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Sri Lanka

ESTABLISHMENT OF A CERAMIC RESEARCH AND DEVELOPMENT LABORATORY

US/SRL/78/207

SRI LANKA

Technical report: Progress report*

Prepared for the Government of Sri Lanka
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Mr. Y. Kato,
Chief Technical Adviser

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United Nations Industrial Development Organization
Vienna

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PROJECT REPORT FOR THE PERIOD 21st APRIL - 20th JULY,1985

During the last year from January - December, 1984, I was attached to the Establishment of a Ceramic Research and Development Laboratory Project, as the Chief Technical Adviser. For the purpose of follow-up services for this project, I have been working here from 21st April to 20th July, 1985, for a period of three months. On this occasion, I would like to submit the present condition of operation which include implementation of activities, equipment, training etc., and to find out the existing difficulties and problems. I have also suggested various recommendations for the further improvement of the project. In this report, I have not included general information and background of the project,which has already been submitted in my final report, in 1984.

I. Present Situation of Project

Since Sept. 1984, the project has operated with 12 research officers. Most of the equipment is being used for testing of material and research work. For example during the month of April,June & May 1985,results of 226 orders have been submitted to the clients, done by the laboratory staff. It appears to be, that all the research and testing work are done in a satisfactory mannar.

However, I would suggest that all the staff must pay more attention to create their ability in both theoretical and practical fields. Needless to say, the combination of both theoretical knowledge and practical experience will assist in many type of ceramic works.

For the purpose of the improvement of the project,I would like to forward the following suggestions:-

i) Project National Manager should be appointed, who will over-look most of the project activities under the guidance of the UNIDO Expert. These activities would include management, adminstration, research and consultancy work.

ii) Staff training both internal & external should proceed continuously, in order to create greater ability. Since the beginning of the operation, internal training has been provided by UNIDO Experts. Besides, this year, external training has been arranged for most of the research officers, who will complete their training abroad by the end of the year. We also organized a collaquium for research topics among the staff of the laboratory from 7th June, 1985. The research staff members were asked to explain what they had done regarding their project topics and to discuss results and problems encountered with a view to a solution of each problem. On these occasions, the UNIDO Experts assist the research officers in the preparation and correction of report, also mannar speech etc.

I have also provided special practical training for the protp-type production during the three months, as no one could make any new products in the correct mannar.

iii) Regarding Equipment

Most of the installation of the equipment was completed in 1984. However, some of the equipment is still not in function.

We should arrange for final adjustment immediately, for e.g.

a) T.G. Unit
b) Dilatometer
c) Filter Press with Pump
d) Pickley PCE Furnace

I would like to mention details of each room regarding the equipment, giving the list of additional equipment and accessories.

Equipment & Additional Requirements for Ceramic Research Laboratory

Room No. 1 (X-ray Room)

Equipment not in function

a) T.G. Unit
b) Dilatometer

Reason: Awaiting Panel I

Additional Equipment Required

Room No. 1 (X-ray Room)

1. X-RD Transmission attachment
   This attachment is essential for clay mineral indentification.
2. X-RD Vacuum Attachment
   This attachment is necessary for clay mineral indentification.
3. Standard samples for XRF
   For quantitative analysis
4. Hanawalt Search Manual/Data File
   Necessary to identify minerals from the diffractogram.
5. Sample Grinder
   A Tungsten Carbide or Silicon Carbide/hard grinder
6. Muffle Furnace - Maximum temperature 1400°C.(sample preparation for XRF)
7. D.T.A.
   A.S.T.M. cards for D.T.A.

Room No. 2 (Microscopy Laboratory)

8. Automatic Petro - Thin Section preparation Machine
9. Altrasonic Bath (for cleaning small parts of equipment)
10. Polarizing Microscope for both reflecting and transmission light with photographing facilities.

11. The accessories for Scanning Electron Microscope
    a) Back Scattering Detector
    b) Energy Dispersive X-ray Spectrometer
    c) Large Sample Holder
    d) Image Selector
    e) Ultra High Resolution CRT
    f) Dynamic Forcusing Unit
    g) Beam Controller for X-ray Analysis

12. Enlarger- for colour and black/white

Rcom No. 3 (Pilot Plant)

13. Vibrating Sieves 30,45.60,80,100,120 mesh B.S.

14. Weighing Balance 0 -20Kg manually operated - pan type

15. De-Airing extrusion machine for laboratory use, capacity 30kg/hr.

16. Pestle and Mortar of diameters 20 cm,25 cm, 10 cm, 7.5 cm.

17. Diaphragm pump with filter press - capacity 30 kg.

18. Automatic mixture for small samples weighing 5000 g.- 2 g. with two spare pestles & mortars.

19. High speed sample grinder.

Room No. 4 (Kiln Room)

20. High temperature measuring Thermocouple and indicator (digital) range 0 - 1800^{o}C.

21. Temperature Indicator for Pt-Pt/13% Rh Thermocouples (digital).

22. 02 nos of Pt-Pt/13% Rh Thermocouples

23. Pitot Tube - to measure the velocities of the fluids flowing through pipes etc.

24. Gas Flow Meter - to measure the quality of gas used for kilns etc.

Room No. 5 (Physical Laboratory)

25. Mercury Balance - to determine bulk density of solid materials.
26. Ridgen Type Surface Area Measurement Appratus to determine the surface areas of fine powders.
27. Laboratory scale Froth Flotation Cell for mineral separations.
28. Laboratory Scale Welfy Table for mineral Separations.
29. Magnetic Seprator (Laboratory Type)
30. Electro Static Seperator (Laboratory Type)
31. Hardness Tester (by indentation)
32. Compressive Strength Measuring Equipment for bricks, plaster of Paris.
33. Laboratory Hydrocyclone Unit with pressure variable facilities.
34. Thermal Conductivity Apparatus.

Room No. 6 (Chemical Laboratory)

35. Atomic Absorption with cathode tubes.
36. Spectrophotometer with changeable wave lengths.
37. Conductivity Meter
38. Vacuum Pump (heavy duty) Muffle Furnace for chemical analysis.
39. Magnetic Stirrer with hot plate.

Equipment not in function:

a) Crucible Furnace does not reach up to required temperature.
b) pH Meter from old stock.

IMPLEMENTATION OF ACTIVITIES
1985

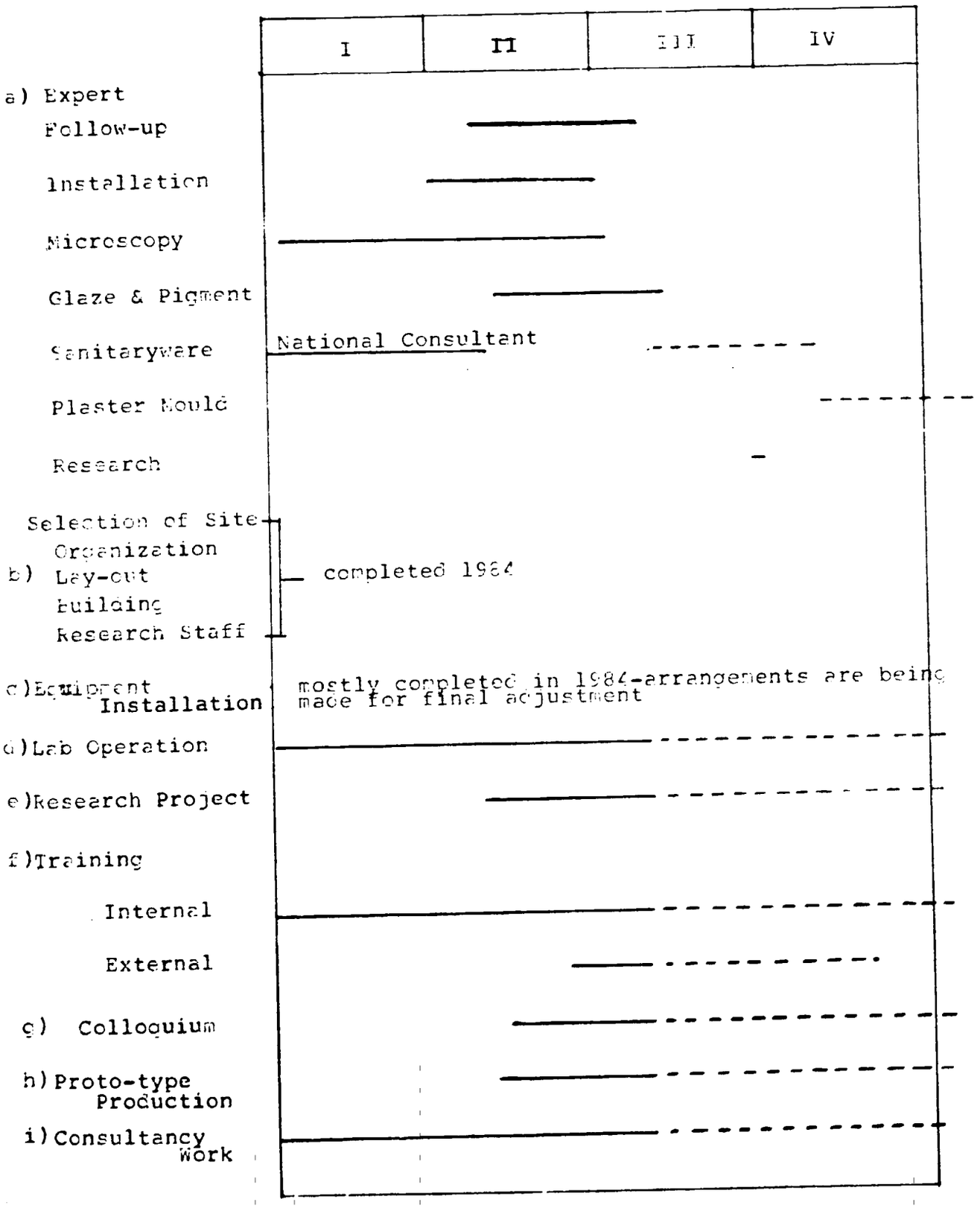

Fig.A

II. Implementation of Activities

Hereby, I would like to submit implementation of project activities from January 1985 to date, on fig. A, with explanation and details:-

a) Expert

1)	Follow-up Services for Project Superviser	Dr. Yoshimori Kato- 3months 21st April - 21st July
2)	Follow-up Services for Installation	Dr. F.A.von Metzsch 3 months 28th March - 27th June
3)	Microscopy	Dr. Ilse Sacher 6 months 7th Jan. - 6th July
4)	Glaze & Pigment	Mr. I. Knizek 3 months 5th May - 4th August
5)	National Consultant for Sanitary Ware	Mr. T. Sivanadian Jan. - April Requested for another 3 months extension

Following Experts are expected to join this project in 1985.

1)	Ceramic Research	Dr. Z. Engelthaler for 2 weeks
2)	Plaster Mould	under for recruitment for 3 months

b)	Selection of Site	completed in 1984.
	Building Arrangement	completed in 1984.
	Research Staff personnel	appointed in 1984.

c) Equipment Installation, mostly completed in 1984.
see my Final Report

d) Laboratory Operation

Operation is continuously proceeding since the middle of Sept. 1984.
(from January to June 1985 - which is a period of six months, 519 results have been submitted to clients

	1984		1985	
	Sept. - Dec.		Jan. - June	
	Internal	External	Internal	External
Total No. of Orders	310	75	490	115
Total No. of Orders Conpleted	255	53	441	78

Internal Orders from Ceramic Corporation Factories

External Orders from the following customers:-

Cultural Triangle Project UNESCO
Geological Survey Dept.
Abhayagiriya Project
Jetawana Project
Sigiriya Project
Sumagi Tile Industries
Lanka Porcelain Ltd.
A.G.A.'s Office Horana
Mineral Sands Corporation
Hemas Drugs Ltd.
Dankotuwa Procelain Factory
Industrial Development Board
Ellawala Exports Ltd.
Ceylon Gems Corporation

Orders from individual persons - 13 nos.

e) Research Project

We have allocated a research project for each laboratory staff member, on May 1985 and all the research officers must proceed with their own research work.

General Project

Preparation of technical data sheets if all raw materials

	Officer
X-ray Laboratory	
1. Recovery & usage as a raw material of waste clay from Boralesgamuwa Refinery & Piliyandala Factories	Mr.H.W.S.Siritunga
2. Effects of moisture expansion and thermal expansion on crazing, peeling and spit-out of earthenware body, made at Piliyandala & Negombo Factories.	Mr.C.L.Ranatunga
Mineralogical Laboratory	
1. Usage of paddy husk as a raw material for ceramics	Mr. N. karunasinghe
Kiln Room	
1. Conservation of energy on the basis of a Thermal Balance Sheet, in Sanitaryware Kiln at Piliyandala	Mr. P.Mithraratne
Pilot Plant	
1. Development of soft & hard porcelain bodies & glazes	Mr. E.C.Alles
2. Calculation in Ceramics (recently appointed)	Mr.C.M.A.C.B.Gange

Physical Laboratory

1. Fundamental study of different types of glazes	Mr. A.S.Pannila
2. Development of a Zirconium Silicate sagger body, to be used in the porcelain & tile industry	Mr. K.P.A.Jayakody

Chemical Laboratory

1. Study of lead release in ceramic and all other tableware	Mr. K.A.N.Dharmasiri
2. Cation exchange capacity and its effect on the rheology of local clays	Miss L. Pigera

Design Room

1. A study on the current market trends (design-wise) on ornamental ware	Mrs. R.D.Hemalatha

Chief Research Officer

Fundamental study of pigment preparation and application	Mr. B.D.S.R.Silva

f) Training

i) Internal - for laboratory staff

Trianing commenced on the 25th May, 1984. The lectures dealt with the general aspects of manufacture of various types of ceramic ware and in particular, the quality control of raw materials used in the manufacture of different bodies and glazes, shaping of products, application of decoration and firing of all types of products.

ii) External Training for laboratory staff

It is proposed to have 12 officers trained abroad over a period of two to three months, for each officer. Mr. C.L. Ranatunga has gone to Germany for study and training.

Schedule of this training is given below:-

Laboratory	Name	Place	Duration	Period
XRD/DTA	Mr. Ranatunga	Philip's Holland	2 wks	June-Aug.
	Mr. Siritunga	Netzsch& Sphinx Lab. Germany	8 "	Sept-Nov.
Microscopy	Mr.Karunasinghe	JEOL(Japan)	4 "	
		Aichi Ceramic Centre(Japan)	4 "	Aug-Sept.
Pilot Plant	Mr.Alles	Czechoslovakia UNIDO Centre	4 "	Sept-Oct.
		Netzsch(Germany)	6 "	
	Mr. Gaspe	Aichi Ceramic Centre(Japan)	8 "	Oct-Nov.
Kiln Room	Mr.Mithraratne	Czechoslovakia UNIDO Centre	4 "	Sept-Oct.
		Netzsch(Germany)	4 "	
Physical Laboratory	Mr.Pannila	Czechoslovakia UNIDO Centre	2 "	Sept-Oct.
	Mr. Jayakody	BCRA (UK)	6 "	
Chemical Laboratory	Miss Pigera Mr. Dharmasiri	Aichi Ceramic Centre(Japan)	8 "	Aug-Sept. Oct-Nov.
Designer	Mrs.Hemalatha	Aichi Ceramic Centre Japan	8 "	Aug-Sept.
Chief Research Officer	Mr. Silva	Nagoya Ceramic Research Centre	12 "	Sept-Nov.

g) Colloquium

Commenced on 7th June, 1985

	Name	Laboratory	Topic
by	Mr. K.A.N.Dharmasiri	Chemical	Study of lead release in ceramics and tableware
	Mr. A.S.Pannila	Physical	regarding particle size determination
	Mr. N.Karunasinghe	Microscopy	Electron Microscope Observation
	Mr.H.W.S.Siritunga	X-ray	XRD operation & details of various raw materials
	Miss L. Pigera	Chemical	Method & Principle of Chemical Analysis
	Mr. E.C.Alles	Pilot Plant	Development of soft & hard porcelain bodies and glazes

h) Proto-Type Production

Actually, I introduced various types of glazes especially oil-spot, copper red, celadon and crystal glaze for proto-type production after my arrival. These products could be utlized for the exhibition, with other scientific and technological details. This exhibition will be held in September, by the Natural Resources Energy & Science Authority of Sri Lanka on 27th & 28th Sept. 1985. The theme of the exhibition is "Central Exhibition On Science Technology".

i) Consultancy Work

This activity must continuously be done for various requests by customers. During my 3 months assignment, I have visited the following factories and have given the necessary technical advice for the improvement of quality & productivity.

Dankotuwa Procelain Factory
Negombo Ceramic Factory

Lanka refractories (pvt) Lrd., Meepe

Midya Ceramic Factory, Kottawa

Government Pottery Centre, Kelaniya

III. Recommendations

I have submitted the following suggestions to the Ceramic Research & Development Project in my final report, dated December 1984. Basically my recommendations are the same as last year. Hence, I would explain the present situation.

1) Arrange to have self-supporting system

This means, that the cost of operation of the research Laboratory, should be covered by the fees obtained from customers for orders done. For this system, the price list for services that could be rendered by the Ceramic Research Laboratory, has been fixed, which may cover the expenditure of the Ceramic Research Laboratory.

2) Long-Term Staff Training

Continuous staff training is necessary for both, of a theoretical and a practical nature. The staff of the Pilot Plant expecially, must have sufficient practical experience, as otherwise they will not be able to do any new type of product

3) Request to UNIDO for continued Assistance

To achieve success in this project, assistance is necessary from UNIDO for the next two years.

For this matter, the Chairman of the Ceramic

Corporation has requested the Ministry of Industries & Scientific Affairs for approval on 4th July,1985, giving all details. Therefore, arrangements for this is proceeding through the proper channel.

4) Director or Manager

A Director or Manager for the CRL should be appointed by the UNIDO, for period of two years. He will have to work under the UNIDO Expert, studying the correct method of conducting research and adminstration of the Ceramic Research Laboratory.

At present, the General Manager of the Ceylon Ceramics Corporation is working as the Manager of the Ceramic Research Laboratory and it is not possible for him to devote the necessary time to the management of the Ceramic Research Laboratory.

5) National Consultant

A National Consultant must be appointed for a period of time. At present, Mr. T. Sivanadian, who was appointed by the U.N. as a Sanitaryware Specialist, could assist in this field.

6) Information

Collection of new technical details and information is necessary for the purpose of future improvement of the laboratory. The CRL must have close contact with foreign universities and ceramic associations or information centres in different countries, which will enable the laboratory to obtain more useful technical information.

7) **Site of Laboratory**

Laboratory must be moved to Colombo, which will facilitate communications with other institutions, library facilities for the convenience of customers, power supply and security. This should be arranged in the near future.

I thank the Chairman and General Manager of the Ceylon Ceramics Corporation, my colleagues of the U.N. Staff and the Research Officers of the Ceramic Research Laboratory for the close co-operation given to me during my 3 months assignment in Sri Lanka.

I believe that the Ceramic Research Laboratory would be successful in assisting the Nation to progress in the scientific field.