrial manufacturing investment the potential investor, whether an individual entrepreneur, or a multinational company, will carry out a detailed assessment of the risks involved in the particular project in relation to the potential rewards. When the investor is from overseas he will carefully compare the risks and rewards of investing in his own country to that of investing in Sierra Leone, or any other alternative country.

The basic requirements of any investor are:

A. Political Stability

The more stable the political situation, the more confidence the investor has in the long-term security of his investment. Manufacturing investments are long-term and once the investment is made it normally cannot be withdrawn easily without large losses. An unstable Government will tend not to attract any foreign investment.

B. Macro-Economic Conditions

The potential investor is seeking a low-inflation environment with no artificial price controls on his production. As some of the inputs for any manufacturing unit would have to be imported then free access to foreign exchange and easy regulations for imports and exports are required and expected.

C. Track Record

The potential investor will look carefully at the track record of the Government and the way it has handled past agreements made by foreign investors, especially retrospective changes to formal

agreements. Any change will alter the parameters under which a particular project was originally planned and hence its profitability. Too many changes will deter the potential investor. The proposed new Mining Act should increase the confidence of potential investors both in the mining sector and the industrial minerals sector.

D. Taxation

Any investor expects to be taxed on the profits of the new business. However taxes must be seen to be fair and reasonable and not subject to massive changes. Excessive taxation will deter any investor and that investment will be transferred to countries with low-tax regimes.

E. Repatriation of Funds

If a foreign investor invests in a manufacturing plant in Sierra Leone, repatriation of dividends from the profits of the operation should be possible without any restrictions. Similarly any capital brought into the country should be freely transferable.

F. Freedom from Confiscation

The foreign investor must be secure in the knowledge that his assets in the country will not be confiscated in a changing political climate.

G. Interest Rate

Interest rates for normal short-term loans or overdrafts from commercial banks should be at reasonable rates. Very high rates will prevent the investor from obtaining normal working capital requirements at an acceptable cost.

As of 15th November 1993 the commercial bank prime rate in Sierra Leone was reduced from 40% to 35% and lending rates from 45 to 50%. These are crippling interest rates for manufacturing industry.

H. Availability of Lines of Credit and Supplier Credits

Any new manufacturing project will require to import machinery and equipment into Sierra Leone. The availability of bi-lateral lines of credit, which allow supplier credit to be available and to be insured is frequently an enabling factor in obtaining funding. The availability of bi-lateral credit is frequently linked, at least in the investor's mind, to the stability of the Government.

Currently no bi-lateral lines of credit are available and insurable supplier credits are also not available for Sierra Leone.

I. Availability of Equity Capital and Development Bank Loans

In any developing country, such as Sierra Leone, the availability of finance at reasonable rates together with equity participation by a development bank can frequently make the difference between a project being implemented, or abandoned.

The National Development Bank does provide loans to new projects at a current borrowing rate of 35%. This is substantially below the current rates from the commercial banks. Equity participation theoretically can be given but the bank does try to avoid this at the present time. Loans can be disbursed in foreign currency at the current market rates but the exchange risk has to be borne by the project.

The African Development Bank is now prepared to advance foreign currency loans at an interest rate of 7% to projects they judge to be viable. The exchange risk has to be borne by the project, therefore the future rate of inflation has to carefully considered by any investor, especially in a project which has no export earnings and where all debt must be serviced from local earnings.

J. Conclusions

The present investment climate for industrial development is not currently favourable in Sierra Leone, as the country is judged to be high-risk. Consequently there are no bi-lateral lines of credit and no insured supplier credits.

In addition interest rates are still too high. As of 23rd November the prime rate at the commercial banks was 35% with short-term lending rates at 45-50%. To try to finance normal working capital requirements of an industrial project at these rates would be ruinous. The alternative of using foreign currency accounts would provide reasonable interest rates but would also expose the project to currency exchange risks. The rate of depreciation of the currency is slowing with inflation now at 16 to 18% per year, compared with over 100% in 1991. However the risk of further depreciation is high, consequently the effective cost of foreign exchange loans will rise accordingly.

The commercial banks currently judge that any new industrial project in Sierra Leone is a high-risk venture and want to see a project actually producing and selling goods for some months before considering any loan arrangements. With such a cautious (or realistic) attitude the commercial banks are effectively closing the door on potential new manufacturing projects. It is highly probable that this attitude will not alter until interest rates fall to more reasonable rates of say 10 to 15%.

VII. FINANCIAL ANALYSIS OF A MEDIUM-SCALE AND ROOF-TILE MANUFACTURING UNIT

A. Pre-Feasibility Analysis of a Small to Medium Scale Brick and Tile Unit

Because of the current poor investment climate in Sierra Leone and in particular for any industrial project, a new small to medium-scale building material project or ceramics project would not obtain the necessary funding support from the commercial banks to enable it to be implemented. Short-term funding would only be readily available to an established operation, which was seen to be selling all of its production and this funding would, in any case, be at the current borrowing interest rate of 50%. Bearing this in mind and also the fact that local entrepreneurs have very limited amounts of risk capital for new projects, this pre-feasibility analysis has concentrated on a possible small-scale brick and tile manufacturing unit, which is more easily funded by the local entrepreneurs themselves. Such a unit could then be easily expanded in future years, as the economy and investment climate hopefully improves.

1. Market and Plant Capacity

The assessment of the precise market for clay bricks and tiles at the current time in Sierra Leone is extremely difficult to do with any degree of accuracy because of the lack of reliable statistical information in the country. In the latest Annual Statistical Digest (1991) no information on housing or building permits is available. On visiting the Central Statistics Office to try to obtain up-to-date figures on the level of imports of steel, aluminium and polyester roofing sheets and also imports of cement, it was determined that none were readily available.

The Sierra Leone Housing Corporation estimates that at least 33,000 new houses are required in Freetown alone to eliminate the housing backlog. Throughout the country a total of 66,000 applications for houses have been made to the Corporation. The Corporation was hoping to build 6,000 houses in a three year period from 1993 to relieve some of the backlog but because of continuing financial

restraints very few are likely to be built.

There is no doubt that there is a huge demand for building materials in Sierra Leone, especially those materials of reasonable price but it must also be recognized that the very low earnings of the vast majority of people in the country mean that even if they wish to build a new house, or improve their existing house, they do not actually have the financial resources to do so. This fact and also the lack of financing organizations, such as building societies, from which people could borrow funds for new houses at reasonable rates of interest means that the huge demand for new housing does not actually translate into a large market for building materials, such as fired clay bricks and clay roofing tiles.

A local entrepreneur estimated in 1992 that the demand for building materials in the Freetown area was:

Bricks	10 million per year
Clay floor & wall tiles	6 million per year
Clay roofing tiles	10 million per year

He initially proposed that a production unit should be established for 3.0 million bricks, 2.0 million floor and wall tiles and 4.0 million roof tiles should be established.

Quite apart from the fact that the entrepreneur could not finance such an investment, the volumes of production in the current economic situation appear far too optimistic and sales would certainly not be immediately achieved at these levels. A more modest production unit is therefore suggested with a total production of approximately 1.0 million standard perforated bricks (215mm x 102.5mm x 65mm) and 0.3 million roof tiles per year using one rectangular intermittent kiln. Additional kilns can then be added as required, if the sales increase beyond the capacity of one kiln. This reduces the initial capital expenditure and also the risk.

Product pricing

It is anticipated that the 1993 price of standard perforated bricks of 215mm x 102.5mm x 65mm would be Le 150 per piece and the price of clay roof tiles would be Le 200 per piece, based on 24 tiles being equivalent to a standard 8 foot x 4 foot steel roofing sheet.

If the saleable production after normal production losses is based on 1.0 million bricks and 0.3 million roofing tiles the total revenue would be:

Bricks	Le 150 million
Roof tiles	Le 60 million
Total	Le 210 million

@ Le590/US$ = $356,000

This equates to an average product price of $ 0.274/piece

2. Materials and Inputs

Raw Materials

The raw materials cost is limited to the labour cost involved in hand-quarrying of the clay from the deposit and a payment to the local chieftain for extraction rights.

This payment is estimated to be Le 500,000 per year ($848).

Transportation costs will be minimal, as the production unit will be located at the clay site.

With a fired weight of approximately 2.5 kg for the perforated bricks and roof tiles, the production unit would require approximately 3.0 kg of raw material per piece of production, allowing for moisture, loss on ignition and production losses. The majority of production losses would be recycled.

With a saleable annual production of 1.3 million pieces the raw material requirement would be 3,900 tonnes per year.

Fuel Wood

The intention is to use a mix of mangrove wood (Le 4,000 per tonne) and waste material from coconut and palm oil plantations in Dasu, Mattru, Masanke and Port Loko areas, being 75, 65, 50 and 20 miles from the proposed site respectively. Arrangements have been made to collect the waste material free of charge, the only cost being that for transportation. The average transportation cost is estimated at Le 4,000 per tonne. Rice husk will also be available from a number of rice mills on a similar collection basis.

The fuel required to fire 1,000 standard bricks is estimated at a total of 1.0 tonne of waste fibre material and wood, or a cost of Le 4,000 per 1,000 bricks or roof tile.

The total cost of fuel wood is therefore estimated at:

Le 4,000 x 1,300 = Le 5.2 million
@ Le 590/US$ = $ 8,814

Utilities

Water is abundant in the area and will be available at no cost apart from the labour cost of collection.

Electricity is not available on-site until 1994, therefore power will be provided by a generator. The annual cost of diesel at Le 1,250 per gallon is estimated at:

Le 1.2 million.
@ Le 590/US$ = $2,034

Spare Parts and Consumables

The annual cost of spare parts and normal consumables, such as lubricants, cleaning materials and office stationary is estimated at:

Foreign spares	$ 9,000
Local spares	Le 0.8 million
	@ Le 590/US$ = $1,356

3. Location and Site

The entrepreneur has a site of 28 acres in Koya District, Royeima near Port Loko, which is approximately 35 miles from Freetown. The clay raw material source, which is abundant and of good quality for brick and tile manufacture, is located on-site.

The site has a good road connection to Freetown and labour costs in the area are low.

The value of the site at the current 1993 market prices of Le 1.2 million per acre is Le 33.6 million. At Le 590/$ this equates to $57,000.

4. Project Engineering

The production area, according to the original requirements of the entrepreneur, requires an industrial building of 2,000 square metres, constructed with open sides. The current 1993 cost of such a building, including all foundations (granite) is:

Le 486,560/m^2
@ Le 590/US$ = $ 825/m^2

A 2,000 m^2 building would therefore cost a total of:

Le 973,120,000
@ Le 590/US$ = $1.65 million

This size of building was dictated by the entrepreneur's wish to have sufficient open space under cover to allow air drying of the products. A large stock of work-in-progress would be required to ensure that the kiln always had sufficient dry products for firing on a continuous basis.

In relation to a small to medium-scale manufacturing unit these building costs appear to be out of all proportion to the total cost of the project and it would not be likely that the local entrepreneur could find funding for such a building.

A more economical method would be to aim at initially constructing

the smallest practical sized building to protect the brick and roof tile machinery and include provision for an artificial drier, so that bricks and tiles could be dried on a regular cycle throughout the year. Far less building area would then be required for work-in-progress, thereby reducing the capital costs.

For a simple basic production line and the drier a building of 400 m^2 would be sufficient. The cost would therefore be:

Le 194,624,000
@ Le 590/US$ = $330,000

Equipment Costs

The following equipment has the capacity to produce up to 10,000 tonnes per year, or approximately 4 million brick per year on a single shift basis. This is in excess of the initial requirements for one intermittent kiln but the plant is then very easy to uprate by simply adding additional kilns, when required.

1 conveyor belt, 6m long x 600mm wide, complete with support, storage hopper, motor and switch. One set of spare parts for conveyor belt. Installed power 0.75kW.

1 extrusion unit (non de-airing), 300mm diameter barrel, complete with hopper, motor and one die for bricks plus one die for tile slabs. One set of spare parts for two years operation, including two sets of spare blades, two sets of spare wearing steel plates and bearings.

Installed power 22kW at 1,500rpm
Nominal output: up to 5.6 tonnes per hour, approximately 2,000 standard bricks, 215 mm x 102.5mm x 65mm

1 semi-automatic cutter for bricks and tile slabs with a conveying system. One set of spare parts.

Installed power 0.55kW

1 semi-automatic tile press (electrical version), complete with:

- one mould for Flemish type roof tiles
- one mould for Mangalore type roof tiles
- one set of spare parts

Installed power 5.5kW
Nominal output: 300 roof tiles per hour, or 600 floor tiles per hour.

1 electrical control panel for the equipment.

Total FOB European port cost	US$ 96,000
Estimated CIF costs	US$ 6,000
Total CIF costs	US$ 102,000

No special foundations are required for the above equipment, therefore the only local costs would be for transport to site, labour costs for erection and on-site wiring.

Local costs are estimated at: US$ 10,000

1 Chamber drier, two compartments, complete with recirculation fans, exhaust and waste fibre/wood burner system, including temperature and humidity controls.
Installed power 16kW

CIF Cost of imported equipment:	US$ 60,000
Local building cost (side walls):	US$ 4,000

1 Rectangular down-draught kiln built of local materials
Annual output approximately 3,300 tonnes.
Installed power 5kW

Local cost US$ 30,000

1 Generator set 55kW

CIF Cost US$ 20,000

Locally Supplied Equipment

10 Carts or wheelbarrows
Local cost US$ 200

Office furniture
Local cost US$ 700

The following items are existing and would be provided as part of the initial capital supplied by the entrepreneur.

		Estimated value (US$)
1	Electric chain saw	1,700
1	Circular saw	1,900
1	Water pump	1,700
2	Tractor and trailers	17,000
1	Typewriter	800
1	Copier	1,500
	Total	23,100

Summary of capital cost of land, buildings & equipment (US$)

	Foreign	Local
Land	-	57,000
Building	-	330,000
Machine line	102,000	10,000
Chamber drier	60,000	4,000
Down draught kiln	-	30,000
Generator	20,000	-
Local equipment	-	24,000
Pre-production expenses	-	7,600
	182,000	462,600

5. Overhead Costs

The estimated normal overhead costs are:

	Local
Maintenance	5,000
Insurance	3,000
Communication	2,000
Travel	3,000
Advertising/ leaflets	3,000
Total	16,000

Depreciation in the analysis has been allowed at the normal international rates of:

Buildings, 4.0% straight line
Machinery, 10.0% straight line
Drier, kiln 6.67% straight line

Amortization of pre-production expenses has been allowed at 12.5%, straight line.

6. Manpower

The labour requirements of the production unit and the anticipated costs, including rice allowance, transportation allowance and medical costs, are as follows:

		Le/month	Total Le/month
1	Manager	80,000	80,000
1	Production Supervisor	60,000	60,000
3	Production Operatives (skilled)	45,000	135,000
8	Production Operatives	40,000	320,000
4	Kiln operatives	45,000	180,000
1	Sales Assistant	50,000	50,000
1	Clerk	45,000	45,000
2	Drivers	45,000	90,000
	Total		960,000

The estimated annual cost is: Le 11,520,000

@ Le 590/US$ = $ 19,525

During the pre-production period, which is estimated to be six months the labour cost is estimated to be:

Le 2,500,000
@ Le 590/US$ = $ 4,200

Other miscellaneous pre-production costs, in addition to the main capital costs are expected to be:

Le 2,000,000
@ Le 590/US$ = $ 3,400

In the following financial analysis it has been assumed that the financing of the project (capital plus pre-production expenses) by the local entrepreneur and his partners together with the African Development Bank equity and foreign exchange loan at 7%/ annum would be as follows:

	US$	
	Foreign	Local
Local equity, including land, buildings & equipment	-	462,600
African Development Bank equity	100,000	-
African Development Bank loan	82,000	
	182,000	462,600

As it is known that local commercial bank lending rates are 50% (November 1993) and that the banks also appear unwilling to loan to new industrial ventures at the present time, the emphasis on financing has to be equity inputs.

Internal Rate of Return (IRR)

Using this assumption of no local borrowing and a high equity input does result in an attractive Internal Rate of Return of 26.05% and a Return on Equity of 22.96% (see the following UNIDO COMFAR schedules). Bearing in mind that only a modest production of 1.3 million pieces per year has been planned in this initial phase, any further increase in production by the addition of additional kilns would rapidly increase further the profitability of the project.

The discounted cash flow schedules show that the factor having the most sensitivity is the sales price of the product, rather than variation in initial investment costs, or variation in operating costs. A reduction in the sales price of 20% would reduce the IRR to only 15%, which would then make the project unattractive. It is therefore important that the production unit aims at quality production to avoid downgrading product to second quality, which would reduce the average sales price.

Working Capital

In addition to the above investment working capital of $ 5,602 will be required during the first year, of which $ 4,321 is in local funds. The working capital will rise to $ 6,357 from Production Year 2, the first year of 1.3 million pieces production.

Net Income

The net income statement shows that the project is profitable in the first production year (Year 2 of project). Dividends could therefore be paid from the first production year unless the shareholders wished to accumulate funds for further expansion in the future.

Taxation

Taxation has been charged at 45% with no tax holiday. An initial allowance of 40% and 20% in the three subsequent years has been allowed for, as per the current regulations in Sierra Leone.

Debt Service Ratio

This is strongly positive, even when the net cash flow is reduced by up to 40% (see schedule), which means that if the entrepreneurs could find some loans from private sources at reasonable rates to reduce the amount of equity required, the project would still be viable, if the loans were not too excessive.

Break-even Analysis

The project has a very low break-even point of 20% capacity, which would assist the project in overcoming any unforeseen problems in the early years, ie: there is a good safety margin built into the project.

Final Comment

The financial analysis does show that a clay brick and roof tile project in Sierra Leone could be a viable enterprise but due to the present poor investment climate for industrial projects they have to have a high proportion of equity finance. Therefore the most important factor in Sierra Leone affecting any implementation, is whether local entrepreneurs do actually have the necessary capital to invest in such a project.

*Please refer to **ANNEX F** for details:*

UNIDO COMFAR FINANCIAL SCHEDULES

FINANCIAL ANALYSIS
FOR A
BRICK AND ROOF TILE PRODUCTION UNIT
IN
SIERRA LEONE

December 1993

PART THREE

LEGAL AND REGULATORY ASPECTS OF MINING IN SIERRA LEONE

VIII. DISCUSSION OF THE CURRENT MINING LEGISLATION

Sierra Leone as any country with potential for mining development needs a well defined legal framework to promote new mineral investment. Rules should be clear, transparent and stable. Criteria for granting mineral rights should be explicit and factual and should not be at the discretion of the Government. Investors need to be reasonably assured that they will be granted a mining lease if they discover a commercial deposit and comply with all legal requirements.

A - EXISTING LEGISLATION

Most of the legal provisions concerning mining activities in Sierra Leone were enacted many years ago and are currently substantially obsolete and inadequate.

The existing Mining Law, the Minerals Act (Cap 196) of 1927, does not provide an adequate framework for the exploration and the development of large-scale mining projects involving foreign companies. The Alluvial Diamond Mining Act of 1956 (Cap 198) which covers artisanal mining is obsolete.

Consequently, the Minerals Act has been disregarded to a large extent and major mining projects in Sierra Leone (rutile, bauxite, iron ore and diamonds) have been the subject of detailed SPECIFIC investment agreements entered into between the Government of Sierra Leone and investors and subsequently ratified by an Act of Parliament.

The disadvantage of specific detailed mining and fiscal regimes for each mining project is that negotiations take time, cost money and may therefore discourage potential investors. The need for a modern Mining Code has been obvious for many years.

The new Mining Code which has been under discussion since the late 80's has been prepared by the Government in consultation with the

United Nations Center for Transnational Corporations (UNCTC) and the World Bank. A final draft was discussed in Washington in May 1993 and has been submitted for approval by the GOSL.

It is based on Mining Codes signed recently in Africa, such as the Ghana Mining and Minerals Law of 1986, and the Papua New Guinea mining law. It provides systematic rules for the prospecting, exploration and development of large and artisanal mining operations. The objective is to limit the negotiation of specific Investment Agreements to a limited number of issues, such as work programmes, exploration expenditures obligations, or land rentals.

B . ASSESSMENT OF THE DRAFT MINING CODE

Mining codes all over the world are a compromise between the right of the State to control and supervise the development of its mineral resources and the basic guarantees and incentives that mining companies need to assume the risks associated with mining exploration and development.

The final draft Mines and Minerals Act (MMA) dated May 21, 1993 is the result of several previous drafts and has been reviewed by the World Bank and the UNCTC in New-York. It is very broad in scope and covers many areas such as mining taxation, environmental law, foreign exchange regulations and customs regulations. There is a risk of conflicts with existing and future regulations.

When enacted, the MMA will not eliminate the need for negotiating specific Investment Agreements. The fact is that most developing countries negotiate specific agreements with foreign investors for major mining projects, in particular when the expected production is exported. Sierra Leone is no exception.

The draft MMA has been discussed in detail at a Workshop held in Freetown on November 10 and 11 and it is not the purpose of this report to summarize the proposed legislation. These comments are limited to the most important issues which may warrant further consideration.

While respecting the right of GOSL to set up its mining policy, the Mission is concerned that certain provisions may deter mining companies from investing in the country. Sierra Leone is still a new player in the mining exploration world in spite of its recognized mineral potential and hence it needs a legal and tax framework especially inducive to mining investment. Sierra Leone competes for limited exploration funds with other countries in Africa as well as with established mining areas such as North America, Australia, Chile, etc.

The proposed draft still gives **large discretionary powers** to the Secretary of State and the Director of Mines. This is also the case in the Minerals Act of Bostwana, but these powers are limited by the proviso that the Government's consent may not be unreasonably withheld.

1. Potential Problem Provisions

It is the consultant's view that potential investors are likely to react adversely to the following provisions:

* Section 117 provides that *"the Secretary of State may grant ... a permit to export saleable minerals from Sierra Leone on conditions determined by the Secretary of State in the permit"*. This provision creates uncertainty by giving large discretionary powers to Government officials. The export of minerals should not require government discretionary approval but should be a right subject to specific regulations to curb transfer pricing and profit shifting. Mining companies are extremely reluctant to risk exploration money if they have to negotiate the right to export their production.

* In many countries, mineral rights granted *"for all minerals"* or *"for all minerals except ...."*. However, Sections 54, 55 (d), 60(c), 63(b), 66(3) and others provide that exploration licences and mining leases are restricted to a specified mineral, although there are provisions to add additional mineral(s) if application is made and approved by the Director of Mines. This is an

unnecessary restriction.

Mining companies take risks, invest their shareholders' money, take bank loans and require therefore a large degree of **OPERATIONAL INDEPENDENCE** and **CONTROL OVER THE MANAGEMENT** of their operations, within the limits of approved programmes and budgets. In this respect, sections 68 (1) and 71 create severe constraints.

Section 68 (1) (b) provides that the holder of a mining lease shall commence production on or before the date referred to in the programme of development. Obviously, technical problems, changing economic conditions or force majeure may delay the start-up date. Sanctions in case of non-compliance, if any, are unclear.

Also, section 71 states that the suspension, cessation or curtailment of production is subject to approval by the Secretary of State and shall be given if *"it appears that the estimated revenue from mining operations for the succeeding twelve months will not exceed the estimated operating expenses for that period."* This is very restrictive and probably unacceptable to most mining companies.

* Dredging operations will require three different permits: a mining lease, a dredging licence (Part XI of the draft MMA) and an export permit. The granting of a dredging licence (section 88 (3) and an export permit (section 117) is largely discretionary. These requirements are burdensome and do not encourage exploration and mining development.

It should be noted that Sierra Rutile operates currently under three *"mining leases and dredging licences"* numbered 2113, 2117 and 2134. It is unclear if the draft MMA will require in the future separate approval procedures for the mining lease and the dredging licence.

* Mining companies need **FLEXIBILITY** to run their operations in the most efficient manner. It is not unusual to modify work programmes, especially exploration programmes, often at short notic . For example, drill rigs may be shifted from one area to another depending on results or because or logistical problems. A drilling programme may be cancelled because of poor results. Conversely, it may be technically sound to concentrate drilling on a specific area to confirm encouraging results. Section 56 and 66 of the draft MMA provides that modifications to work programmes *"shall, unless the Secretary of State rejects the same within two months after being notified have effect after such period."*

  Experience shows that processing applications through any administration anywhere in the world takes time. As a consequence, drilling rigs and crews could very well be put on stand-by for two months, waiting for approval of a modified exploration programme. Obviously, this is not the intention of the draft MMA. Still, this is a risk that cannot be ignored.

* The obligation under section 55 (c) for the operator to pay to the Government the shortfall between the stipulated minimum expenditures (subject to carry over from one year to another) and actual expenditures can probably be managed. Still, it is not an incentive to cut costs and get the most work out of the exploration funds. Work programmes are more important than expenditures commitments.

2. Payments

It is unclear if Part XIII lists all the payments to be made by mining investors or if there are other payments which may be due under other existing or future laws, such as the Customs Act. Part XIII refers to royalties, income tax, withholding tax on dividends, customs duties on imports, agricultural development levy. It does not specifically mention **the pre-shipment inspection fees** due on EXPORTS of minerals, an issue which has been a bone of contention

between mining companies and the Government for a number of years. It is unclear if *"the export duties"* referred to in section 112 refer to the pre-shipment inspection fees.

3. **The Draft MMA and Existing Agreements**

Finally, the consequences of the draft MMA on the Rutile and Bauxite Agreements of 1989 and 1992 need further consideration. There appears to be a conflict between section 126 of the draft MMA and clause 11(e) of the Rutile Agreement and 9(d) of the bauxite Agreement.

Section 126 of the draft MMA states that the Rutile and Bauxite Agreements **shall apply with such modifications as may be necessary to give full effect to the provision of this Act.**

Clause 11(e) of the Rutile Agreement reads that The provisions of the Minerals Act (a defined term) and amending Act and Rules, shall be binding upon and inure to the benefit of the Company, except such provisions thereof as may be inconsistent with the terms or provisions of this Agreement. **Any inconsistence between a provision of any such Act or Rule and a provision of this Agreement shall be resolved by giving effects to the provision of this Agreement.**

Clause 9(d) of the Bauxite Agreement is similar but its scope is broader and applies not only to the Minerals Act (a defined term) but to the Income Tax Act and ... all regulations and rules from time to time in force thereunder, affecting the operations of the company ...

Clause 9(d) states further that any legislation including any legislation amending the same or substituted therefor shall be binding upon and inure to the benefit of the company, except to the extent provided to the contrary by the expressed or implied terms of this Agreement.

As a matter of fact, there are areas of inconsistency between section 126 of the draft MMA and the Rutile and Bauxite agreements, such as but not limited to:

Sections 95 (royalty rates),
102(a) (The 1.5% limitation on head office overhead) and
106 (2) (the Agricultural Development Fund levy)

It should be noted that certain provisions of the draft MMA, such as section 101 regarding the Minimum Income Tax, are more favourable for the current mining operators than those contained in the 1989 and 1992 Mining Agreements.

Technically, this issue could be resolved by adding the following sentence at the end of section 126 **unless provided otherwise under the Agreements listed under subsections (a) to (e) of this Act.**

4. Separate Accounting

Section 107 provides for separate accounting for each mining lease. This can be done easily through proper cost accounting. Natural resources companies are used to keep their costs and revenues on a property per property basis. However, Section 107 goes further and states that the **Mining leases holders will have to maintain separate balance sheets, statements of earnings and cash flow statements for each mining lease.** This means that mining operators will have to register and operate as many separate companies as they hold mining leases. Assets and liabilities will have to be allocated to each lease. This is probably feasible but is excessive and creates an inordinate amount of paper work and administrative constraints. We respectfully suggest that the reference to balance sheets, statements of earnings and cash flows be deleted.

C. RECOMMENDATIONS

1. The Draft MMA

The draft MMA has been on the drawing board for many years and is badly needed to promote both local and foreign investment in mining. The MMA is needed to achieve two of the GOSL's objectives in the mining sector:

(i) the promotion of foreign investment in the mining sector and in particular the development of the diamond kimberlite potential and

(ii) more revenues to the Treasury from the alluvial gold and diamond small mining sector through a better system of licensing and marketing.

2. Making the Draft MMA More Attractive to Industry

The main goal of the draft MMA is to encourage exploration and mining development. It is hoped that the comments under B a) to f) above will be of help to GOSL and assist in making the current draft more attractive to mining companies; thereby attracting more foreign investment for the benefit of the country.

3. Mining Industry Comment on the Draft MMA

If not yet done, it would seem advisable to circulate the draft MMA to the current mining operators to obtain their comments and suggestions.

4. Pre-Shipment Export Inspection Fees

It is suggested that GOSL verify whether pre-shipment export inspection fees are paid in other countries by the mining operators. If this is the case, it is recommended that pre-shipment export inspection fees be added to the list of payments to be made by the mining lease holders to GOSL (Part XIII). This will not resolve the current dispute with Sierra Rutile and Sieromco but will apply to future operators. Please refer to paragraph XI B (f) for more details on this issue.

5. Regulations

It will be necessary to draft complementary regulations to the Mines and Minerals Act. It is recommended that these regulations be drafted in consultation with mining industry representatives such as surveyors, local title experts, geologists, mining engineers, reclamation specialists, etc.. Mining companies operating in the country should be given the opportunity to offer their comments and suggestions.

IX. THE FOREIGN INVESTMENT LEGISLATION

In addition to a modern Mining Code, many mining countries such as Chile (Decree Law 600) , Ghana, Indonesia or Papua New-Guinea, have enacted a specific foreign investment legislation to encourage foreign investors. The purpose of these statutes is to provide investors with basic guarantees as well as a basic set of incentives.

A. The Development and Industries Act of 1983

In Sierra Leone, the Development and Industries Act of 1983 offered incentives to local and foreign investors, such as:

* partial or total exemption from customs duties payable on capital equipment and raw materials.

* generous depreciation allowances.

* guarantees against nationalization.

* tax holidays up to five years, etc..

The 1983 Act was not successful in attracting new investment and according to a statement made by the Secretary of State for Finance in his budget speech for the 1993-1994 financial year *there is clear evidence that the Act failed to encourage investment*.

Part of the problem was the complex and lengthy approval process involving the Ministry of Trade, Industry and State Enterprises (MTISE), the Ministry of Finance and the Customs Service. Also, it appears that some of the tax incentive provisions may have been misused.

Consequently, it is likely that the 1983 Act will be repealed and will be replaced by the new SLEDIC legislation.

B. The New SLEDIC Legislation

a) In October 1993, Dr. Ahmad Iman, a consultant retained by UNIDO recommended that:

(i) investment incentives be tied up to export development and employment and not any more to import substitution activities

and

(ii) that an Investment Centre be set up to advertise and promote investments in Sierra Leone.

Besides, he drafted an Industrial Development and Promotion Act 1993.

b) However, in a discussion paper dated June 10, 1993, a consulting group retained by the World Bank questioned the need for an Investment Code and suggested that *investors should be guided by the general business codes of the country* and that the move from a regulated economy to market-oriented economy eliminated the need for investment codes. Also, it was suggested that tax holidays and other tax incentives are not an efficient method of promoting investment.

The discussion paper proposed among other recommendations that The Sierra Leone Export Development and Investment Company (SLEDIC) be set up to promote (and not regulate) investments.

c) In November 1993, the decree establishing SLEDIC was approved by GOSL. SLEDIC will receive assistance from UNIDO and the World Bank. UNIDO will finance a three-year $1.9 million programme to promote export development.

d) The Sierra Leone Export Development and Investment Promotion Council Decree, approved by GOSL **EXCLUDES** mining or recovery of minerals from the definition of manufacturing. Besides, there is no represehtative of the Department of Mineral Resources on the Board of the Promotion Council. It appears

therefore that promoting investments in the mining sector may not be part of the SLEDIC's functions. This remains to be confirmed.

SLEDIC will probably focus its activities on export promotion and investment in the agricultural and manufacturing sectors by small and medium size companies.

C. Mining and Foreign Investment Law

Investments in the natural resources area, such as oil and gas or mining are of a different magnitude and can exceed $100 million. Incentives, if any, should be tailored to the mining industry specific needs. Also, investors need to be expressly guaranteed against the risk of discriminatory treatment, expropriation, transfer restrictions, etc.. Finally, there is a need to define a procedure to settle disputes between the investor and the Host country.

The new Mining Act does contain **incentives** to investing in mining such as:

* generous depletion allowances: 50% of qualifying expenditures for the first year and 25% thereafter.

* a reduced income tax rate on mining operations (37.5% compared to 45%).

Also, the newly emerging business environment is more favourable to the private sector. Now no prior approval is needed to invest in the manufacturing sector and, in addition, customs duties have been slashed.

The basic **guarantees** required by mining companies can be the subject of specific provisions in an Investment Agreement entered into between the host government and mining companies, and/or be covered by an agreement for the promotion and protection of investments entered into between the government of the host country

and the government of the investor.

The purpose of these bilateral international conventions is to create favourable conditions for greater investment for nationals and companies of one state in the territory of the other state.

For instance, the United Kingdom and Ghana on March 29, 1989 signed an agreement for the Promotion and Protection of Investments. Ghana signed similar agreements with Germany and The Nederlands.

The Consultant's view is that concluding such bilateral international agreements with countries which are major investors in the mining sector, such as the United States, Switzerland or Australia could assist in establishing an environment favourable to additional foreign investment in mining.

To sum up, the mining sector does not need at this time specific incentives or guarantees other than those provided for in the draft MMA and in the Rutile and Bauxite Mining Agreements. In the future, bilateral international conventions for the protection of investment may be considered but this is not a priority.

X. MINING AND ENVIRONMENTAL PROTECTION

Environmental protection in Sierra Leone is under the responsibility of the Department of Lands, Housing and Environment, set up in 1986. In May 1990, GOSL approved a national environmental policy which includes an obligation to carry-out an Environmental Impact Assessment for any major project. Part XII of the draft MMA deals with the protection of the environment and requires that an Environmental Impact Statement be prepared before the granting of a mining lease. GOSL is currently drafting a general environmental legislation with the assistance of the United Nations Environment Programme (UNEP). The project is still at a preliminary stage.

A. The Need for Environmental Protection

It is a fact that the mining industry operating in Sierra Leone has done little until recently to rehabilitate lands damaged by mining activities. Former major operators such as Sherbro Minerals, Delco or Bethlehem Steel did not rehabilitate the areas they mined out in the 60's and 70's. The National Diamond Mining Company (NDMC) had no environmental policy and, in more recent times, probably little money for rehabilitation. Small independent miners have done and continue to do substantial damage to the environment. Until recently, GOSL had no environmental legislation and still has not the capability to protect the environment.

Sierra Rutile and Sieromco commenced production in 1979 and 1963 respectively. There was no obligation at that time to protect the environment and little was done until the late 80's to rehabilitate mined out areas.

At that time, it was considered that environmental degradation was the unavoidable consequence of any mining operation. Environmental standards have obviously changed over the years and practices which were tolerated twenty or thirty years ago are now unacceptable.

Both the Sierra Rutile and the Sieromco agreements of 1989 and 1992 include fairly general requirements regarding environmental

protection and rehabilitation. Both agreements require the companies to prepare a comprehensive master plan and to implement at their expense programmes and measures approved by the Government for the effective revegetation of mined-out areas, including replanting and dealing with impounded water and mining spoils. The Sierra Rutile master plan was published in July 1990 although work had commenced in 1987. Rehabilitation accelerated in 1990 with major plantings at the Bamba-Belebu former mine area. Sieromco had until October 1, 1993 to submit its rehabilitation master plan. However the company has been carrying out rehabilitation work in recent years.

The July 1990 Sierra Rutile master plan includes programmes in several types of activities:

* rehabilitation of mining ponds and water resources development

* health and sanitation (health centre clinics, village maternity aide scheme, water wells programs)

* education (assistance to local schools)

* village relocation, road improvement

* agricultural development

* loans to small businesses

* Power and sanitation, a five-year program operated by CARE and funded by the company ($260,000 per year)

Also the draft MMA includes broad and general provisions regarding environmental protection, including the obligation to carry-out an Environmental Impact Statement as a condition to the granting of a mining lease.

Starting around 1989, GOSL has defined its environmental policy and is in the process of putting in place the basic elements of a

modern environmental legislation.

On the other hand, it should be recognized that Sierra Rutile has put in place a comprehensive rehabilitation plan and that both companies have started reclamation work.

B. Comments and Recommendations

There are basically two methods to control pollution and protect the environment in the mining sector:

* host countries can apply general pollution control to the mining industry as it is done in industrial countries. The problem is that few developing countries have both a general environmental legislation and the specific regulations applicable to mining activities. Also, they lack the administrative apparatus required to enforce the law,

* include specific environmental provisions in the Mining Agreement between the host country and the mining company. These provisions can be fairly general or they can be comprehensive.

As regards Sierra Leone, it will take many years to enact a general environmental law and the specific regulations applicable to different methods of mining (open pit, underground operations, dredging, large-scale and small-scale alluvial mining...). In the interim the following approach is recommended:

a) Negotiate **COMPREHENSIVE** and specific environmental protection clauses in Mining Agreements. The Ok Tedi copper agreement signed in the early 80's between the Government of Papua-New Guinea and Broken Hill Proprietary included such a clause and is still a reference. (see Annex B).

b) Establish contact between GOSL's environmental authorities and the UNEP Industry and Environment Programme Activity Center (UNEP-IE/PAC), based in Paris. The IE/PAC is currently working on a mining rehabilitation technical guide which should be

published in 1994. Address is 39-43 Quai André Citroen, 75739 PARIS CEDEX 15. Telephone: 1 44 37 14 50.
Fax: 1 44 37 14 74.

c) Improve coordination between the Department of Land, Housing and Environment and the Department of Mineral Resources regarding environmental mining issues. Mining operators should not be subject to conflicting directives or instructions coming from different branches of GOSL and should be supervised by only one governmental agency. It is recommended that the environmental unit at the DMR be expanded and given the capability to carry out these duties.

d) GOSL to ensure that it is kept informed on the current basis of the **estimated costs** of reclaiming the Sierra Rutile and the Sieromco properties. In the years 2000 and 2002, GOSL has an option to buy an interest in both projects and the outstanding reclamation liability will be a factor to be taken into account in the decision process. **Reclamation cost money and that there is a risk that GOSL may end up buying a reclamation liability.**

The Sierra Rutile Master Plan provides little cost information. Clause 10 (k) (iii) of the Sierra Rutile Agreement provides however that the Master Plan shall include an estimate of the costs of reclaiming and rehabilitating mined-out areas. Reclamation work has now be going on for about six years and operators should be able to provide preliminary cost estimates and update them as necessary.

Also, the estimated cost of outstanding reclamation should be properly accrued in the operators' accounts.

XI. REVIEW OF EXISTING AGREEMENTS

The Consultant was asked to evaluate the existing mining agreements currently in force in Sierra Leone including shortcomings and possible future improvements.

A. A Comparison of the Rutile and Bauxite Agreements

In recent years, GOSL has received considerable assistance from the United Nations Center for Transnational Corporations (UNCTC) and other UN Agencies to renegotiate the original agreements signed in the 60's and early 70's with the rutile and bauxite companies:

RUTILE: Participant Agreement dated February 4, 1972 amended by Supplemental Agreement dated May 23, 1975. Both agreements were replaced by the Sierra Rutile Agreement ratified by the Parliament in 1989 (Act No. 8).

BAUXITE: Initial agreement dated 1961; amended in 1976, 1980 and 1987 and replaced by the 1992 Bauxite Mineral Prospecting and Mining Agreement (N.P.R.C. Decree No. 11).

The following is a comparison of the Rutile Agreement of 1989 with the Bauxite Agreement of 1992.

ITEM	SIERRA RUTILE AGREEMENT	SIEROMCO AGREEMENT
Date of signature	11/03/1989	04/03/1992
Effective Date	12/21/1989	10/01/1992
Production Date	06/30/1984	n/a
Term of Mining Lease	25 years to year 2009	Renewed for 15 years as of Jan/01/92 ML No. 2131
Extension	15 years	n/a
Other Minerals		
Diamonds	excluded	excluded
Others	Company is entitled to the grant of a mining lease	n/a
Accounts	in US dollars	in US dollars
Mining Rent	$486/sq. mile in 1983 dollars	$400/sq. mile
Surface Rent	$4/acre	$10/acre
Escalation	4% to 5% per year	as per price index
Royalty gross sales FAS payable in $ deductible	3.5% 4% above $600/T	4%
Income Tax	37.5%	37.5%
Minimum Income Tax on turnover	3.5%	3.5%
Credited against Additional Profits Tax (A.P.T.)	No	Yes
Capital Allowances on Qualifying Expenditures (Q.E.)	Year 1: 20% then : 15%	7.65% on Q.E. before Jan 1 1992 10% thereafter

	SIERRA RUTILE	SIEROMCO
Losses carried forward		6 years
Advance Royalties	$1M in 1990 $1.04M in 1991	none
Additional Profits Tax (A.P.T.)	yes	yes 50% on net chargeable income over $10 million
A.P.T. rate	$625-$675/t 10% $676-$725/t 15% $726-$775/t 20% $776/t and up 25%	
	escalated 4% as of 1992	escalated as per price index
Customs duties and charges on imports		
Mining equipment	not to exceed 10%	10% previously none
Fuel	not to exceed 8%	8% (no change)
Other imports	as per Customs Act	same
No taxes other than taxes listed in Agreements	yes	yes
Right to export	yes	yes
Right to retain proceeds abroad	yes	yes
Free repatriation of funds	yes	yes
Dividends withholding Tax	10% as of year 2000	10%

	SIERRA RUTILE	SIEROMCO
Government Option		
To buy	47% interest	up to 49%
As of	Jan 1, 2000	Jan 1, 2002
Price	Certified book value at Dec. 31, 1992	fair market value
Right to use water to divert streams to build dams	yes	yes
Surface damages (crops, buildings, trees..)	Compensation to be paid to land owners	same
Reclamation of mined-out areas	yes	yes
	Sierra Rutile to restore all mining areas to reasonable surface contour	Sieromco to carry out effective revegetation of mined out areas
Company to prepare a comprehensive rehabilitation Master Plan	yes (done)	yes
Reprocessing	Sierra Rutile to conduct a feasibility study on the local production of paint pigments.	Sieromco to study feasibility of producing bricks, roofing ceramics and tiles.
Other Investments	SIERRA RUTILE to build a Zircon production facility (done)	n/a

	SIERRA RUTILE	SIEROMCO
Government Representation	GOSL to nominate two members of the Board of Directors	same
Assignment of interest to third parties	subject to GOSL's prior written approval	same
Agricultural Development Fund	1.5 million Leones per year (less than $3K at current rate of exchange)	3 US cents per ton produced of bauxite with a minimum of $50K
Annual audit of accounts	not provided for but accounts are audited.	yes
GOSL access Access to the Books	not provided for (implied)	yes
GOSL to receive copies of sales contracts	no	yes
GOSL to receive copies of services agreements	no	yes
Arms'length standard	not provided for	expressly provided for but implied
GOSL to receive annual report on market conditions	no	yes
International arbitration	World Bank (ICSID)	same
Governing law	Sierra Leone and international Law	same

B. Comments and Discussion

a)GOSL has received expert professional assistance from the United Nations Center for Transnational Corporations in negotiating the 1989 and 1992 rutile and bauxite agreements. Both agreements are very similar but the bauxite agreement contains new provisions regarding the full disclosure of all sales contracts and regarding also export pricing matters aimed at curbing transfer pricing and profit shifting practices.

b)It is a fact that previous arrangements between GOSL and Sierra Rutile or Sieromco have not been beneficial to the country in terms of tax revenues. Payments to GOSL were for many years limited to a lump sum calculated on production and the companies did not pay any royalty or income taxes. Sierra Rutile was granted a three-year tax holiday from 1984 to 1987.

However, it is fair to acknowledge that these agreements have been very beneficial to Sierra Leone in terms of employment, infrastructure and regional development. Also GOSL had to take into account the fact that the rutile operation had failed twice before Nord Resources took it over.

c)It is the Mission's view that the agreements of 1989 and 1992 protect the fundamental interests of Sierra Leone and are now beneficial for the host country. Both agreements contain clauses which are very favourable to the Government, such as:

*The 3.5% minimum corporate tax, which is due in respect of any financial year, even if companies show no profit. When added to the 3.5% or 4% royalty, this is equivalent to a 7% or 7.5% annual royalty, which is very high by international mining standards. It is suggested that both SRL and Sieromco accepted to pay this minimum corporate tax because they had been in operation for many years and had recouped all or part of their initial investments. Promoters of a new mining project may well have serous reservations about this type of provision.

* Both agreements include an additional profit tax to be paid in addition to normal income tax in case exceptionally high profits are realized. This type of provision was introduced in the early 80's in Papua New Guinea and a few other countries. In the case of Sieromco, GOSL will receive 50% of net chargeable income which exceeds $10 million per year (escalated). It is unlikely that the A.P.T. will ever become due because of persistent depressed commodity prices.

* Payments to GOSL such as mining rents or surface rents are now expressed in US dollars and escalated, based on a flat percentage (4% per year) or based on a price index for industrial goods.

d) However and in spite of these significant improvements, it is still the view of many Sierra Leonians and Government officials that the country is not getting a fair share of rutile and bauxite mining.

It should be noted that mining companies pay not only royalties and income tax but also customs duties, fuel import duty and other minor taxes and contribute to community development programmes. Also, income tax is withheld on employees salaries (Pay As You Earn).

In total, Sierra Rutile contributes about $10 million per year to GOSL Treasury. Sieromco's total tax payments (royalties plus income tax and not including other payments) may be estimated at $5 to $6 million. In addition, both companies transfer foreign exchange into the Sierra Leone banking system to pay for their local expenses. In total, it is estimated that the current mining operators contributes approximately 20% to the Government's revenues.

e) GOSL has been exposed in the past to certain transfer pricing practices which have been detrimental to the country. However it proved possible to impose on Sieromco strict obligations in

the area of export pricing which have been incorporated in the draft MMA.

Contrary to Sieromco, Sierra Rutile is not part of an integrated group of companies and sells its products on an Arms' Length basis to unrelated third parties such as Dupont (USA), Tioxide (UK), SCM Chemicals (UK) and Kronos (Netherlands). The risk of profit shifting to affiliated overseas companies by way of transfer price is therefore non-existent. However, GOSL must be able to control the quantity and the quality of exported minerals.

f) Both Sierra Rutile and Sieromco refuse to pay the export inspection fees charged by Specialist Services International (SSI), a Government contractor, to inspect the companies' shipments at the export terminal. This issue has been pending for about two years.

The amount of money at stake is not negligible. Based on mineral exports statistics, inspection fees chargeable on the rutile and bauxite exports are estimated at $753,000 for the year 1991:

Sierra Rutile	0.75% of $75.9 million	= $569,000
Sieromco	0.75% of $24.6 million	= $184,500

The 1990 amendment to the Customs regulations states that all imports and exports are subject to pre-shipment inspection fees and price verification in accordance with the law, unless they can show that they have been exempted by the Authorities...

The Ministry of Trade argues that the Customs law must be enforced and that these fees are not an additional form of direct taxation but the payment of services rendered.

Both Sierra-Rutile and Sieremco are not opposed to pre-shipment inspection but argue that they are exempted of paying the corresponding fees by virtue of the mining agreements

dated respectively 1989 (Act No. 8) and 1992 (N.P.R.C. Decree No. 11).

* Clause 6 (i) of the rutile agreement reads that there shall be no other taxes, duties, charges, levies or **OTHER PAYMENTS OF ANY KIND** whatsoever to the Government imposed on the company for the duration of this agreement, except for those listed in said clause. The said list does include charges on Imports Inspection Fees but does not make any reference to export inspection fees.

* Clause 4 (i) of the bauxite agreement is broader and states that for the duration of this agreement, no taxes..., royalties, duties, excise, charges, levies, fees, dues, contributions of any kind whatsoever payable to the Government or any agency of the Government shall apply to the company... other than... (those expressly listed).

Payments by Sieromco to the Government include import inspection fees, freight levy, harbor dues and port charges. The nature and the amount of these payments are described in clause 4 (g). No reference is made to export inspection fees.

Both companies agree however to pay minor taxes which do not result in a tax burden which exceeds the equivalent of $100,000 per year or $250,000 over any five-year period. The bauxite agreement provides also that minor taxes do not include any reasonable charge made for the provision of the Government or any of its agencies of services **requested by** and rendered to the company.

A final point is that SSI appears to do very little for the projected fee. The mission understands that SSI virtually accepts the shipping weights and assays from Sierra Rutile's and Sieromco's export documentation. The inspection fee thus appears to be taxation by stealth, with the proceeds split between SSI and GOSL.

From a legal standpoint, both Sierra Rutile and Sieromco have a strong case.

C. Recommendations

a) The 1992 Bauxite agreement benefited from the experience of the 1989 Rutile agreement and should be used as model form for future agreements and serve as a basis for discussions. However, each mine is unique and it is unlikely that any model agreement would be appropriate without substantial modifications in each case. Therefore, there is no need to spend an inordinate amount of time (and money) putting together a set of model forms for each type of mining operations. Again, the Bauxite agreement is well adapted to the Sierra Leone context and should be used as a basis for discussions.

Indonesia is an exception and has been able since the late 60's to conceptualize, draft and impose the Production Sharing Contract to potential investors. Negotiation in Indonesia is limited to critical points, i.e. initial and production bonus and other key parameters.

b) The UNCTC recommended early 1992 that a bauxite monitoring unit be set up to keep GOSL informed of developments which may affect the bauxite market and monitor sales and shipping contracts. To-date, this recommendation has not been implemented due to lack of funds. It is suggested that this recommendation be implemented and extended to the rutile market.

c) The GOSL' mining policy needs stability to gain the confidence of the international mining industry. The Mission's view is that the government should resist any temptation to revise the rutile agreement to incorporate certain provisions regarding full disclosure and export pricing policy contained in the 1992 bauxite agreement. Renegotiation would be counterproductive and will deter mining companies from

investing in the country.

d) The Government's nominees on the Board of Directors of both SRL and Sieromco should participate actively in Board meetings and fully exercise their prerogatives as members of the Board. As far as feasible, they should have extensive experience in mining and corporate affairs.

e) Clause 10 (1) of the Rutile Agreement states that *the company shall conduct feasibility studies on the local production of paint pigments and other products from rutile produced in Sierra Leone....* The Mission has reached the conclusion that this production is not economically feasible at this time. However, GOSL should keep in mind that it has the right to ask the company to conduct such a feasibility study.

XII. A COMPARISON WITH OTHER COUNTRIES

A. Fiscal Mining Policies

It is interesting to compare the Sierra Leone current or proposed fiscal mining policies with those currently in force in other mining countries. This comparison shows that Sierra Leone is generally in line with its competitors:

	SIERRA LEONE	BOTSWANA	CHILE	GHANA	PAPUA N.G
Foreign Investment code	No	No	yes	yes	yes
Mining Agreements	yes	yes	yes	yes	yes
Special mining Tax law	no	no	no	no	yes
Government participation	yes	15% to 25% (free)	no	10% free + 20%	10 30%
Board Representation	yes	yes	no	?	?
Income Tax	37.5%	40%	32.5% (effective)	45%	35%
Royalties	3 to 5%	3 to 10%	none	3%	1.25%
Minimum Income Tax	yes	?	no	no	
Depreciation Rules	very liberal	over life of mine	very liberal	year 1: 75%	liberal
Withholding Tax on Dividends	10%	16%		none	17%
Import duties	5%	none	7.5% to 10%	on mining equipment	
Additional Profit Tax	yes	?	yes	yes	yes

SOURCE: Countries other than Sierra Leone. Strategy for Africa Mining. World Bank Technical Paper Number 181.

B. The Government Participation Issue

Government Participation is an important issue that cannot be ignored. Although the draft MMA does NOT make any reference to Government participation, it is a fact that the declared mining policy of GOSL was for many years to acquire a **majority participation in major mining projects**. Mandatory Government majority participation is a strong deterrent and very few companies will accept high risk exploration investment under this condition. This policy may account in part for the low level of exploration carried out in Sierra Leone over the past twenty years.

Around 1970, GOSL decided to take a 51% participation in all major mining projects. An illustration of this policy is the 51% participation acquired in 1970 in the National Diamond Mining Company. The ultimate outcome of that acquisition would not be encouraging to any potential investor in Sierra Leone mining projects.

As recently as 1989, this was still the official policy. Clause 9 of the Rutile Agreement reads that **the declared Mining Policy of the Sierra Leone Government remains on a 51/49% basis in favour of Government**. However, due to special circumstances, GOSL agreed at that time to limit its option to buy an interest in Sierra Rutile to 47% in year 2000 at the certified book value, payable in US dollars.

In 1991, GOSL negotiated the right to purchase after ten years of production **up to 40%** of the shares of the Sunshine Kimberlite Mining Company, registered in Sierra Leone to mine the NDMC kimberlite deposits. This agreement was not ratified.

In 1992, GOSL negotiated an option to acquire in year 2002 **up to 49%** of Sieromco at the fair market value and to pay for its participation in US dollars. The Bauxite Agreement does not make any more reference to the 51% Government participation. It should be noted that in year 2002 Sieromco will have been in operation for about forty years. **The risk is that GOSL may end up buying a reclamation liability.**

This issue of Government participation is largely political and it is the Government's prerogative to decide its position on this issue. The World Bank Technical Paper No. 181 which was circulated during the November Mining Workshop deals with this issue (pages 33 and 34) and the Mission agrees with its conclusions.

The fact that the draft MMA does not make any reference to government participation may indicate a change of policy which needs clarification. Any potential investor will raise this issue, so early resolution is important.

Minority participation, in the range of 10 to 25%, is not unusual in established mining countries. In Botswana, Government policy requires that 15 to 25% of the equity in major projects be granted to Government in return for exclusive access to depletable natural resources, use of the country's infrastructure and specific geological information.

C. The Additional Profits Tax

As mentioned above, a few mining countries have introduced an Additional Profits Tax (APT) to share the windfall profits which may be generated by mining operations under exceptional circumstances such as large reserves, high grade, low operating costs and high commodity prices. This was the case for the Bougainville project in the early 80's at the time Papua New Guinea negotiated the first APT with the operator.

Mining companies consider an APT as a major disincentive to investment. They assume the exploration risks, the technical risks associated with mineral development as well as sovereign risks and high profits in good years compensate losses incurred in bad years and are needed to pay for unsuccessful projects.

As recommended by the World Bank in Technical Paper No. 181 on a Strategy for African Mining *...an APT should only be considered by countries with a well established mining sector track record, good*

proven mineral potential or established quality projects.

Sierra Leone was able to negotiate an APT with Sierra Rutile and Sieromco at a time when commodity prices were high. However, due to the current depressed market conditions, it is doubtful that these clauses will ever come into force. It should be noted that both companies were in production for many years before the APT was negotiated.

The Additional Profit Tax is not a way to attract new mining investments to Sierra Leone and, as a matter of fact, is **NOT** mentioned in the Mining Code which may indicate a change in policy. However, it may possibly come up again in the future at the time of negotiating a Mining Agreement. Therefore, it is believed that GOSL should clarify its position on this matter in order to attract more investment in the mining sector.

D. Comment on the Papua New Guinea Mining Act of 1992

A new Mining Act was enacted in August 1992 in Papua New Guinea and takes into account the experience accumulated under the previous Act. For details, please refer to the publication prepared by the Department of Mining and Petroleum in Port Moresby. This Act contains some interesting provisions.

The number of possible tenements has been reduced to simplify the Administration of the Act. The only tenement for undertaking exploration is the Exploration Licence (EL). An EL confers the exclusive right to explore for **all minerals** and is valid for two years with indefinite two year extensions, subject to a 50% relinquishment at each extension. Renewals are reasonably assured if the EL holder has fulfilled his obligations, ... *unless the renewal is not considered to be in the State interest.*

Section 26(3) provides that *Where the programme does not meet the prescribed minimum expenditure requirements, but the Board considers that the applicant has otherwise satisfied the (approved*

programme) requirements, the Board may recommend approval of the programme.

Section 26(4) addresses the important issue of retention in case of sub-economic mineralization. EL's may be extended where a mineral deposit has been located but cannot be mined because of unfavourable market conditions, or because the said deposit is needed to sustain future operation of an existing or proposed mining operation at another location or because local conditions make it difficult to obtain the required approvals.

The 1992 Act makes a distinction between:

* Special Mining Leases (up to 40 years) which apply to major mining projects subject of a specific *Mining Development Contract.*

* Mining Leases (up to 20 years) for the sole purpose of mining alluvial minerals and which must be held only by citizens of PNG or companies controlled by PNG citizens.

Alluvial Mining Leases (AML) is a simplified type of lease granted to traditional land owners who want to undertake alluvial mining on their own customary lands when said lands are already covered by an Exploration Licence. **To avoid potential conflicts between small miners and exploration companies, an AML may be granted over an EL, subject to the right of the EL holder to object to the AML. This is a new concept which may apply to the artisanal mining in Sierra Leone.**

PART FOUR

XIII. DISCUSSION

One of the main objectives of the Mission was to determine whether the Government could earn more revenue from the rutile mining operations in the country. The Mission noted that Sierra Rutile only renegotiated its agreement with GOSL in 1989 and for GOSL to try to renegotiate that agreement after such a short time would send all the wrong signals to the international mining community and would be likely to deter further investment in the mining sector. Since 1989 the general tax regime of other industry and business sectors has improved so that Sierra Rutile has moved from being in a generally preferential position to the rest of the industries in 1989 (except for the minimum tax provision), to a position where there is either no preference, ie: oil duties, or it actually pays more, ie: spare parts duty.

The present depressed market prices for rutile are expected to continue for some years, due to a continuing oversupply on the world market. As Sierra Rutile is a high-cost producer profitability is already low. The company is investing in the future with a $71 million investment programme to increase output and reduce unit costs, so that it can remain competitive. This is relatively high risk in that if the rutile prices continue to fall the company will still have to service the debt on a much more highly capitalised plant.

The Government will automatically receive additional revenue from the expansion plan by virtue of the minimum tax provision. To try to obtain a further significant increase in revenue from SRL runs the risk of pushing the company into a loss-making position. As the operation has already failed twice before, this risk should be understood.

A better way to increase the revenue of the Government from the mineral sector, apart from encouraging new mining operations for exportable minerals, is to encourage the use of the available industrial minerals in the country for the manufacture of clay bricks, clay roofing tiles and other ceramic products, such as tableware. The establishment of such manufacturing units would not only provide badly needed employment but would utilize the

country's resource base to provide useful products to replace imported cement, imported roofing sheets and imported tableware, thereby reducing the foreign exchange requirement.

To assist in this development a ceramic testing laboratory and pilot plant should be established at the university college, so that training in ceramic technology could be provided to potential entrepreneurs and technicians. In parallel with this training courses for bricklayers should also be established, as there is currently no pool of trained bricklayers in the country.

Additional investigative work should also be carried out on the industrial mineral resources of the country by the Geological Survey and funds should be provided for this purpose by the Government from the revenue obtained from the exported minerals.

The present economic environment in Sierra Leone, although improving due to the IMF supervised Structural Adjustment Programme, is still not attractive to potential investors in the secondary processing of minerals and manufacture of products from industrial minerals, such as fired clay bricks, clay roofing tiles and other ceramic products, such as tableware items. The lack of available bi-lateral lines of credit, insurable supplier credit terms, extremely high short-term borrowing rates of around 50% and the reluctance of commercial banks to give loans to new industrial projects even at these high interest rates all combine to deter potential investors from establishing new industrial projects. Only further improvements in the reduction of inflation and interest rates will change this situation.

The main message of this report is also that developing countries need not only to promote but support and stand behind mining investors in order to create an environment really attractive to foreign investment in the mining sector, the so-called enabling environment. The Government's role is mainly to provide a general business climate which is conducive to private sector activity and mining in particular. This enabling environment includes among other requirements a satisfactory legal and regulatory framework with clear, transparent and stable rules and a fiscal package which

maximizes the benefit for the country while remaining competitive.

The proposed Mining Code is a significant step in that direction in spite of certain shortcomings which could be easily amended to make it more attractive to foreign investment. The proposed fiscal scheme is satisfactory and competitive with other tax schemes in force in other developing countries.

The Government's role in the mining sector is to encourage mining companies (large, medium or small) that have the technical expertise, the financial resources, the managerial capability, and a successful track record to find and develop new deposits, either on a 100% basis or in association with joint venture partners.

The Government needs to ensure that the mineral rights holders (1) keep the Department of Mineral Resources well informed of their activities, (2) fulfil all their obligations and (3) comply with all applicable laws and regulations (labor, work safety, environmental protection, etc..)

It is suggested that Governments anywhere in the world should refrain from direct or indirect intervention in the management of exploration, development or mining operations. Within the scope of approved work programmes and budgets, mining operators need a large degree of operational independence and some flexibility to run their operations in the most efficient manner for their benefit and the benefit of the host countries. This implies a spirit of mutual trust and mutual respect which is also part of the enabling environment.

As regards legal and regulatory matters, the Mission came up with the following conclusions and recommendations:

1. The draft MMA protects fully the rights and interests of the Government of Sierra Leone (GOSL). However, to attract more mining investment, it is recommended that certain provisions be amended or clarified in order to reduce the Government discretionary powers and assert the company rights to control and manage its operations. Within the limit of approved

programmes and budgets, mining companies do require a large degree of operational independence to operate in the most efficient manner.

If not yet done, it is highly recommended to obtain the comments of the current mining operators on the proposed draft MMA.

2. It is recommended that the required complementary regulations be drafted in consultation with the industry representatives and persons directly involved in exploration and mining operations such as mining title consultants, surveyors, geologists and mining or environmental engineers.

3. The mining sector in Sierra Leone does NOT need additional incentives or guarantees other than those provided in the draft MMA , the current Rutile and Bauxite Mining Agreement or in existing or forthcoming foreign investment regulations.

4. There is a need for a promotional brochure on mining investment opportunities to be circulated to potential mining investors. Please refer to Annex A for a draft.

5. The review of the current Bauxite and Rutile Agreements show that these agreements negotiated with the assistance of the United Nations Center for Transnational Corporations are beneficial to the GOSL. Any attempt to renegotiate these agreements signed in 1989 and 1992 would be counterproductive and send the wrong signal to the industry.

6. The 1992 Bauxite Agreement should be used as a model form for future major projects. Each mine is to some extent unique and there is no need to spend an inordinate amount of time developing a set of model agreements for each type of mining (under ground operations, open pit, dredging, heap leaching, small scale mining).

7. A comparison of mining taxation packages in selected developing countries shows that the proposed mining taxation