



TOGETHER
for a sustainable future

OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.



TOGETHER
for a sustainable future

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

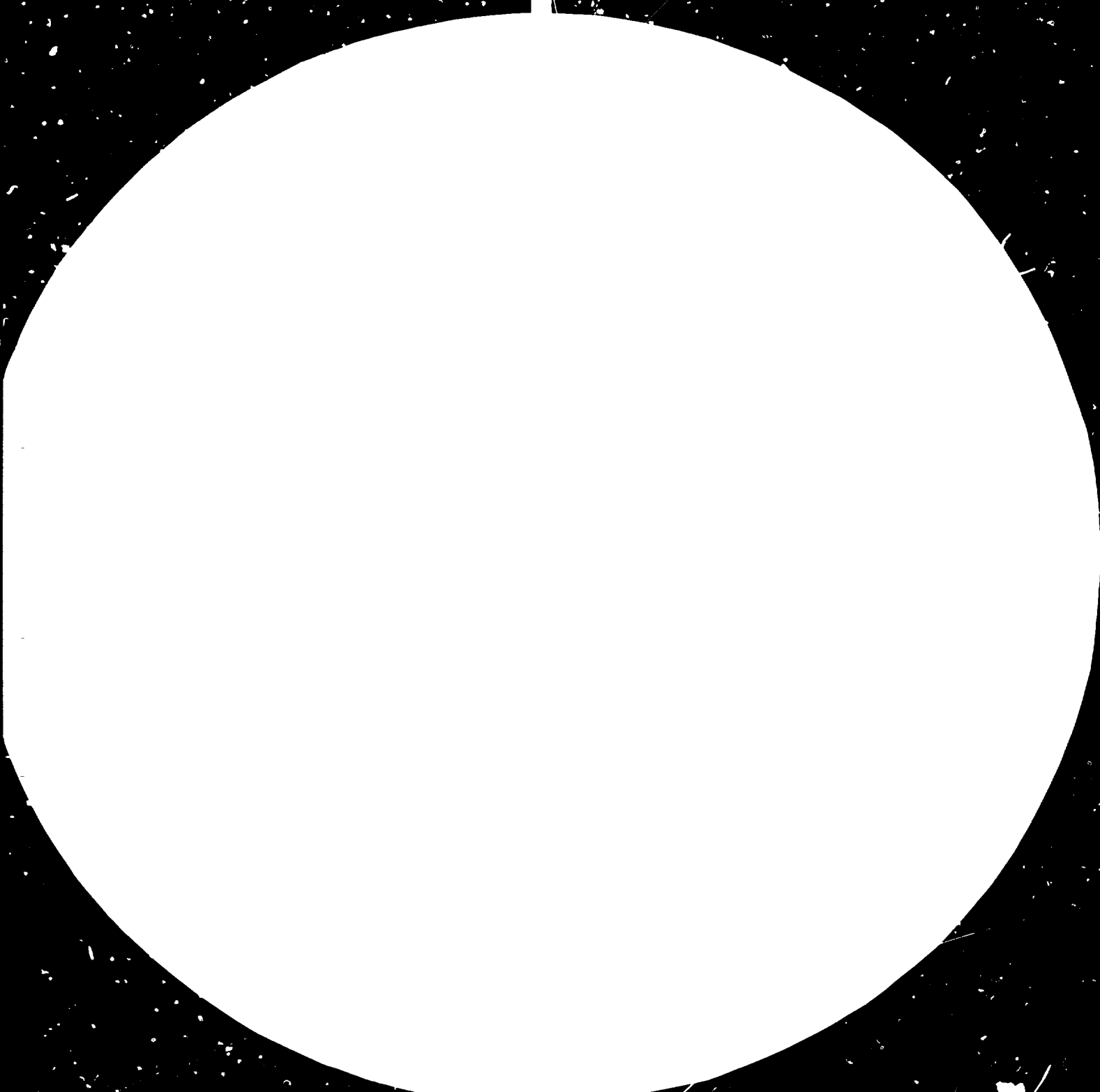
FAIR USE POLICY

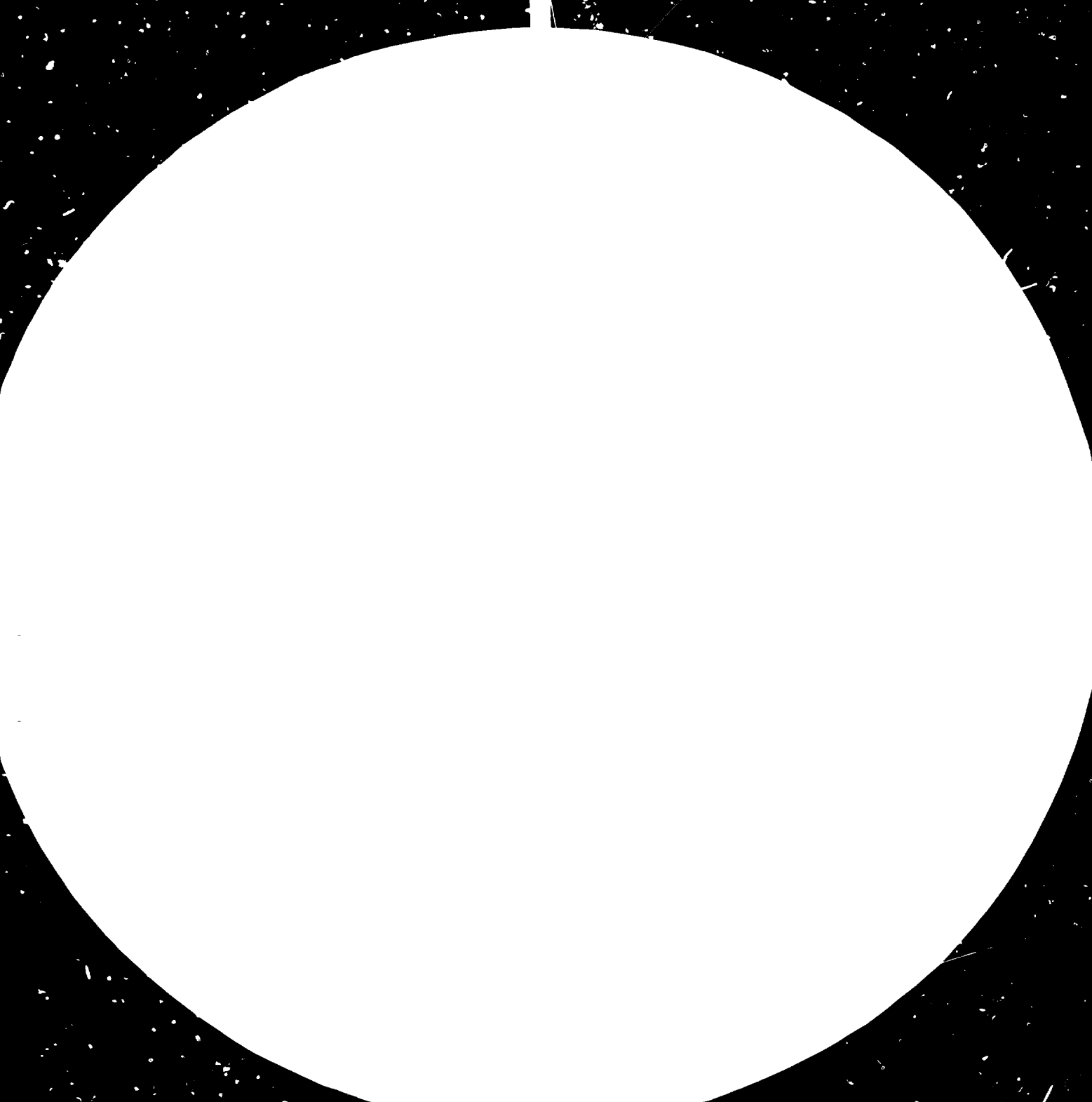
Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org







MICROCOPY REPRODUCTION TEST CHARTS

NATIONAL BUREAU OF STANDARDS - Gaithersburg, MD 20899



11076



Distr.
LIMITED

ID/WG.361/11
6 January 1982

ENGLISH

United Nations Industrial Development Organization

Workshop on the Regional Project for
Co-operative Research among Metallurgical
Research and Development Centres in
Asia and the Pacific

Jamshedpur, India, 7 - 11 December 1981

CONTRIBUTIONS OF THE PAKISTAN COUNCIL OF
SCIENTIFIC AND INDUSTRIAL RESEARCH FOR
MINERAL AND METAL INDUSTRY *

by

Asaf Ali Qureshi**

* The views expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. This document has been reproduced without formal editing.

** Chief Scientific Officer, Ore Processing and Metallurgy Division,
PCSIR Laboratories, Lahore, Pakistan.

V.82-20100

Basic metal industry shall see the light as and when the mineral resources reach the stage of exploitation. Continued efforts are put-in by the exploration agencies to find workable mineral deposits. Constant efforts, are being made by the PCSIR to extend scientific and technical services to the mineral sector in respect of minerals such as iron, graphite, chromite, phosphorite, copper, antimony, manganese etc. The Annexures will throw some light on the research activities of the Ore Processing and Metallurgy Division of the PCSIR Laboratories, Lahore. Based on the research findings of the PCSIR, some of the minerals such as phosphorite, chromite, graphite and copper ore are in the advance stages of utilization.

At present the Foundries and allied industries process the imported metals. The Foundries are capable of producing sound and heavy castings required for cement, sugar, Engineering industry, etc. However, with the emergence of Pakistan Steel Mills, the import of iron and steel will be considerably reduced. Besides, proposals on Mini Steel plant based on indigenous ores, are under active consideration of the Government.

The overall Research and Development activities of the PCSIR and the Government's desire point towards the establishment of metal industry in the country. Any suggestion or assistance from the UNIDO sources in order to strengthen the Research and Development activity will be appreciated. It is recognized that the UNIDO's role to help/guide the metal industry in Pakistan has been quite useful.

DEVELOPMENT OF PROCESS
FOR BENEFICIATION OF
MALAKAND GRAPHITE

BACKGROUND

Malakand Mines Limited, Peshawar approached the PCSIR Laboratories, Lahore in April, 1980 for the development of a beneficiation process for their low grade graphite ore deposits. These deposits are estimated at 10 to 12 million tonnes at an average grade of 16% carbon.

TERMS OF REFERENCE

1. Development of a flotation process for treating about 10 tonnes of ore per day.
2. Designing and commissioning of the plant.
3. Trial production of graphite concentrate containing 85% C.

R & D WORK

A comprehensive bench-scale study on the ore was carried out which includes crushing, grindability, mineralogical evaluation and flotation parameters. Based on the bench-scale findings, pilot plant tests were performed on 10 tonnes of ore supplied by the Agency. The clients supplied the concentrate produced on pilot plant to consumers. The market report was satisfactory. The flow-sheet of the process was passed on to the clients and all the unit operations were explained with minute detail.

PRESENT STATUS OF THE PROJECT

A flotation plant of 10 tonnes ore treatment capacity is being installed near Dargai. It will come in production in December, 1981.

BENEFICIATION OF
LOW GRADE CHROMITES OF
BALUCHISTAN & NWFP

BACKGROUND

Huge deposits of low grade chrome ore, (15-35%Cr₂O₃) occur in Zhob Valley, Baluchistan and in Malakand area of NWFP. These deposits, roughly estimated at 20 million tonnes, can not be exploited until some processing plant is put on mine sites to produce metallurgical or industrial grade chromite concentrate.

TERMS OF REFERENCE

1. Development of a beneficiation process for low grade chrome ores.
2. Designing fabrication and installation of pilot plant. Pilot plant testing and development of a process flow sheet.

R & D WORK

After the evaluation of the ore samples, bench-scale beneficiation tests on half a tonne of the ore and pilot plant tests on 20 tonnes of ore were carried out to develop a process flow sheet. The Cr₂O₃ content of ore has been upgraded from 15-35% to 46-48%.

PRESENT STATUS

1. A detailed report containing technical data has been written.
2. Preinvestment feasibility reports on plants treating 20 and 100 tonnes of ore per day have been prepared.
3. The Baluchistan Development Authority and Sarhad Development Authority are actively considering to set up concentration plants with the help of the PCSIR.

DEVELOPMENT OF METALLURGICAL GRADES OF
MAGNETITE, PYRITE AND CHALCOPYRITE FROM
SAINDAK COPPER ORE

BACKGROUND

Resource Development Corporation (RDC) approached PCSIR Laboratories, Lahore in December 1980 to carry out the title study on about 100 tonnes of Saindak Copper Ore.

TERMS OF REFERENCE

1. Development of about 2 tonnes of pyrite concentrate of particle size 80-90 % -325 mesh and containing about 0.5% SiO₂, 0.3% Cu and 45% Fe.
2. Development of about 1 tonne of magnetite concentrate containing over 65% Fe and less than 5% SiO₂.
3. Recovery of chalcopryrite and molybdenite from the bulk ore samples.

THE ORE DEPOSIT

The ore deposit at Saindak comprise of three ore bodies, North, East and South occuring close to one another. The total estimated ore reserves are reported at 350 million tonnes. The ore is essentially a low grade porphry type containing about 0.5% Cu with minor amounts of molybdenum, gold and silver values. The recoverable by-products are pyrite and magnetite.

PRESENT STATUS OF THE PROJECT

About seventy tonnes of the ore has been processed. Various products recovered from the ore fall within the specified metallurgical limits. The overall recovery of chalcopryrite obtained was over 92%.

BENEFICIATION STUDIES ON
NOKKUNDI IRON ORE

BACKGROUND

In September 1980 Pakistan Industrial Development Corporation (PIDC) entrusted the Ore Processing and Metallurgy Division, PCSIR Laboratories, Lahore to carry out beneficiation studies on iron ores from Chigendik and Pachinkoh deposits of Nokkundi District. The PIDC in its exploratory drilling work had proven over 20 million tonnes of iron ore of magnetite type containing 45-52% Fe. The probable reserves in the area were estimated at 100 million tonnes.

TERMS OF REFERENCE

1. The PCSIR Laboratories will perform physical , chemical and mineralogical studies on the iron ore samples from Chigendik & Pachinkoh.
2. Beneficiation tests will be carried out on the bench-scale and process flow-sheet will be developed.

PRESENT STATUS OF THE PROJECT

The R & D work on the project as described in the term of reference has been completed. About 300 kg of magnetite concentrate was developed and supplied to PIDC for further tests in the U.S.A. A process flow-sheet for the beneficiation of the ore to obtain a product containing over 67% Fe and less than 3% SiO₂ has been finalized.

BENEFICIATION & UTILIZATION OF
INDIGENOUS LOW-GRADE IRON ORES

BACKGROUND

The largest iron ore deposit in Pakistan occur at Kalabagh. The reserves are estimated at over 300 million tonnes. Containing about 32% Fe and 22% SiO₂. The iron ore minerals are siderite and goethite. The gangue minerals are chamosite, glauconite. The recoverable iron in the ore is about 60%.

TERMS OF REFERENCE

1. Evaluation of physical, chemical and geo-chemical characteristics of Kalabagh iron ores.
2. Beneficiation study of the ore with a view to determine the ultimate possibility for its utilization in the manufacture of iron.
3. Development of a pilot-plant for the beneficiation of low-grade iron ores.

PRESENT STATUS OF THE PROJECT

Studies on the evaluation and beneficiation have been completed on bench-scale. The process involved flotation of siderite and goethite minerals using fatty acid, collectors. The concentrate is subjected to high intensity magnetic separation. The cleaner concentrate was pelletized and indurated. The pellets assayed 56% Fe, 6.8% SiO₂, 2.6% CaO and 0.1% P. The iron recovery corresponded to over 85% of the recoverable iron. A pilot plant with rated capacity of 3-5 t/d has been designed, fabricated and installed by these laboratories.

RECOVERY OF IRON, ALUMINA AND
TITANIUM DIOXIDE FROM
ZIARAT LATERITE

BACKGROUND

Laterite deposit occurring at Ziarat (Baluchistan) area is a complex material containing 25-32% Fe, 18-31% Al_2O_3 and 2-6% TiO_2 . The principal mineral constituents identified in the ore were hematite, goethite, boehmite and anatase. The ore reserves were conservatively estimated at 15 million tonnes.

TERMS OF REFERENCE

1. To determine physical, chemical and mineralogical characteristics of the ore.
2. To study technical feasibility of extraction of iron, alumina and titanium dioxide from Ziarat Laterite on bench scale for possible pilot plant studies in future.

PRESENT STATUS OF THE PROJECT

The physical work on the project was completed in October, 1980. The process studies at PCSIR Labs., Lahore involved bench scale study on 1-50 kg batches of the charge subjected to reductive sintering followed by magnetic separation, leaching and precipitation of the constituents. The study proved that about 96% iron, and over 90% alumina and titana were recovered on bench scale and sub-pilot plant scale.

