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GEOLOGIC NOTES

Occurrence of Scheelite at Batu Tiga, Bukit Besi, Trengganu, West Malaysia.

N.H. Chong, Department of Geology
University of Malaya

Batu Tiga is situated about 5 kilometres northwest of the Bukit Besi Iron Mine, Trengganu. At present the Batu Tiga area is being mined for cassiterite. The cassiterite, which is very fine grain, usually minus 300 mesh (B.S.S.) occurs in lenses scattered within the larger bodies of pyrrhotite and iron oxides.

Some samples of pyrrhotite collected from the Batu Tiga area were examined using a short-wave ultraviolet light. Scheelite, which fluoresces blue under the influence of short-wave ultraviolet light, was found to be present in some of the pyrrhotite samples. The writer believes that this is the first time that scheelite has been reported in the area (Bukit Besi-Batu Tiga area).

Detailed examination of the thin and polished sections of the ore revealed that scheelite occurs as fine-grained disseminations in pyrrhotite and chlorite. The apparent diameter of scheelite grains ranges from 0.02 mm to 1.00 mm. The larger grains are generally polygonal in shape (Fig. 1) and fractured. Pull-apart texture is common among the more elongated scheelite grains (Figs. 3 and 4). The presence of fractures and pull-apart texture in the scheelite grains suggests that the deposit has been under the influence of stress. This influence is further supported by the existence of 120° triple junctions in the pyrrhotite grains, indicating that the ore body was subjected to stresses of considerable magnitude after the deposition of the pyrrhotite (Stanton, 1964). Similar 120° triple junctions features have been observed in the Bukit Besi Iron Mine pyrrhotite (Hosking, et. al., 1969).

The fractures in the scheelite grains have been healed by pyrrhotite and chalcopyrite (Figs. 3 and 4). When pyrrhotite is subjected to stresses of significant magnitude, part of it may undergo plastic deformation and flow into the fractures present in the scheelite grains, and heal them. The chalcopyrite may have come from the chalcopyrite exsolution bodies present in the pyrrhotite. When the ore body is under the influence of stresses, some of these chalcopyrite exsolution bodies tend to migrate to the regions of low pressure, mainly the fractures in the scheelite grains, and settle there.

Fig. 1 Fractured hexagonal scheelite grain in pyrrhotite.

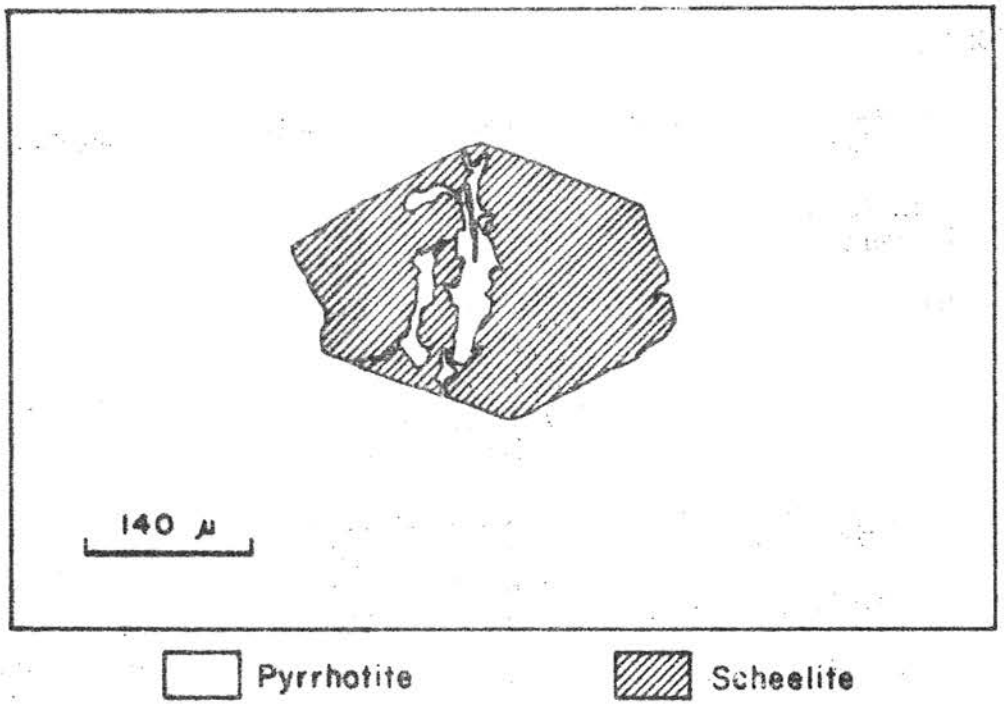
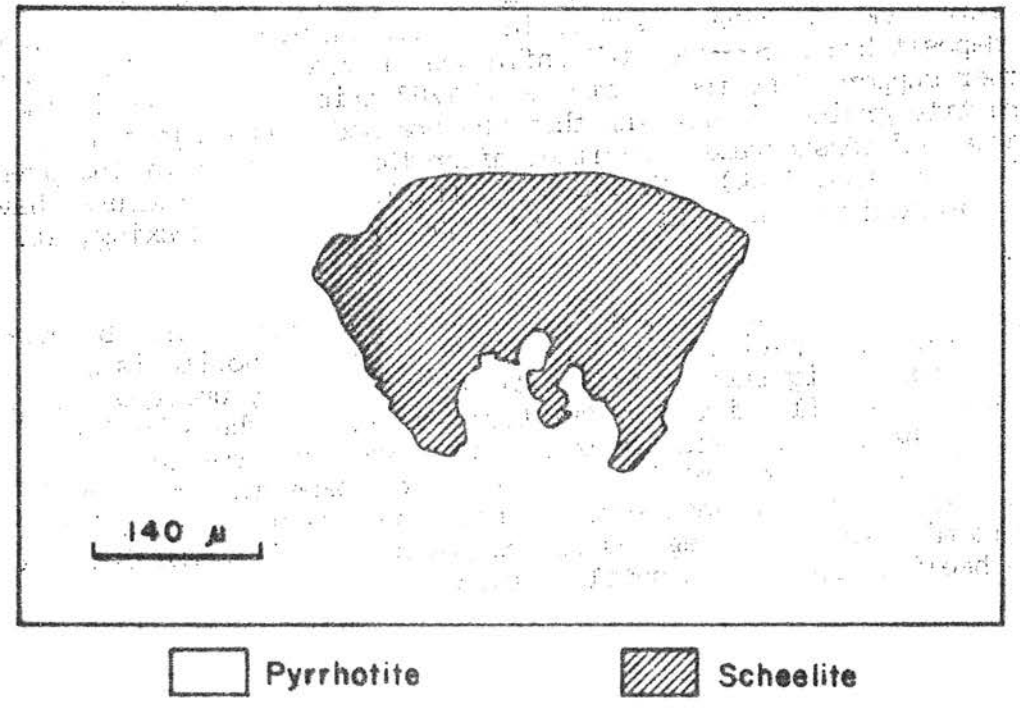


Fig. 2 Embayed scheelite grain in pyrrhotite.



(All figures are tracing from photomicrographs)

Fig. 3 Scheelite grain showing pull - apart texture.

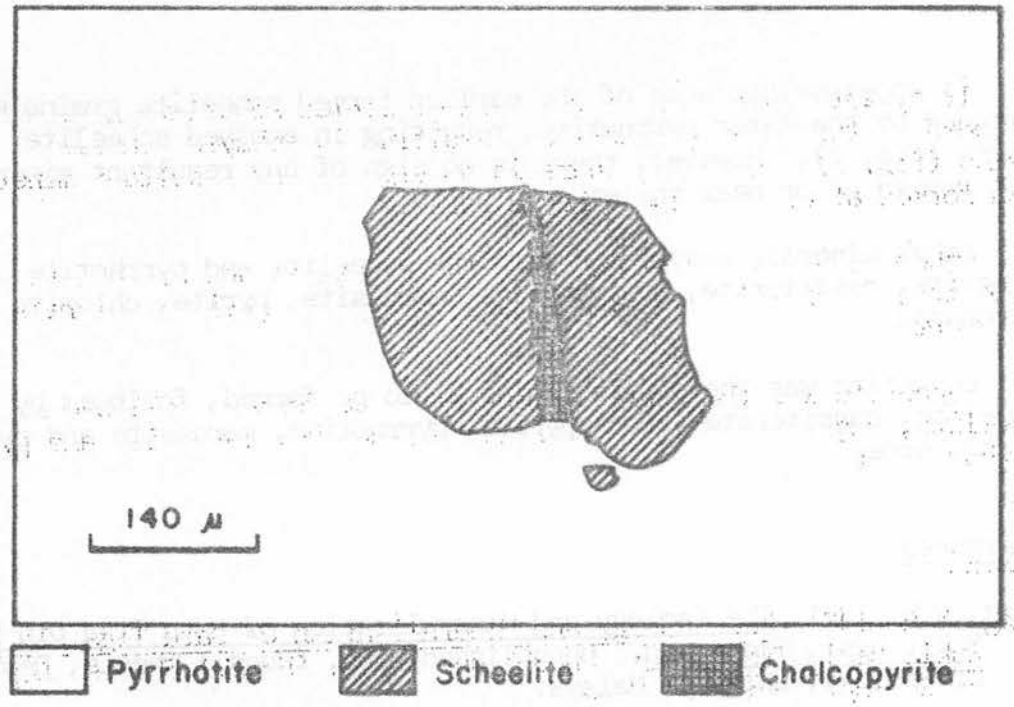
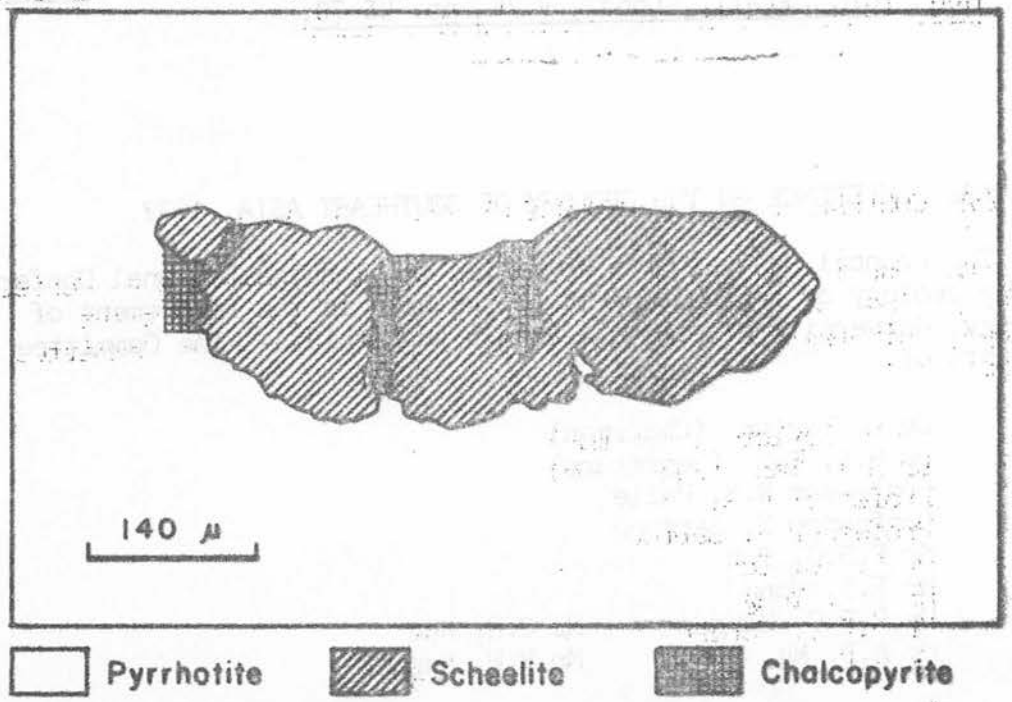


Fig. 4 Chalcopyrite healing the fractures of a pulled - apart scheelite grain in pyrrhotite.



(All figures are tracing from photomicrographs)

It appears that some of the earlier formed scheelite grains were corroded by the later pyrrhotite, resulting in embayed scheelite grains (Fig. 2). However, there is no sign of any resultant mineral been formed at or near the embayed parts.

Other minerals associated with the scheelite and pyrrhotite are magnetite, cassiterite, arsenopyrite, marcasite, pyrite, chlorite and quartz.

Magnetite was the earliest mineral to be formed, followed by scheelite, cassiterite, arsenopyrite, pyrrhotite, marcasite and pyrite in that order.

References

Chong, N.H. 1971 The Geology and Mineralisation of Batu Tiga Old Pit, Bukit Besi, Trengganu. Unpublished B.Sc. (Hons.) Thesis, Dept. of Geology, Univ. of Malaya.

Hosking, K.F.G., Leow, J.H. and F.E. Haser, 1969 Magnetite-Cassiterite-Polysulphide skarn vein at Bukit Besi Mine, Trengganu, West Malaysia: G.S.M. Newsletter No. 20, pp.3-5

Stanton, R.L., 1964 Mineral Interfaces in Stratiform Ores: Trans. Inst. Min. Metall., Lond., V.74, pp. 45-79.

REGIONAL CONFERENCE ON THE GEOLOGY OF SOUTHEAST ASIA, 1972.

The Council has set up a Committee to plan the Regional Conference on the geology of Southeast Asia, to be held in the Department of Geology, University of Malaya, 20 - 25 August 1972. The Committee consists of:

Dr D. Taylor (Chairman)
Dr B.K. Tan (Secretary)
Professor N.S. Haile
Professor S. Sartono
Mr E.S.C. Toh
Mr F.S. Yong
Mr R.P.C. Morgan
Mr A.P. Ng
Mr C.H. Kho
Mr R.W. Murphy

A First Circular was issued on 21 June 1971. Any members who did not receive this should please contact:

The Secretary
Regional Geological Conference Committee
Geological Society of Malaysia
c/o Department of Geology
University of Malaya
Kuala Lumpur, MALAYSIA.

The First Circular has been sent to all members of GSM; all Universities, Geological Societies, and Mining Associations, Oil Companies, and similar Organizations in Southeast Asia; ECAFE; UNESCO; and to certain Geological Surveys and Societies outside of the South-east Asian area.

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NEWS OF THE SOCIETY

Resignation of Hon. Secretary/Appointment of New Secretary

Mr R.P.C. Morgan has resigned from the Office of Hon. Secretary of the Society as he is leaving Malaysia for U.K. at the end of July. Mr R.P.C. Morgan has been Hon. Secretary since the beginning of this year. The Council has recorded its appreciation of his valuable services.

Mr E.B. Yeap has been appointed Hon. Secretary of the Society with effect from 23 July 1971.

Meeting of 18 June: Ice Ages and Coral Dating

W.S. Moore

Dr Willard S. Moore of the U.S. Naval Oceanographic Office, addressed the Society on "Ice Ages and Coral Dating" on 18 June 1971, in the Department of Geology, University of Malaya, with the President, Dr D. Taylor, in the chair.

Dr Moore stated that four major aspects of ice ages have to be explained by any theory:

1. Ice ages occurred in the Pleistocene, the Carboniferous-Permian, and the pre-Cambrian.

2. Each ice age shows complex oscillations with a series of advances and retreats, of which there were at least four in the Pleistocene.

3. The extent of the advance of ice in each of the Pleistocene glaciations was about the same, but,

4. The ice stayed for different length of time after each advance before retreating.

Any theory thus must explain these facts, including the reason for the primary advance, and the series of retreats and advances - a sort of "flip-flop" mechanism.

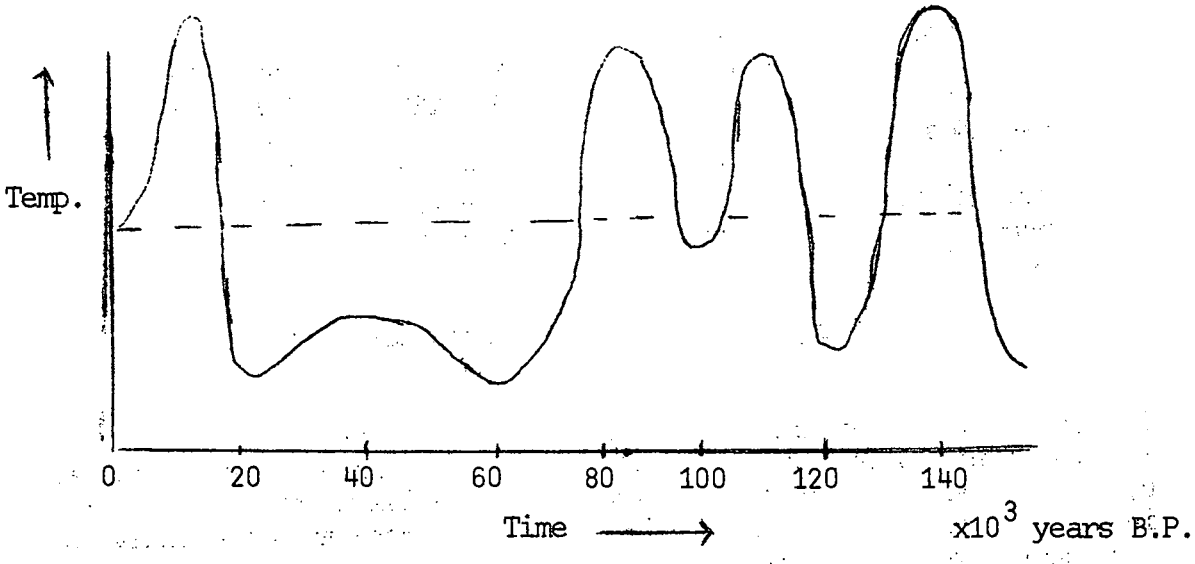
Dr Moore reviewed various theories which have been advanced to explain ice ages. At present the winters are seemingly cold enough to initiate an ice age in the northern hemisphere; what is required is colder summers. The obvious idea that heat from the sun varied - perhaps because the solar system periodically passes through a dust cloud - is inadequate.

Since palaeomagnetic data indicates that the north pole has been moving from the Pacific to the Arctic in late Cenozoic time, perhaps the Pleistocene ice age had to do with this change from a position where the pole was in contact with freely circulating oceanic water, to its present insulated position in a nearly land-locked Arctic ocean?

The ingenious theory of Donn and Ewing proposes that the Arctic ocean controls the ice ages. They suggested that when the Arctic is frozen, there is not enough precipitation around the margins to sustain a build-up of ice sheets. However, supposing a free circulation formerly existed through the Davis Strait between Greenland and Canada, and the Arctic ocean was not frozen, precipitation on lands around the margins of the ocean could result in a build-up of ice sheets. This would increase the albedo (reflectivity) and thus lower the amount of heat retained by the earth, until, with a further spread of the ice, the lowered sea level would isolate the Arctic Ocean (because the sills across the channels around it would emerge) which would freeze over and thus reduce precipitation, leading to a retreat of the ice. Attractive as this theory is, deep-sea cores from the Arctic indicate that it has been frozen for at least 200,000 years.

Of other theories left in the field, the Melankovich astronomical theory is interesting, in that it enables a graph of supposed past temperature fluctuations to be drawn, which can then be tested by various means. The astronomical theory suggests that fluctuations in temperatures are due to precession of the earth's orbit (with a period of 21,000 years), variation of the eccentricity of the orbit (which varies from 0.01 - 0.04 in 92,000 years) and the tilt of the axis (which varies from 22 - 24° in 40,000 years). This will affect the amount of heat received by the earth, although the calculated effect is only to lower the temperature by c. 2° C, probably too small to initiate an ice age. The proponents of their theory, however, suggest that it would be enough to trigger off an ice age if other factors, e.g. polar wandering, were favourable for this.

The graph of temperature fluctuations "predicted" from the astronomical theory is approximately thus:



How can observations on tropical corals relate to theories of the ice age? It is generally accepted that periods of glaciation coincided with lowered world sea-levels, because much water was locked up in ice sheets, whereas inter-glacial periods coincided with high sea-levels. Such sea levels are well dated for the last retreat of the ice, by C_{14} and other methods, but C_{14} dating only extends to about 40,000 years B.P.

However, corals take up uranium (but not thorium) into their skeleton to the amount of 2-3 ppm. The reaction $U^{234} \rightarrow Th^{230}$ provides a means of dating back to several hundred thousands years, since U^{234} has a half life of 80,000 years. Material to be dated must be still in the form of aragonite, and not have been affected by groundwater to the extent that recrystallization has occurred, or that uranium has been picked up by the carbonate. Shells, such as molluscs, are not very suitable for dating, since they take up only infinitesimal amounts of uranium (0.003 ppm). Dates by this method have been obtained from corals from raised terraces on various islands in the Pacific and elsewhere. It is supposed that raised coral terraces are most likely to represent high sea levels resulting from warm interglacials. Terraces will be more likely to form when the sea level is constant for a time, rather than during the comparatively rapid rises and falls at the onset and end of an interglacial. Neotectonic uplift, or subsidence, or warping, will, of course, complicate the picture.

Results so far (based on the work of H.H. Veeh and others) are tabulated below:

Island	Reef Complex	Elev. (m)	Age ($x10^3$y)
New Guinea	I	1	6 ± 1
" "	II and III	1 - 50	50 ± 10
" "	IV	50 - 120	(68 ± 8)*
Barbados	I	6 - 18	82 ± 3
"	II	26 - 27	103 ± 4
New Guinea	V	150 - 200	125 ± 10
Barbados	III	35 - 55	122 ± 6
New Guinea	VI	200 - 270	185 ± 15

* age from shells; possibly not reliable

It will be seen that there is a fairly good cluster of dates around 125,000 years, which could correspond to an interglacial as predicted by the astronomical theory. However, the precision achieved so far is inadequate to test the theory rigorously, and more accurate analyses from more places, are now being attempted.

Dr Moore described his recent collecting trip to Semporna Peninsula, Sabah, where very extensive coral, raised up to 10 metres a.s.l. could represent a Pleistocene high sea-level stand. The material from there seems unaltered, and hopefully suitable for dating by the U/Th method. Although there is evidence of a Holocene sea-level of up to +6 m in this region, this level was probably only maintained for a short time, and is thus not likely to account for the very extensive Semporna raised coral reefs. There is some evidence, in the form of a

notch with dead coral above mean sea level at the base of low cliffs of raised coral at the head of the beach in places near Semporna, in which, a "second generation" of dead coral was found. If the main coral flats are indeed Pleistocene, this notch and coral could have formed during the Holocene transgression.

Publications

Bulletin No. 4 has been published and is being distributed to all members in good financial standing.

The Editor would like to invite members to submit papers or notes on any topic within the scope of interest of the Society for Bulletin 5, and Geologic Notes for future Newsletters. No papers have so far been submitted for Bulletin 5, which cannot now be issued until 1972.

Mineralogical Sub-group

The Chairman of the Mineralogical Sub-group (Mr J.H. Leow) has announced that the following have been elected as Society representatives on the commissions of the International Mineralogical Association.

Commissions on Abstracts, Mineral Data, and Teaching	:	Dr C.S. Hutchison
Commission on Ore Microscopy	:	Mr J.H. Leow

Members having points or problems to raise on these topics should contact the representatives at the following addresses:

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