Geol. Soc. Malaysia, Bulletin, 7, June 1974; pp. 79–88.

A major unconformity exposed in Sungei Siput, Pahang

WEE HENG TIAN and D. TAYLOR[1]

Abstract: A distinct angular unconformity was located in Sungei Siput in the Pekan district of Pahang. The underlying rocks are cordierite-andalusite hornfels overlain unconformably by a younger sequence of unmetamorphosed conglomerates grading upwards into conglomeratic sandstone, orthoquartzite and arkosic sandstone interbedded with purplish to blue mudstone. Due to the absence of fossils the age of the sediments is not known but lithologically they can be correlated with the Tembeling Formation or the Gagau Group.

Lead-zinc and iron mineralization is present in the underlying rocks with a gossan exposed at the surface. The presence of gossanous hematite-magnetite pebbles in the conglomerates shows that the underlying mineralization was emplaced prior to the deposition of the overlying clastic sediments and was undergoing oxidation and erosion at the old land surface now represented by the plane of the unconformity.

Aerial photograph interpretation suggests that the younger sequence underlies at least 40 square miles on the north bank of the Sg. Pahang and is cut off by faults along the Sg. Lepar valley to the east.

INTRODUCTION

An angular unconformity is exposed in Sungei Siput in the Pekan District of Pahang at map reference 067 322 on 1 inch to 1 mile topographic sheet no. 91. It lies some 55 miles southwest of Kuantan and is accessible by timber road right up to the site. The unconformity was encountered while on detailed mapping of a lead-zinc prospect in 1972, under an option given to CRM (Sdn.) Berhad by the Eastern Mining and Metals Co. Ltd. (EMMCo) who had earlier prospected the area.

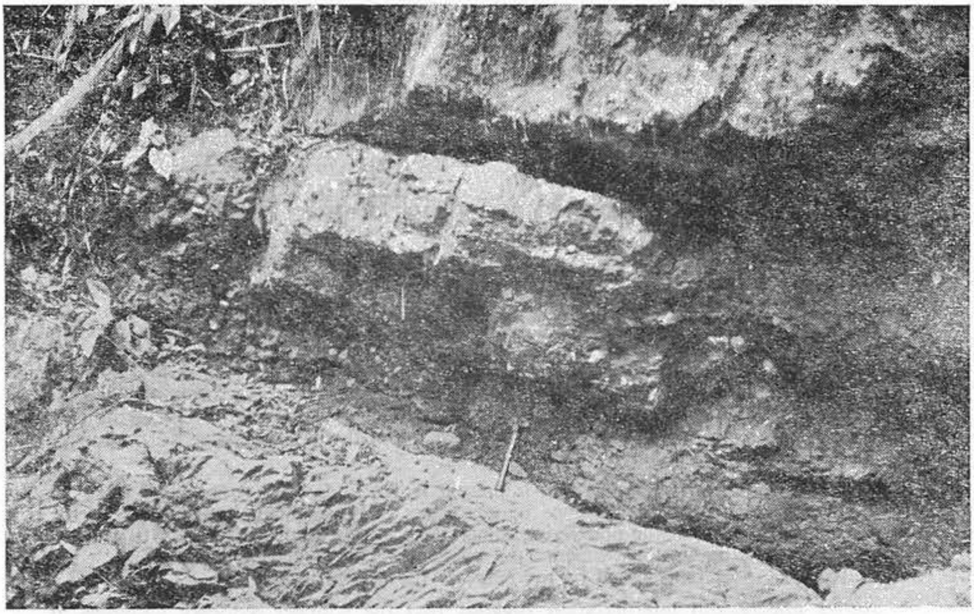
The unconformity is between an older basement rock of hornfels and younger overlying sediments of polymict conglomerates passing upwards into conglomeratic sandstone, orthoquartzite and interbedded sandstone and mudstone. A narrow scarp zone is formed from the conglomerates and immediately overlying sediments, and may be followed on the aerial photographs. The actual plane of unconformity is well exposed in the Sg. Siput itself leaving no room for doubt about the mutual relationships of the rocks. The best exposure is shown in Plate 1.

The Underlying Rocks

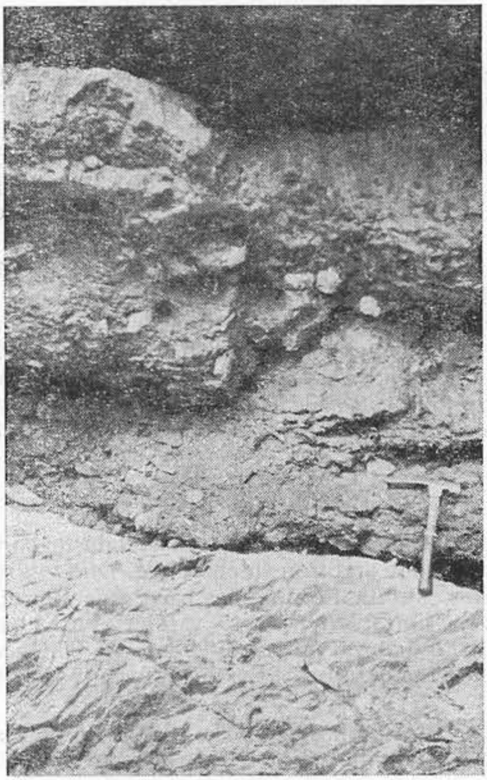
The basement rock is made up of siliceous andalusite-cordierite hornfels with interbeds of quartzite, phyllite and iron sulphide ore. Due to intensive contact metamorphism by the nearby granite, bedding has been generally obscured. Where bedding can be observed, the hornfels appears to be folded into a major synclinal trough trending north–south with dips varying from 20° to 70°. The geology of the country immediately surrounding the outcrop of the unconformity is shown in figure 1.

Joints are prominent in the hornfels. The major set strikes NW–SE with dips ranging from 45° to 82°E, with a minor set at right angles to it, dipping east from 39° to 88°.

[1] Conzinc Riotinto Malaysia (Sdn.) Berhad.



Unconformity — Basement Rock of Hornfels (whitish grey) and Overlying Conglomerates (grey). Looking southeast.



Closer view of part of the same outcrop. Note the close jointing of the Hornfels (whitish grey).

PLATE 1

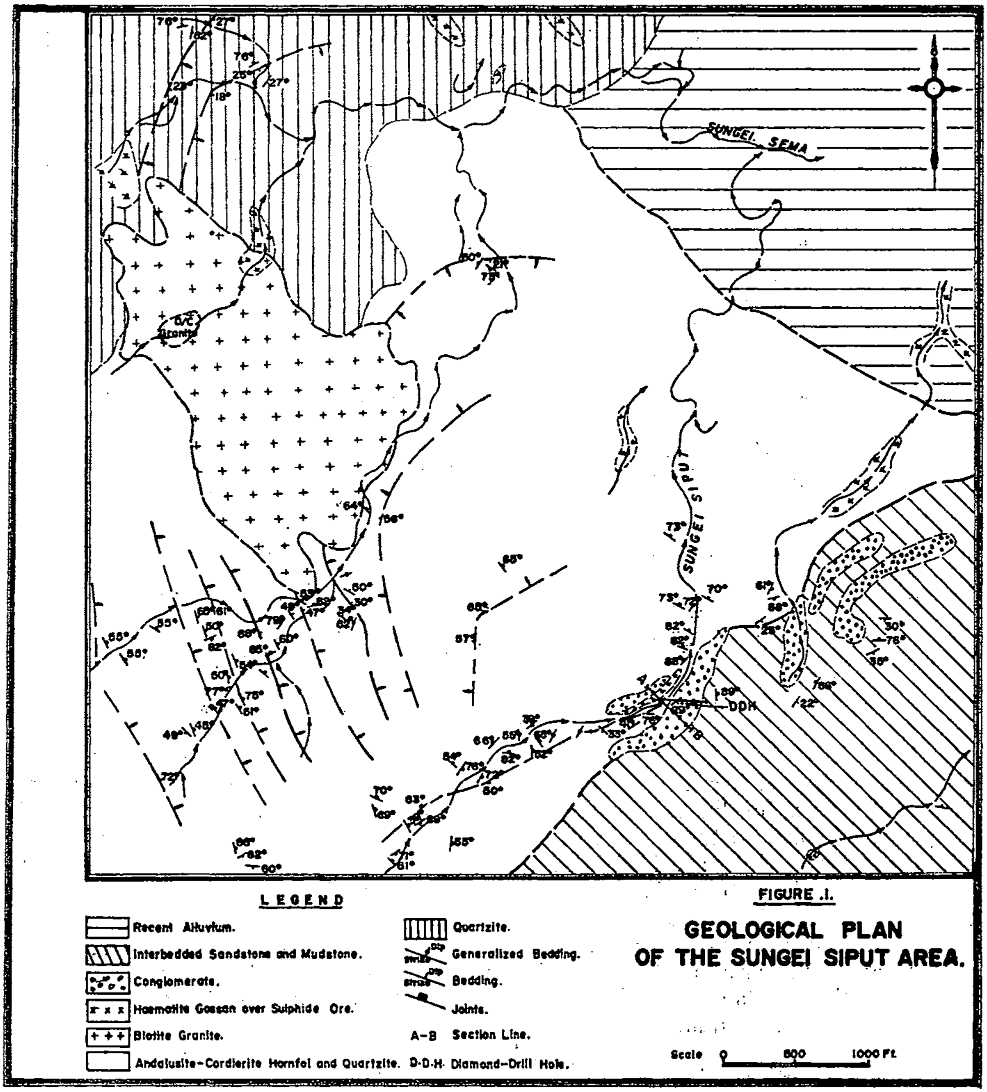


FIGURE 1.
GEOLOGICAL PLAN OF THE SUNGEI SIPUT AREA.

The hornfels contains a little galena in association with pyrite and chlorite in hairline fractures. Close to these fractures, disseminated galena and pyrite are found. Locally more massive sulphides together with magnetite occur and near the surface are weathered to a massive haematite-magnetite ironstone gossan. Figure 2 shows the relationship between the mineralization and the unconformity.

The Overlying Sequence

Immediately overlying the plane of unconformity is the basal conglomerate which at this point is approximately 100 feet (30 metres) in thickness. It strikes NE–SW and dips gently southeastwards at angles up to 29°. It is generally pinkish

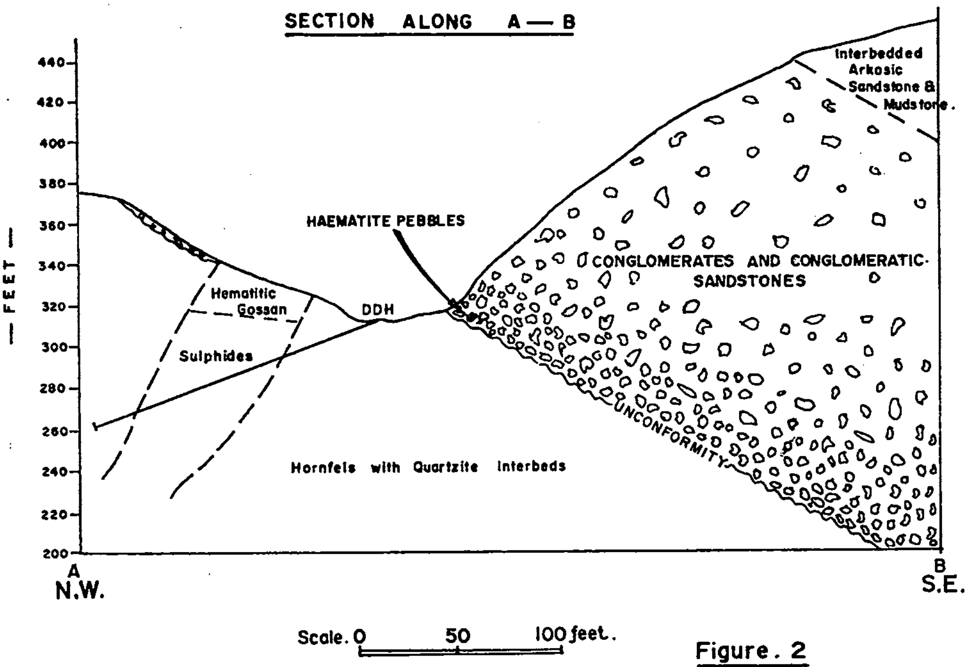


Figure. 2

DDH — Diamond Drill-Hole

grey in colour and has a polymict composition. The bulk of the clasts consists of quartzite, with subordinate quartz, phyllite, hornfels, chert, gossanous hematite and magnetite pebbles up to 6 inches in diameter. The clasts are generally subrounded and sorting is moderate to fairly poor. The clasts appear to have derived from two provenances. The subrounded to rounded quartzite is from a distant source and the more angular fragments of phyllite, hematite and hornfels are contributed by the underlying rocks nearby. The matrix of the conglomerate is argillaceous sandstone consisting mainly of subrounded quartz with minor constituents of felspar, sericite, zircon and fragments of hematite, hornfels and phyllite. The cement is clay minerals, probably hydromica, quartz overgrowth and iron oxide.

Conglomeratic sandstone and orthoquartzite are intercalated between the conglomerates and the overlying mudstones and sandstones. They form a prominent scarp, which may be followed for several miles both to the east and southwest on aerial photographs.

The interbedded sandstone and mudstone is flatlying with dips varying from horizontal to 24°. Fractures are well-developed in a NE–SW direction and to a lesser extent at right angles. The sandstone is arkosic in composition with zircon as an accessory mineral. Most of the felspars have been altered and in thin section can be seen to be replaced by quartz. The cementing medium is made up of authigenic quartz and iron oxide which may be of secondary origin, deriving from overlying weathered mudstones through leaching. The mudstone is generally bluish in colour, changing to purplish when it is weathered. It has a characteristic spheroidal weathering around its close fractures resulting in the formation of many rounded detritals of mudstone at outcrop. These interbedded sandstones and mudstones are best seen in road cuttings on timber trails between Sg. Siput and Sg. Kemuning. While no complete section has been measured, the low dip of the beds allows a minimum likely thickness to be estimated from the topography. At least 650 feet (200 metres) is indicated.

Environment of Deposition of the Overlying Sequence

The younger sediments were deposited under fluviatile and deltaic conditions. There is no evidence of marine beds in the area. The thickness of the conglomerates combined with the roundness and moderate sorting of its clasts indicate gradual deposition in the shallow depressions of a river system. The deposition of the basal conglomerate was followed by deltaic sedimentation interrupted by periodic floods to yield sandstone and mudstone. The sediments of the lower part of the sequence were probably laid down under conditions similar to those prevailing when the coastal plains of Selangor were built up. Here basal gravels varying greatly in thickness rest on an irregular surface of older rocks and are overlain by pebbly sands and sands with interbeds of clay and finally with widespread clays. These beds developed under conditions of a slowly rising sea level with an abundant supply of fluvial sediment which maintained the surface at or above sea level at all times.

Extent of the Overlying Sequence

An examination of the aerial photographs and an examination of outcrop and float in some of the larger streams indicates that the younger rocks occupy an area of at least 40 square miles and cover most of the country between the Sg. Sema, a tributary of Sg. Lepar, and the Pahang River. Shallow open folds may be seen on the air photos and the sequence seems to dip overall to the south and east. It is possible that these rocks extend southeast beyond the Sungei Pahang near Kuala Mentiga and link up with similar rocks recently mapped by the Geological Survey on Bt. Harimau Berjemor and Bt. Geret in the Pahang Tenggara area. The presence of a strong unconformity below these rocks on Bt. Geret was noted by Cook and Suntharalingham (1969). The approximate extent of these younger rocks is shown in figure 3.

CORRELATION

The age of the overlying sequence is not firmly established as no fossils have yet been found in it. However on lithological grounds they may be correlated with either the Upper Triassic to Jurassic Tembeling Formation exposed in Sg. Tekai Pahang as defined by Koopmans (1968) or with the Gagau Group as described by officers of the Geological Survey, notably Rishworth (in press) and Burton (1973). The distribution of the Tembeling Formations and the Gagau Group in relation to the Sg. Siput outcrops is shown in Fig. 4. Fig. 5 shows the possible relationship of the Sg. Siput beds to the type section of the Tembeling given by Koopmans (1968) and extended to the Maran River and Yih River sections of Berantai Syncline by Ayob (1968) as published by Smiley (1970). The correlation by Smiley (1970) of the flora collected by Ayob from the Maran River section with the flora known from the Gunong Gagau and Johore areas, where the type localities of the Gagau Group are found, raises interesting problems for the whole correlation and definition of the Mesozoic in the Malay Peninsula.

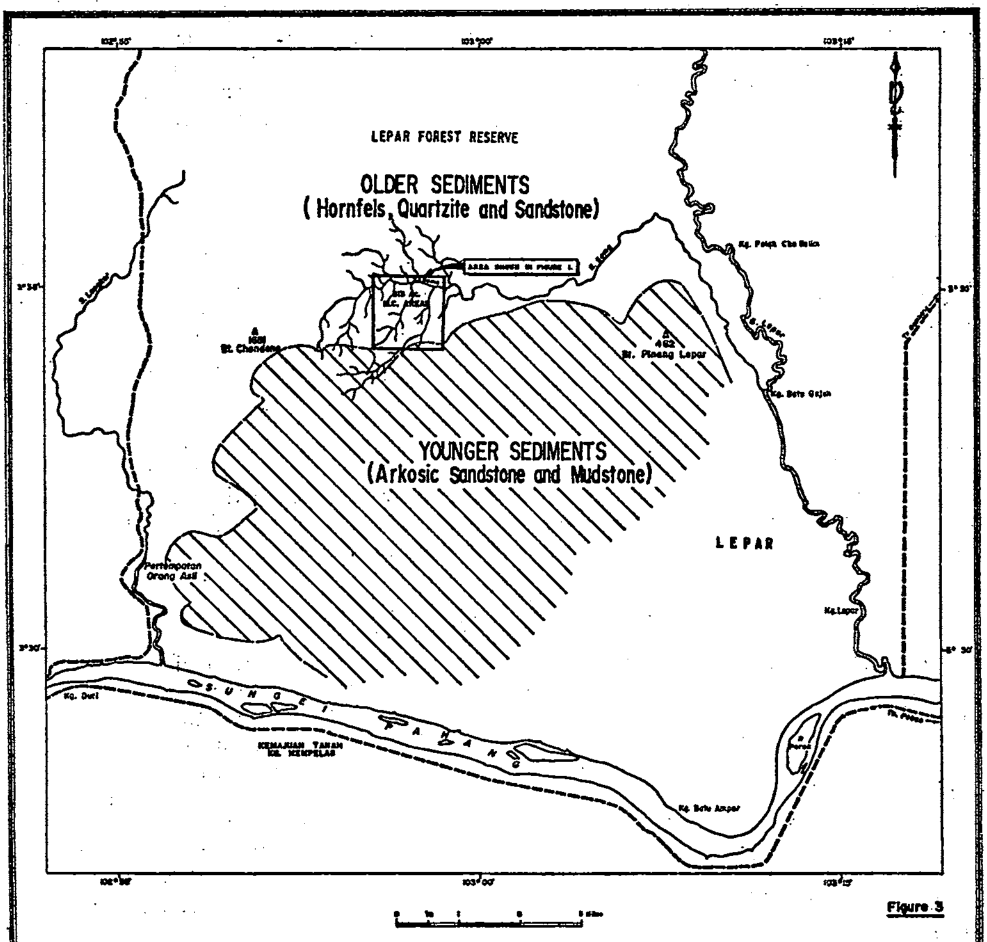


Figure 3

APPARENT EXTENT OF YOUNGER SEDIMENTS NORTH OF SUNGEI PAHANG.

An unconformable base to the Tembeling Formation has been inferred but not observed in the Tekai type area, and the same situation is found in the Berantai Syncline. The base of the Gagau Group is frequently seen to be strongly unconformable, as may be seen in the photograph by Rishworth figured in Burton (1973). The base of the younger sequence in Sg. Siput is of this latter type, suggesting a correlation with the Gagau Group, while the nearest rocks of similar lithology in the Berantai Syncline were placed by Koopmans into his Tembeling Formation but have been shown by Smiley to have a flora identical with the Gagau.

At this time we prefer to leave open the question of the precise correlation of the overlying sequence in the Sg. Siput until more evidence is forthcoming for the dating of these various sedimentary sequences, whose locations are shown in figure 4.

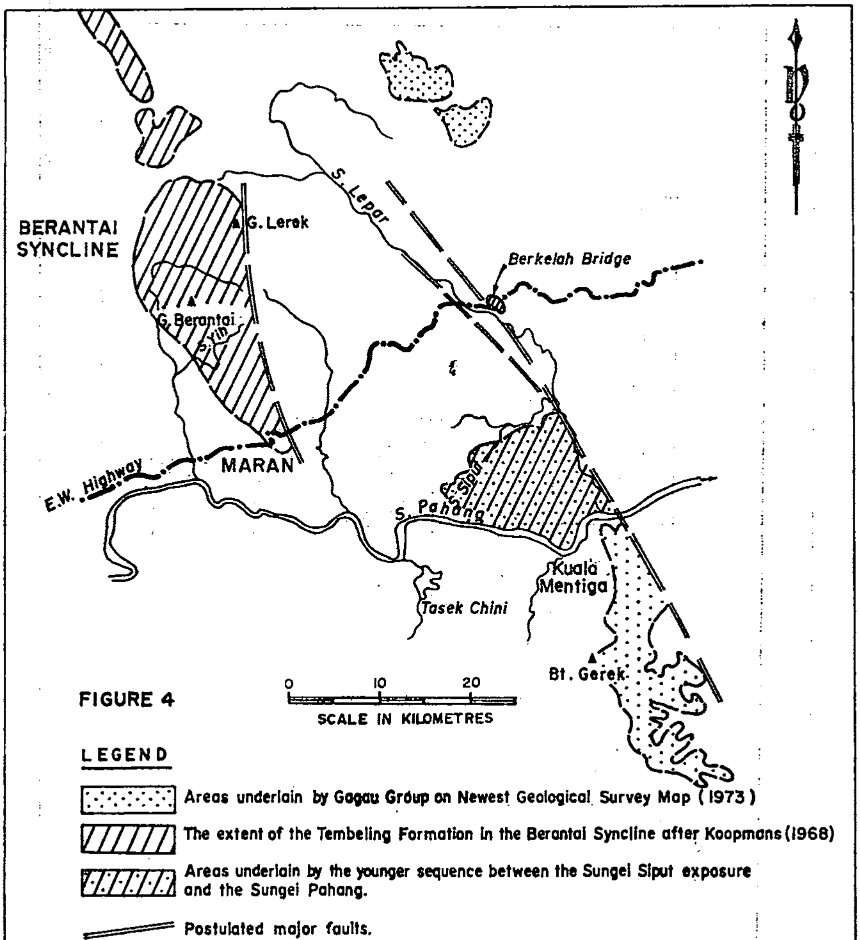


FIGURE 4

DISTRIBUTION OF THE TEMBELING FORMATION AND OF THE GAGAU GROUP IN RELATION TO THE SUNGEI SIPUT OUTCROPS.

DATA FROM KOOPMANS (1968) AND GEOLOGICAL MAP OF MALAYSIA (1973)

The basal conglomerate in Sg. Siput may correlate precisely with the small basin of conglomerate exposed in road cuttings immediately to the east of the Sg. Berkelah Bridge on the East–West Highway. These outcrops were considered by Koopmans (1968) to be of the base of his Tembeling Formation.

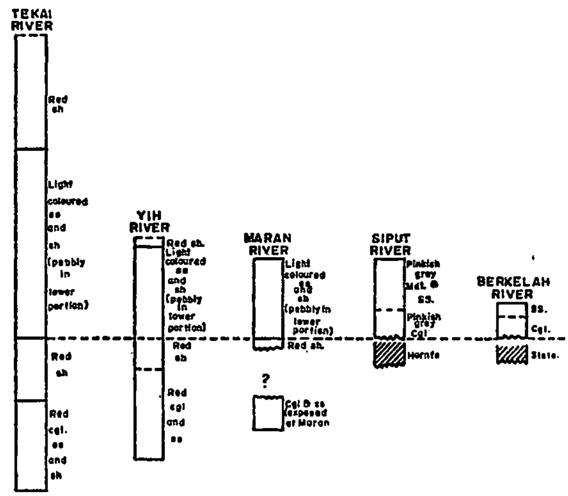


Figure 5

Correlation of Stratigraphic Sections in the Tembeling-Maran-Lepar area of Pahang. Tekai, Yih and Maran sections after Smiley (1970) based on original work of Koopmans (1968) and Ayob (1968)

Folding movements subsequent to the younger sedimentary series have been generally slight, with only minor warping and a little uplift. Air photo interpretation however suggests that the whole of the younger sequence may be faulted out to the east by a complex of faults along the low ground of the Sg. Lepar valley. A left lateral movement of 9 miles would bring together the conglomerates at the base of the younger sequence in the Sg. Siput – Sg. Sema valley and the conglomerates exposed in the road cuttings east of the Sg. Berkelah Bridge. The relationship could also be due to normal faulting with a downthrow to the east.

Wrench faulting with this trend and direction of movement has been reported from Kelantan by H.D. Tjia (1969) and Aw Peck Chin (1969), and Tjia considered these faults to extend south to the Maran and Gunong Chini areas. The postulated fault along the Lepar valley would fit into this pattern. Whatever its nature some at least of the movement along these faults post dates the younger sedimentary series, a relationship also shown along the east side of the Berantai Syncline by Mohd. Ayob (1968).

GEOLOGICAL HISTORY

A geological history for the one square mile or so of ground shown in figure 1 can be worked out which, while undated, may be of assistance in unravelling the structure and history of the wider region because of the unequivocal nature of some of the relationships observed.

The first event of which we have record is the deposition of a thick sequence of rather poorly sorted sandstones and shales. The dominant rock type is perhaps a rather siliceous siltstone or fine grained impure sandstone of very nondescript appearance. Within the area mapped the lower sediments are more sandy and the upper more argillaceous. These sediments were folded into a major synclinal structure whose axis probably plunges northeastwards. Subsequent events have obliterated much of the evidence of bedding or other sedimentary structure and little more can be said about these rocks.

A small and poorly outcropping area of granitic rock occupies about a quarter of a square mile on the west side of the synclinal axis. It occupies a discordant position with regard to the relict sedimentary structure in the older sediments and is surrounded by an aureole of contact metamorphism which affects all the older rocks within the area mapped, yielding rocks ranging from dark coloured quartzites to siliceous fine grained hornfels. Andalusite and cordierite are widespread. The mineralization found in these rocks cannot be assigned a clearly pre-metamorphic or post metamorphic age, mainly because of inadequate exposure.

The conglomerates, sandstones and mudstones of the overlying sediments are quite unmetamorphosed, but the conglomerate contains pebbles of hornfels identical to underlying rocks. The conglomerate also contains sub-angular fragments of haematite of the type forming the nearby gossan over the more massive sulphide ore. Granite clasts are however absent. These facts clearly indicate that not only had the granite been emplaced and the country rocks been metamorphosed before the overlying series had been laid down, but the mineralisation had been emplaced and then exposed to sub-aerial erosion also. At least some of the gossan now exposed at the surface was formed at a much earlier period, most probably during the Mesozoic. The granite was either not exposed at the pre-unconformity surface, or the sediments were derived from a direction other than northwest.

ACKNOWLEDGEMENTS

We would like to thank Conzinc Riotinto Malaysia Sdn. Berhad for granting us permission to publish the paper and we are also grateful to the Geological Survey Kuantan for allowing us to use the facilities in their laboratory for the examination of thin sections of these rocks.

REFERENCES

AYOB, M.; 1968, Stratigraphy and sedimentology of the Tembeling Formation in the Gunong Berantai Area, Pahang Uupubl. M.Sc. Thesis, Department of Geology. University of Malaya 150 p.

AW PECK CHIN; 1969, Sungai Aring Area, South Kelantan *Annual Report of the Geological Survey of Malaysia,* pages 103–107.

BURTON, C.K.; 1973, Mesozoic. Chapter 5 in *Geology of the Malay Peninsula. West Malaysia and Singapore* Eds D.J. Gobbett and C.S. Hutchison. John Wiley-Interscience. New York, p. 97–141.

COOK, R.H. AND SUNTHARLINGHAM, T.; 1969, *Annual Report of the Geological Survey of Malaysia,* page 93.

KOOPMANS, B.N.; 1968, The Tembeling Formation — A Lithostratigraphic Description (West Malaysia). *Geological Society of Malaysia Bull. 1.* pp. 23–43.

RISHWORTH, D.E.H.; 1973, The Upper Mesozoic Terrigenous Gagau Group of Malaya, (In press, Geol. Surv. of Mal.).

SMILEY, C.J.; 1970, Later Mesozoic Flora from Maran, Pahang, West Malaysia Part 1; Geologic Considerations. *Geological Society of Malaysia Bull. 3.* pp. 77–88.

TJIA, H.D.; 1969, Regional implications of the Lebir Fault Zone. *Geological Society of Malaysia Newsletter No. 19,* July 1969.