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INTERNATIONAL URANIUM RESOURCES EVALUATION PROJECT

I U R E P

NATIONAL FAVOURABILITY STUDIES

BURMA

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C O N T E N T S

A. INTRODUCTION AND GENERAL GEOGRAPHY

The Socialist Republic of the Union of Burma lies in the uppermost region of South-East Asia, between the Tibetan Plateau and the Malayan peninsula. Its principal neighbours are India to the north-west, China to the north-east and Thailand to the south-east. It has an area of 676,555 square kilometers and a population of 30 million.

Burma forms part of the great monsoon region of Asia, but its climate is profoundly modified by the relief of the country. There are three seasons: the cool season, which is also rainless (October - February), the hot rainless season (March - May) and the rainy season from (June to October). The average temperature is 27°C.

The chief artery of traffic is the river Irrawaddy, which is navigable as far as Bhamo, 1450 kilometers inland. A 770 road called Ledo road, twisting through mountains, swamps and jungles connects Burma with Ledo in India. The total length of all-weather motorable roads in Burma was over 21,740 kilometers in 1974. Railway kilometrage in 1974 totalled 3,136 km.

B. GELLOGY OF BURMA IN RELATION TO POTENTIALLY FAVOURABLE URANIUM BEARING AREAS

Burma falls naturally into three great geomorphological units: (1) The Arakan Yoma, a great series of fold ranges of Alpine age, forms the barrier between Burma and India; (2) The Shan (Plateau) massif occupying the whole of the east of the country and extending southward into Tenasserim. It forms part of what has been called the do-Malayan mountain system and has existed as a geomorphological unit since close of the Mesozoic; (3) The central basin lies between the Arakan Yoma and the Shan plateau.

The mountain range of the Arakan Yoma and its continental northward has a core of old crystalline rocks. On either side are hard, tightly folded sedimentary rocks, mainly Tertiary in age. Rocks of Jurassic and Cretaceous age are also known to occur, but the geology of the ranges is still very imperfectly known.

Extensive strike faulting occurs along the eastern flanks of the Arakan Yoma and large serpentine intrusions, probably of Cretaceous age, are associated with the faults.

The western edge of the Shan plateau massif is well marked both physically and geologically. It rises abruptly from the valley and for 640 or 800 kilometers, the edge is formed by a long strip of granitic or gneissic rocks.

The predominant rocks in the Shan Plateau are gneisses which yield the rubies and other gems for which Burma has long been famous, and massive limestone of Devonian-Carboniferous age. Rocks of all ages from Precambrian to Jurassic occur in the massif, while deposits of Late Tertiary and Pleistocene age occupy old lava basins.

At Bewdwin, associated with a croup of ancient volcanic rocks, are very extensive deposits of silver-lead ore, mainly argentiferous galena, which are worked and smelted at the nearby works of Namtu.

Geologically this portion of the Indo-Malayan mountains consists of large granitic intrusions, elongated in the north-south direction and intruded into a series of ancient rocks of unknown age. The basin of the Irrawaddy, between the Arakam Yoma and the Shan Plateau consists almost entirely of Tertiary rocks. The beds are remarkably for their enormous thickness. The Eocene beds are more than 4,500 m., thick, the Oligocene - Miocene more than 5,000 m. This Tertiary basin has been separated into a broader western basin and a narrower eastern one by the complex folded range forming the Pery Yoma.

C. PAST EXPLORATION

A lot of work has already been done as regards prospecting for and production for raw materials. However, there is no information on production of nuclear raw materials in Burma, although there are some uranium occurrences.

Hunting Geophysics Ltd has done some areial prospecting work in the area of Victoria Point in Southern Burma. All the data collected has been plotted on several maps and issued to various Burmese organizations with a complete report. The follow-up ground exploration was done by a prospecting party headed by Dr Gjelsvik. The Hunting Geophysics' and Dr Gjelsvik reports are not available in the IAEA.

The Raw Materials Divsiion in the Union of Burma Atomic Energy Center commenced operations in 1955. The area of Mogok was selected by U Soo Win, the head of the Division, as most favourable for uranium exploration. The region is mountainous, with heavy forest cover. A ground gamma-ray survey was carried out in Mogok Mineral Belt by two geologists accompanied by two assistants, at a spacing of one km. This work showed monazite in all streams over an area of about 150 sq km and has given a detailed studies led to the discovery of some uraninite and pitchblend in the overburden of an old lode.

Based on these first discoveries the Government of Burma requested assistance from the IAEA and an expert was sent there for a period of one year. His field work was mainly limited in the Mogok Mineral Belt, however some reconnaissance field trips were made in other parts of the country. Dr D L Searle concluded that the Mogok area represents a zone of high temperature mineralization but a lower temperature form of uranium mineralization may have developed along the outer edges of the principal high grade zone. He recommended that the area between the Mogok scarp and the Shweli River be systematically traversed.

A mineralogical study was carried out by Dr F J Eckhardt, an IAEA expert, from June 1964 to August 1965. Unfortunately, his work was limited in training the local staff and organization of a laboratory for X-ray diffraction and X-ray flourencence analysis.

D. URANIUM OCCURRENCES AND RESOURCES

Uranium bearing minerals have been recorded from many locations in Burma, as follows:

(a) Monazite bearing baach sands near Amherst, Tenasserim.
(b) Monazite placers from near Momeik, Northern Shan States.
(c) Uraninte crystals from the gem-gravels around Mogok.
(d) A radioactive anomaly in syenite at Kyatpyin, near Mogok.
(e) Radioactive iron ore at Pangpet, near Taunggyi, Southern Shan States.
(f) Radioactive fossil wood from Central Burma.

Mogok Mineral Belt

It occupies the eastern part of Shan massif and is built up by igneous rocks - granites and syenites intruded in metamophic rocks with amphibolite facies. The Belt is bounded to the North by east trending Fault and to the South by a zone of tourmaline migmatization.

The occurrences of uranium are closely associated with the distribution of alaskite granite and syenitic rocks. But some radioactivity has been recorded from the Singu area where there is no sign of alaskite or syenite rocks. It is believed that the alaskites are gnetically related to the syenites. They consist of quartz and a micropertitic feldspar and in some places grade imperceptibly into a syenite consisting of various proportions of hornblende, a pale green pyroxene, plagioclase, microperthitic orthoclase, and accessory sphene, zircon, calcite and apatite. The alaskite is responsible for the migmatization of broad zone to the south of Mogok.

The uranium in the Mogok Belt is concentrated in the acid portion of the syenite suite, namely in the alaskite and nordmarkite rocks. It is believed that uraninite is the main uranium mineral in these occurrences. It is enriched in thorium and it could be supposed that thorianite is also available Monazite has not been recorded from the Mogok area, but has been found to the north to Momeik and in the washed gravels of the UginTaung Sapphire area. However, chemical analyses for total uranium oxide indicate that the alaskite contains very little uranium, namely: 0.0015 - 0.0055% U_3O_8.

The radioactive iron ore deposit at Pangpet, Southern Shan States

This deposit is located 11 km by road to the east of Tannggyi. During the visit of the IAEA expert in 1960 the deposit was explored in detail by the Mining Company and was still in development.

The radioactivity is confined to the limonitic zones, the hematite showing generally being round counts or slightly above. Not all limonite is radioactive, and only a small area contains ore of a grade greater than 0.2% U_3O_8. The majority of ore giving a ratemeter reading of 3 times background assays around 0.03% U_3O_8. There is no sign of a structural control for the mineralization. It is believed that the iron deposit is a replacement ore and that some uranium was involved in its formation. Leaching and weathering processes seemingly have concentrated uranium in the limonitic zones.

The results of several chemical and radiometric assays of radioactive limonite ore are given in the table below:

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	0.05	0.035
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E. PRESENT STATUS OF EXPLORATION

No information is available in the IAEA.

F. POTENTIAL FOR NEW DISCOVERIES

From structural point of view the most favourable geological environments for new discoveries are those in the Central Basin, or as it is named Irrawaddy Basin and Shan Plateau massif.

Sedimentary rocks of enormous thickness were formed in the intramountain Irrawaddy Basin during the Tertiary Period. There is no information about the facies of the sediments but it could be supposed that most of these strata were deposited either in fans or rivers and have features of fluvial facies which is most favourable for uranium concentration leached from surrounding granites and alaskite in Shan plateau massif. The radioactive fossil wood from Central Burma may be an indication for uranium favourability of this basin.

Associated volcanics? - source.

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The Sepculative Potential could be about 10,000 tonnes uranium

I find it difficult to comment on the potential here (Group 2 or 3?) on the strength of the geological data. A geological map would be useful.

Compiled by S Simov
October 1977
IAEA
Vienna

It may be worth noting here that I have just read the U.K. study and noted the Group 4 classification assigned (50,000 - 100,000 t U) to a country with a much smaller land area which has been extensively prospected and has no RAR ('Red book')

Laws relating to management?

BIBLIOGRAPHY

1. Encyclopedia Brittanica

2. IAEA Report of the Preliminary Assistance Mission to Burma, 1959

3. Prospecting for Radioactive Minerals, TA Report 20, 1961

4. Uranium Mineralogy, TA Report No 214, 1965.

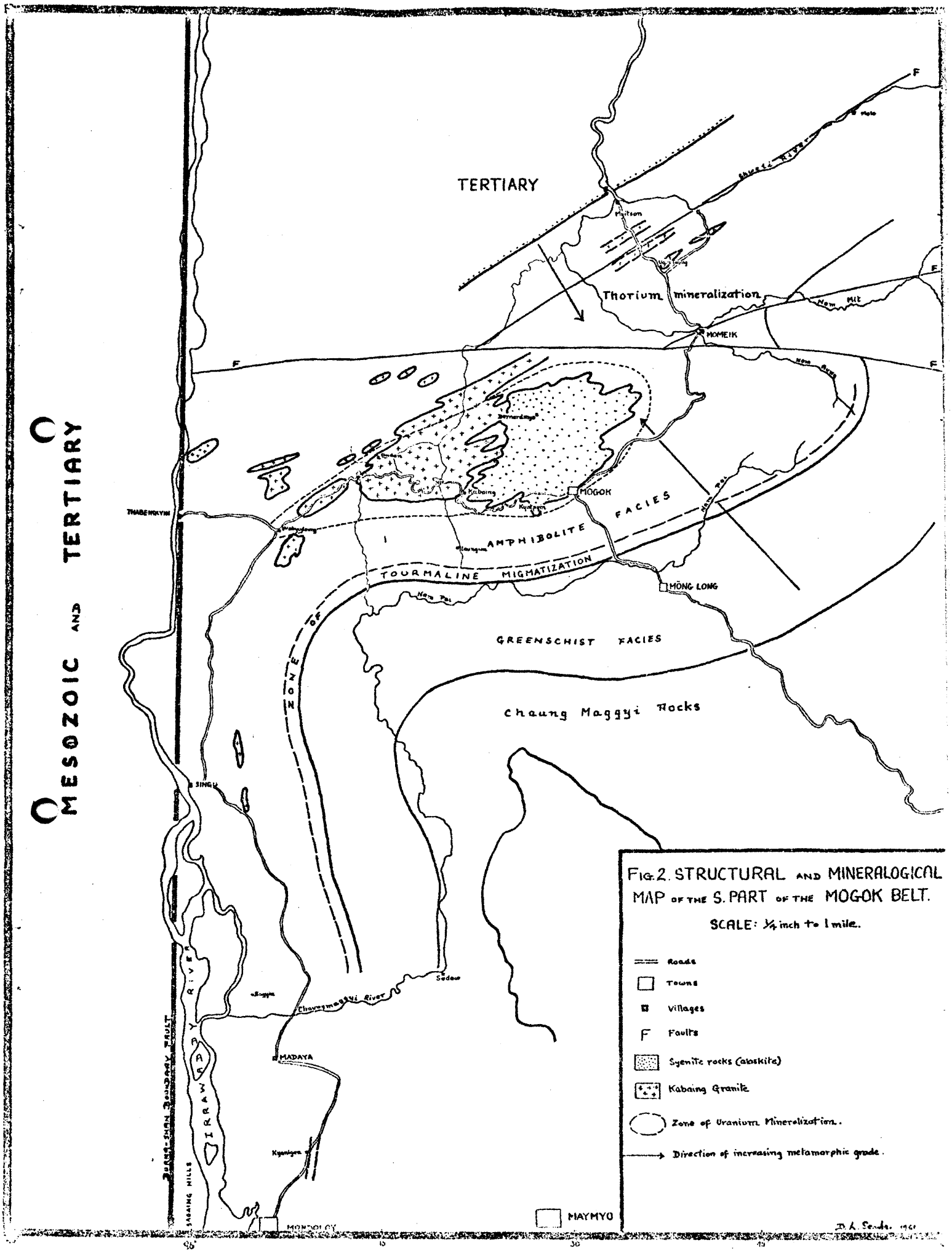

FIG. 2. STRUCTURAL AND MINERALOGICAL MAP OF THE S. PART OF THE MOGOK BELT.

SCALE: ¼ inch to 1 mile.

D. A. Saude. 1961

101- BURMA DOE

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