

Proceedings of the Symposium on
"Mineral Resources of Sri Lanka
and its Developments"



HELD ON
28th AND 29th MAY 1984
AT THE
UNIVERSITY OF MORATUWA

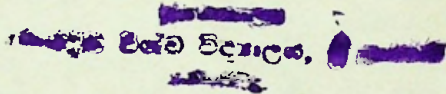
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DEPARTMENT OF MINING AND MINERAL ENGINEERING
UNIVERSITY OF MORATUWA
MORATUWA, SRI LANKA

SYMPOSIUM ON
MINERAL RESOURCES OF SRI LANKA
AND
ITS DEVELOPMENTS



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UNIVERSITY OF MORATUWA

28 — 29th May 1984

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PREFACE

This symposium was organised by the Dept. of Mining and Mineral Engineering, University of Moratuwa, with a view to introduce to the personnel engaged in the fields of Geology, Gemmology, Mining and Mineral processing, some of the recent developments and trends in their respective fields of interest.

The above department was established in 1972 under the Leeds/Katubedda link scheme and since then the department has been conducting undergraduate courses in mining and mineral processing together with part-time courses in Gemmology and Geology at Diploma level. Also it has embarked on a post graduate research programme mainly working on problems related to mineral processing industry in Sri Lanka, by its highly qualified staff.

It is anticipated that this symposium would enhance the liaison between the people engaged in the minerals industry in Sri Lanka and the active researchers in the department, to develop the mineral industry in Sri Lanka.

Dr. W. L. W. Fernando
Head, Dept. of Mining & Mineral Engineering,
University of Moratuwa.

SYMPOSIUM ON MINERAL RESOURCES OF SRI LANKA
AND ITS DEVELOPMENTS

UNIVERSITY OF MORATUWA

PROGRAMME

MONDAY — 28th May 1984

Inaugural Session (09-00 — 09-35 hrs)

- 09-00 Welcome Address
by Professor WILLIE MENDIS,
Vice Chancellor, University of Moratuwa.
- 09-10 Keynote Address — Some Aspects of Mineral Resources with Special
Reference to Sri Lanka
by the Chief Guest Mr. L. K. SENEVIRATNE,
Director, Geological Survey Department.
- 09-30 Vote of Thanks
by Dr. W. L. W. FERNANDO,
Head, Dept. of Mining & Mineral Engineering, University of Moratuwa.

TEA

Technical Session 1 (10-15 — 12-00 hrs)

- Chairman:
Dr. W. L. W. FERNANDO,
Head, Dept. of Mining & Mineral Engineering, University of Moratuwa.
- 10-15 Remote Sensing and its applications for Resources Development
by Mr. S. D. F. C. NANAYAKKARA,
Surveyor General, Survey Dept., Colombo.
- 10-45 Mineral Resources Assessment & long term supply of Minerals
by Mr. D. E. de S. JAYAWARDENA,
Deputy Director, Geological Survey Dept., Colombo.

11-15 Improvement of Brightness of Sri Lankan China Clay
by Dr. P. G. R. DHARMARATNE,
University of Moratuwa.

Technical Session 2 (13-30 — 15-00 hrs)

Chairman:

Mr. C. P. J. SENARATNE,
University of Moratuwa.

13-30 The Present Trends in the Gem Industry
by Mr. LALITH HETTIARACHCHI,
General Manager, State Gem Corporation, Galle Face, Colombo 03.

14-00 An Assessment of Aluminosilicate Refractories from in-situ Deposits
by Dr. W. L. W. FERNANDO,
University of Moratuwa.

14-30 Processing of Gem Minerals
by Mr. SYDNEY JAYASINGHE,
State Gem Corporation.

TEA

15-15 Mining of Graphite in Sri Lanka,
by Mr. N. GREGORY,
State Mining & Mineral Development Corporation.

15-45 Surveying for Marine Minerals
Mr. N. WIJESINGHE,
N. A. R. A.

16-00 Video Film on "Seismic Prospecting"

TUESDAY — 29th May 1984

Technical Session 1 (09-00 — 12-00 hrs)

Chairman:

Mr. P. D. PALLEWATTA,
University of Moratuwa.

09-00 Mathematical Modelling of Mineral Processing Operations
by Dr. G. K. N. S. SUBASINGHE,
University of Moratuwa.

09-30 A Study of Pinched Sluice Concentrators
by Mr. B. JEYADEVAN,
C. I. S. I. R.

- 10-15 Computers in the Mining Industry
by Mr. C. P. J. SENARATNE,
University of Moratuwa.
- 10-45 Radioactive Minerals in Sri Lanka and its Detection
by Dr. GRANVILLE DHARMAWARDENA,
University of Colombo.
- 11-15 Ceramic Industry in Sri Lanka and its Developments
by Mr. A. S. de SILVA,
General Manager, Ceylon Ceramics Corporation.

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Technical Session 2 (13-30 — 15-45 hrs)

Chairperson : Mrs. M. P. J. JAYAWARDENA.
University of Moratuwa.

- 13-30 Upgrading of Sri Lankan Ilmenite
by Dr. M. G. M. U. ISMAIL,
C. I. S. I. R.
- 14-00 The Effect of Feed Concentration on the Performance of Hydrocyclones
by Mr. B. S. MARASINGHE,
University of Moratuwa.

TEA

- 14-45 The Growth of the Mining Industry in Sri Lanka. Historical & Future Trends
by Mr. D. SENEVIRATNE,
formerly at State Mining & Mineral Development Corporation.
- 15-15 The Gem Industry and its Improvements
by Mr. DIXON PERERA,
University of Moratuwa.

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*At Inaugural Sessions of The Symposium
on Mineral Resources and
Its Developments in Sri Lanka*

by

PROF. WILLIE MENDIS
Vice Chancellor

It is indeed most apt that this University should host a Seminar of this importance at a time when the nation is striving to identify and utilise its natural resources for development. Being the only University in Sri Lanka with facilities and expertise to train and undertake research in mining and mineral engineering, it is therefore most appropriate and timely that Dr. W. L. W. Fernando and his energetic staff have organized this Seminar. They must be complimented for this effort.

This University has taken serious care to develop itself as a knowledge centre in the several disciplines within its two faculties. Accordingly, it promotes and encourages gatherings of this type to harness the wide spectrum of knowledge being developed within and outside it. It believes that it is an effective mode of enhancing knowledge and sharing same with the community - particularly with the related industrial sector. The University considered this also as a means of refreshing its own part of knowledge and of chartering new actions in policy. Above all, it hopes that this will serve to show the community the importance of a University as a reference point whenever knowledge, whether by opinion or by consultancy, is sought by any of its disciplines.

The subject of this seminar is a gateway to a key factor of production in our country's thrust towards economic development. Sri Lanka's Industrial Policy has thus clearly stated that "research and development work on the country's natural resources is being given priority consideration." It has further stated that one of its objectives is to "make maximum use of indigenous raw materials and other natural resources."

Against this policy background, the govt. has begun to promote the development of mining and mineral resources. Thus it actively seeks to establish joint ventures in the industrial exploitations of several minerals. Presently, only a small proportion of these have been exploited due to lack of technology, capital and export markets. Their potential is however enormous.

This situation clearly points the urgency to promote the training of personnel in the mining and mineral resources sector. Its technologies can be developed and harnessed only through locally initiated research and training. Hence the University becomes a vital focal point in such an exercise.

I wish to invite Industry, including the state industrial corporations and Agencies, and also private entrepreneurs to collaborate with the University for mutual benefit.

Some Aspects of Mineral Resources with Special Reference to Sri Lanka

by

Mr. L. K. SENEVIRATNA,
Director, Geological Survey Dept.

Man's history on earth can be traced back nearly to a million years or so ago from the evidence that surfaced from examinations of the earth's superficial material. Much of the evidence that pointed to the sites of prehistoric man and his activities came from the findings of the rocks and minerals he used. Some of these he had used in their natural form and some as artifacts. Their use and modification was a measure of the early man's ingenuity in using his environment to his advantage. As he developed through geological time his brain capacity also grew and with it his mental and physical abilities. By the time known civilizations appeared they had a vast knowledge accumulated through the ages as part of their heritage. Through civilization we see that the knowledge of minerals and their development had been clearly linked in the history of mankind and had played a decisive role in his prosperity and advancement. This is attributable to the peculiar inquisitiveness man had of his environment and his insatiable thirst for knowledge. Partly this development had been for self preservation or the preservation of the species and partly to the desire to control his immediate and remote environment. These advancements and turning points in history from the days of the paleolithic man of the stone age can be divided into what has been recognised as the metallic ages of copper, bronze and iron. This indicates how closely the advancement in metallurgy had been connected with the rise and fall of various civilizations. It is also quite clear that the early man attached values to various minerals for their practical and aesthetic use. For example, the early man used ochres for communication and expression of ideas in prehistoric 'paintings' in walls of caves they inhabited. Skills and knowledge thus acquired through ages passed down the centuries to the civilized world which came to possess very advanced knowledge of the properties and uses of minerals and rocks. This is evident from all archaeological sites. To cite an example from our own country the detailed description given in Thupawansa about the material and the technology in the construction of the Great Thupa—Ruwanweli indicates the knowledge that the ancients possessed regarding the engineering properties of the materials used in such marvels of constructional and engineering feats. Some of the skills and knowledge died with time due to disuse of the art; or due to non transference or the destruction of the knowledgeable. Thus

we have lost quite recently the art of making high grade steel from low grade iron which was famous as far as Damascus in Biblical times and the cutting and polishing of almost precision lenses from rock crystal. The latter was practised till quite recently by the last local craftsman at Kiriwaula near Gadaladeniya in the Kandy District. An account of the steel making process as employed by the local craftsman is given by Dr. Ananda K. Coomaraswamy in his administration report of the Department of Mineralogy which was the first state survey set up for mineralogical research in the island. These systematic surveys which started in 1903 under Coomaraswamy gave a great impetus to the Mineral Survey of Sri Lanka. But the period he served the survey was too short to draw the full benefits from him as he swung from natural sciences to the fine arts where he excelled even further. However during his short span of time a mineral inventory of all the then known minerals were compiled containing all the new mineral discoveries made by him whilst hinting at other possibilities in mineral research such as those of nuclear raw minerals. The present survey is the continuation of the then Mineralogy Department which was renamed the Geological Survey in 1958 and continues its functions in the search for minerals on a very much broader base. It is due to the results of the painstaking hard work carried out by the pioneers and successors of the survey in the search for Industrial raw material that the present day mineral based industries of Sri Lanka stand. As these industries continue and expand with the concurrent depletion of raw material resources, new resources have to be discovered, explored, assessed and evaluated. Dwindling reserves and urgent needs and changing trends dictate the patterns and priorities in mineral development. It has sometimes been found that abandoned deposits or new minerals assume sudden importance due to various reasons such as newer uses being found for them or because of improved techniques of extraction have been developed so that low grades become economical prospects. It is of prime importance for a country to have its own mineral inventory and a sound geodata base not only for resource hunting but also for other purposes as well. As with most natural resources mineral resources are of irreplaceable and non renewable nature. Therefore conservation, management and proper utilization has to be given serious thought in planning. Another important aspect in their utilization is the disposal of the wastes originating in processing minerals. No less than in the case of disposal of nuclear waste is the aspect of pollution which has assumed serious proportions and has become a major problem to man and the biosphere. The impact of mining and mineral industry on the environment is therefore a major problem of the Holocene.

Minerals however as we know are locked up in the rocks. Both rocks and minerals have an origin or genesis. They have their own controls and moreover have a time order. Geologically time ordering of events is an important aspect in correlation and in the search for minerals. They require the combined effort of many specialists of geoscience and geochronologists. As we have to start with the rocks in the search for mineral resources, it is natural to categorise rocks in their time sequence. The oldest rocks that are known are the Archaeans in the Precambrian time sequence. The Precambrian time span itself constitutes nearly 85% of the geological history. The rock sequences of the period has been dated back from about

2,500 million years to nearly 400 million years from present. During this long span of time these rocks have been subjected to varied degrees of changes and or of metamorphisms and to tectonic activity bringing about various changes in mineral composition and structure. Because of the absence of fossils and the difficulty in ordering of events in this sequence the search for minerals in this highly complicated terrain is extremely difficult and necessitates the use of adequate and varied exploratory methods. All the same the Precambrian is the host of the largest and richest deposits of metals like Au, U, Ni, Cr, etc. and most other minerals and in some places even of natural oil. But to eke out the information pointing to these resources needs specialist studies in geochemistry, mineralogy, petrology, structural geology etc. As all except the north western coastal limestone belt and the Jaffna Peninsular area of the Island is underlain by the Archaean or Precambrian rock and should have a great mineral potential in comparison with other similar terrains. In the Precambrian of Sri Lanka the two rock groups have been identified: one largely composing the central highlands with extensions diagonally across the country in the directions S. W. and N. E. and is composed of highly metamorphosed sediments known as the Highland Series. The other group is known as the Vijayans which lie outside and bordering it on the east and west. Although the existence of a western Vijayan is doubted by some all recognise the eastern Vijayan and the existence of a major boundary zone between it and the Highland Series. This major boundary extends roughly from the Trincomalee southwards slightly east of the Mahaweli turning round Bibile separating the highlands from the lowland turns westwards round the southern border of the hill country and runs southwards through Timbolketiya area towards Hambantota. This belt has now been recognized as a major mineralised belt having much promise for the future as it is suspected to be a base mineralized zone with a hint of the possible occurrence of gold amidst the ultra basics of the zone. Because of this recognition the Geological Survey has embarked on detailed integrated survey along this belt and is hopeful of finding further clues to possible mineralizations in order to target possible prospects for further and more detailed exploratory work.

At present the main mineral industry developed from resources of the Archaean terrain of Sri Lanka is graphite which is well known and famous for its quality the world over. Apart from this one and only deep mined mineral at present the other main minerals obtained are from Pegmatitic rocks of this terrain are mainly Quartz and Feldspar (which support the country's Ceramic Industry) and Mica. The development of the mica industry increased in the recent years mainly as an export orientated industry. Lesser known export oriented mineral industries that draw from the Archaean resources are those of decorative stone, the construction material and Dolomitic limestone. Because of the increasing demand in the export oriented mineral industry of various minerals a policy decision appear inevitable in the near future as regards the export of raw minerals used in local industry and with regard to export of unprocessed minerals.

After the Precambrian in the geological column of Sri Lanka there appears a big time gap till the Jurassic times represented by the shale and grit sequences of Thabbowa, Andigama and Pallama areas in the Puttalam District. These beds apart from their stratigraphical importance and interest appear to bear commercial grades of refractory clays. This area has also been identified as a target area in the search for nuclear raw material (as an alternative energy source) in the Surveys programme to which has been given much thought and time. It would be relevant and interesting to point out that some of the anomalies detected from the geo-chemical survey also appear to have a close relationship with some of the circular features detected from satellite pictures and is to be pursued in Remote Sensing studies.

After the Jurrasics the next time sequence shown in the geological column of Sri Lanka is the Miocene period represented by the fossiliferous limestone of the north western coastal belt extending from Puttalam on the west coast to Mullativu in the north east and includes the Jaffna Peninsular area. It is interesting to note that in the forestry study conducted by the Remote Sensing Centre of the Survey General's Department a very close correlation is seen between the remote sensing interpreted forest boundary and the boundary between the miocene and Precambrian in this area. The miocene of the Puttalam and Jaffna areas provide grade limestone raw material for the local Cement Industry. The Quaternary deposits form the last and the youngest group in the column. These formations are represented by the laterite in those parts of the Island specially along the south western coastal belt. The older and younger series of Pleistocene gravels, coastal sandstone and inland coral deposits the accumulations of clays and sand in the marshes, lakes, lagoons, estuaries, deltaic areas and the alluvium of the flood plains of rivers respectively.

The world over however the Quaternary had been a marked period of instability in the climate of the earth coupled with changes of sea level and recent tectonic movements. The Quaternary is also interesting and demands serious attention in many other respects as well. Its land forms and surfaces had been and is the home of man both in the past and present respectively. The study of events that had taken place in the Quaternary are of great importance to coastal areas specially in predicting future sea level fluctuations. In this respect it may be pointed out at this juncture that one of the major sea surface depressions detectable from remotely sensed data is that of the south coast of Sri Lanka. The possible behaviour of this is likely to affect all development work along this coast, and therefore should receive greater attention. However, in the present context it is its mineral potential both on an off shore that is of immediate concern. Finally it may be pointed out that it is in this relatively young cover the some very important minerals accumulate such as gold, heavy mineral sands, diamonds, precious and semi-precious stones, the varied clays, sands and gravel that are of considerable economic importance. The search for mineral concentrations in the Quaternary should receive greater attention both in the terrestrial and marine environment.

It is seen that whilst some of the minerals are easily detectable others require different and often sophisticated methods, to detect them. Amongst the new techniques now being widely used and recognised is Remote Sensing. Its varied applications have been found useful in identifying and in targeting areas for further detailed investigation. Often these applications use a multidisciplinary approach and often use computer techniques. In the search for minerals which precedes their development therefore a wide variety of methods and techniques are used. Finally, however, for effective geological research, it has to depend on adequate techniques and methods available and the use of standards in terminology and methodology is necessary to achieve results that are predictable, reliable and comparable with work done elsewhere.

Only in this way and through international cooperation can we hope to contribute worthwhile knowledge which is ultimately directed for a better socioeconomic order and a more peaceful and better life on earth.

Vote of Thanks

by

Dr. W. L. W. FERNANDO

Head, Department of Mining & Mineral Engineering

Vice-Chancellor, Professor Willie Mendis, Chief Guest, Mr. L. K. Senviratne, Director, Geological Survey Department, Dr. C. L. K. Tennekoon, Dean, Faculty of Engineering, Distinguished Guests, Ladies & Gentlemen.

It indeed is a great pleasure for me to see all of you, who are present in this morning, in spite of this unfavourable weather, to take part in the symposium Mineral Resources in Sri Lanka and its development. If not for the continuous support given to us by the Vice Chancellor, Professor Willie Mendis, we would not have organised this seminar. His aim is to make this University, a centre of excellence in Engineering, Computer Technology, Robotics and Satellite Communication. We wish him success in all his deliberations and efforts.

I am thankful to the chief guest Mr. L. K. Senviratne, Director, Geological Survey Department for accepting my invitation at a very short notice and for being here with us to grace this occasion. I am very happy indeed that a number of organisations concerned with the mineral resources of this country are represented here. Very special thanks are due to all those distinguished speakers from Surveyor General's Department, Geological Survey Department, State Gem Corporation, Ceylon Ceramics Corporation, State Mining & Mineral Development Corporation, National Aquatic Resources Agency, Sri Lanka Atomic Energy Authority, Ceylon Institute of Scientific & Industrial Research and the University of Moratuwa. I am glad to say that all the speakers who are present here today accepted our invitation without any hesitation.

My special thanks go to all the donors who contributed very generously towards the cost of this symposium and specially to M. I. M. Naleem Hadjiar.

The staff of the printer's department, and the computer studies in this University helped us very willingly in the preparation and printing of the abstract of the proceedings and I must thank them for all their help.

Also, I must thank the staff of various departments within the University who helped us in many ways, above all the staff of the Department of Mining & Mineral Engineering for their dedication and hard work during last few weeks to make this symposium a success.

Finally, I thank the staff of Sri Lanka Broadcasting Corporation, Rupavahini and the News paper media for accepting our invitation to be present here with us today.

Thank You.