Note on Mollusca from the Lower Mentawir Beds, Balikpapan Bay area, Kalimantan (East Borneo)

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Beets, C. Note on Mollusca from the Lower Mentawir Beds, Balikpapan Bay area, Kalimantan (East Borneo). — Scripta Geol., 59: 1 - 12, 1 fig., Leiden, June 1981.

The Mentawir Beds, so named by L. M. R. Rutten, comprise a succession of Neogene sediments outcropping in the Balikpapan Bay area and originally thought to be of Late Miocene age. Subsequently their lower part was correlated with the Lower Balikpapan Layers and classified as Tf2. The type locality in the Sungai Mentawir area visited by Rutten in 1911 yielded a few Larger Foraminifera and Mollusca. A re-examination of the latter and a revision of the overall data now suggest a Preangerian age, Tf3.

Also, the age determination, Tf3, of a related fauna from the basal Menkrawit Beds of Mangkalihat Peninsula made in 1941 is reconsidered. No unquestionable new departure emerging, the writer adheres to a Preangerian age as originally based on the examination of both Mollusca and corals, despite conflicting evidence brought forward by Larger Foraminifera investigations.

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For: Late Miocene Mollusca from Tapian Langsat and Gunung Batuta, Sungai Bungalun area, Kalimantan (E. Borneo) see pp. 13 - 28.

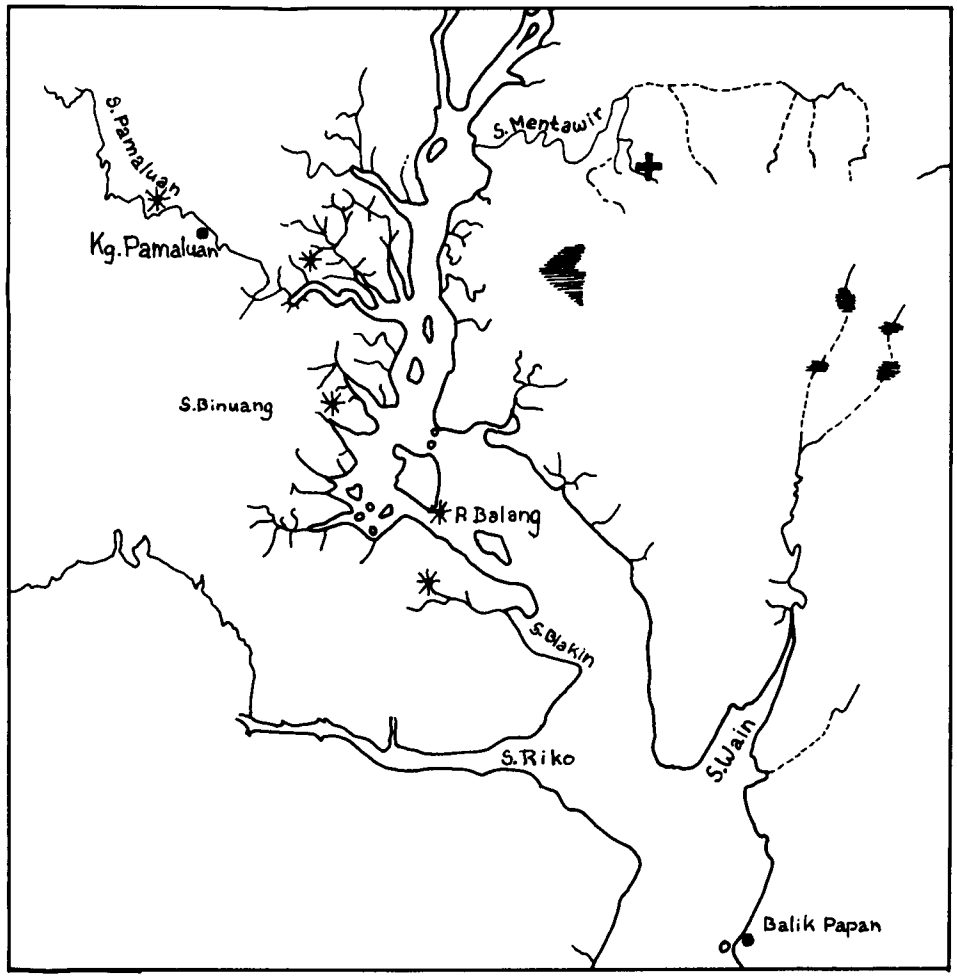

Fig. 1. Part of a sketch map of Balikpapan Bay area depicting some classical fossil localities. Cross to N.E.: Rutten's Sungai Mentawir locality discussed in the present paper. After Rutten, 1911, map facing p. 1160; scale 1:250 000.
Kg. = Kampung (village), P. = Pulu (island), S. = Sungai (river).

Introduction

The modest collection of molluscan fossils discussed in the present paper was made by L. (M.R.) Rutten as far back as 1911. He described the Larger Foraminifera from the same exposure of soft fossiliferous marls outcropping in a tributary of Sungai Mentawir (Fig. 1), their age being considered as "Young Miocene" (Rutten, 1911), that is, by inference, younger than the Javanese Njalindung Beds which at that time were judged to form the top part of "Old Miocene". Thereafter the locality — in what was later to be called Mentawir

Beds s.str. and correlated with the Lower Balikpapan Beds classified as Tf2 — and its Foraminifera, were repeatedly mentioned in a fairly large number of papers by Rutten & Rutten-Pekelharing (1911), Rutten (1912 - 1927), van der Vlerk and Leupold & van der Vlerk (1922 - 1931), Wanner (in Felix, 1921, p. 8), and others. A few of the Mollusca were first mentioned by the writer (Beets, 1941), a later addition listing seven species, and an eighth, *Smaragdia* sp., erroneously so (Beets, 1950a, p. 279). Consequently, it would appear that much had been made of the far from numerous Sg. Mentawir fossils, perhaps even more than warranted at first sight. However, some interesting, though confusing matters of correlation are involved so finally, as an opportunity was offered to do so, it was decided to take a closer look at the earlier results and conclusions.

Faunal lists and geologic ranges

Larger Foraminifera — Original identifications as made by Rutten and subsequently revised by himself and others. Ranges according to van der Vlerk and Leupold, though presumably outdated by evidence accumulated by the oil industry.

Table 1. Range of the Larger Foraminifera expressed in the Indonesian Letter classification for the Tertiary.

Lepidocyclina glabra Rutten, 1911	Tf1 Tf2 Tf3
L. douvillei Yabe & Hanzawa, 1922[1])	Te3 Te4 Te5 Tf1 Tf2 Tf3
L. sumatrensis Brady, 1878[2])	Te5 Tf1 Tf2
Miogypsina polymorpha Rutten, 1911	Tf1 Tf2 Tf3

[1]) = *L. angulosa* auct. non Provale, 1909.
[2]) This is var. minor Rutten, 1911.

Note: *L. douvillei* and *L. sumatrensis* belong to the subgenus *Nephrolepidina*. *L. glabra* and *L. douvillei* are also known, for example, from the Gelingseh (= Upper Balikpapan) Beds yielding a rich molluscan fauna of undoubted Preangerian age.

Conclusion: the Larger Foraminifera, far from pointing unreservedly at Tf2, appear to leave open the possibility of classification of the Sg. Mentawir fauna as either Tf1, Tf2, or Tf3.

Mollusca — The following abbreviations apply to the stratigraphical records of the species. Their number has been restricted in the faunal list. References are likewise given sparingly.

Table 2. Stratigraphical records of the molluscs from the Lower Mentawir Beds.

	W	R	Rr	K	UG	Nj	Ta	NT	UM	M	P	N	PQ	Q	Re
Turritella cingulifera	–	R	–	–	–	–	–	NT	–	–	P	N	PQ	Q	Re
Cerithium bayeri	–	–	–	–	–	–	–	NT	–	–	–	–	–	–	–
Rhinoclavis karangensis	–	–	–	–	–	–	Ta	NT	–	–	P	N	–	Q	–
Rhinoclavis leupoldi	–	R	Rr	–	–	–	–	NT	–	–	–	N	–	–	–
Cerithium cf. *C. rude*	–	R	Rr	–	UG	–	–	NT	–	–	–	–	–	–	–
Gemmula granosa woodwardi	–	R	Rr	K	UG	–	–	NT	UM	–	P	N	–	–	–
Gemmula imitatrix	W	–	–	–	–	Nj	Ta	NT	UM	M	P	–	–	Q	–
Nucula njalindungensis	–	–	–	–	–	Nj	–	NT	–	–	–	–	–	–	–
Corbula solidula	–	–	Rr	–	–	–	–	NT	–	–	P	N	–	–	Re

Re — Recent
Q — Quaternary
PQ — Pliocene/Quaternary
N — Neogene, unclassified
P — Pliocene (Th approximately)
M — Miocene, unclassified
UM — Late Miocene (largely Tg, Odengian)

Preangerian (Tf3):

NT — Preangerian, unspecified
Ta — Tjadasngampar, Java
Nj — Njalindung, Java

pre-Preangerian (Tfl - 2):

UG — Upper Gaj and equivalents (apparently Rembang going upward into Preangerian (in part))
K — Kama (now in disuse), Burma; perhaps correlating with UG
Rr — Rembang equivalents, unspecified
R — Rembang, Java (apparently in some small part correlating with Njalindung)
W — Westprogo

Subdivision of the Preangerian and Rembang accounts for the use of:

NT — Preangerian (Njalindung/Tjilanang and equivalents), comprising a number of faunas mainly from:

East Borneo:

Mandul I., coll. W. van Holst Pellekaan (Shell) (unpublished)
Menkrawit Beds, coll. W. Leupold (Beets, 1941) (see also last chapter but one)
Gelingseh Beds:
Gel — coll. L. Rutten, first published by Martin (1914)
Sa — source area of Sg. Gelingseh, coll. L. Rutten (unpublished)
Loc. 144, Loc. 156 — coll. L. Rutten (partly published)
Tl — Tapian Langsat, coll. L. Rutten (unpublished)
Mk — Muara Kobun, coll. M. Schmidt (Shell) (unpublished)
Kari Orang, coll. H. Witkamp (Shell) (partly published)
Gunung Mendong, coll. M. Schmidt (Shell) (unpublished)
Sekurau, coll. M. Schmidt (Shell) (unpublished)
Gunung Madupar, coll. L. Rutten and J. Wanner (unpublished)

West Borneo:

Coll. Shell (unpublished)

Java:

Tjilintung/Tjiangsana
Tjikao

Sumatra:

Lower Palembang Beds

Rr — Rembang equivalents:

East Borneo:

Ra — Api Api (Pasir), coll. K. Goldschmid (Shell) (unpublished)
Tsk — Tandjung Sepada Ketjil, ditto, ditto

Madura:

Rm — coll. R. Gsell (Shell) (unpublished)

Sumatra:

Rl — Langkang, coll. W. van Holst Pellekaan (Shell) (unpublished)

Comments on the molluscan species

Only brief comments are made. The material is kept in the Rijksmuseum van Geologie en Mineralogie, the registration numbers being RGM 312 133 - 312 141.

Turritella cingulifera Sowerby, 1825

Material — RGM 312 133; three small, yet well identifiable fragments.

Range — Early Miocene to Recent: R - NT (Mandul; Lower Menkrawit Beds: L.742; Sekurau; West Borneo) - P - N - PQ (Togopi) - Q - Re.

Cerithium bayeri Beets, 1941

Material — RGM 312 134; a couple of specimens mentioned in the original description of the species.

Range — Preangerian: NT (basal Menkrawit Beds: L.114; Lower Menkrawit Beds: L.386, L.391; Tl).

Rhinoclavis (Proclava) karangensis (Martin, 1899)

Material — RGM 312 135; four small and damaged specimens.

Range — Preangerian to Quaternary: Ta - NT (Kari Orang; Tjilintung/ Tjiangsana) - P - N - Q.

Rhinoclavis (Proclava) leupoldi (Beets, 1941)

Material — RGM 312 136; a specimen mentioned in the original description of the species.

Range — Early Miocene to Preangerian, Neogene: R - Rr (Ra) - NT (basal Menkrawit Beds: L.114; Gelingseh Beds: Gel; Tl) - N (Mandul, mixture of fossils).

Cerithium (Ptychocerithium) cf. *C. (P.) rude* Sowerby, 1840

Material — RGM 312 137; a juvenile specimen is available.

Range — Early Miocene to Preangerian: R - Rr (Ra, Tsk) - UG (Quilon, Sind, Katchiawar, Kutch) - NT (Gelingseh Beds: Loc. 144, Rutten).

Comments — The specimen from the Mentawir Beds was carefully compared with the early parts of the spires of both *C. progoense* (Martin, 1916) from the

basal Menkrawit Beds (Beets, 1941, p. 52, pl. 2, figs. 95 - 98) and typical representatives of *C. rude* from Rembang (Pannekoek, 1936, p. 54, pl. 3, fig. 35), Api Api and Tandjung Sepada Ketjil; see also Dey (1962, p. 61, pl. 5, figs. 11, 19). The whorls of the Mentawir specimen are characteristically flattened adapically as in *C. rude,* but its sculpture is a little more like that of *C. progoense.* The bias is in favour of *C. rude* but unfortunately the specimen is too immature to render the identification safe.

Gemmula (Gemmula) granosa woodwardi (Martin, 1884)

Material — RGM 312 138; two reasonably well preserved specimens and two fragments.

Range — Early Miocene to Pliocene, Neogene: R - Rr (Rm, Rl) - K - UG (Assam) - NT (Mandul; Gelingseh Beds: Loc. 144 and Loc. 156, Rutten; Mk; West Borneo; Tjikao; Lower Palembang Beds) - UM (Dingle Formation, Panay) - P - N.

Gemmula (Gemmula) imitatrix (Martin, 1916)

Material — RGM 312 139; a single not well preserved specimen.

Range — Early Miocene to Quaternary: W - Nj - Ta - NT (basal Menkrawit Beds: L.114; Lower Menkrawit Beds: L.386; Upper Menkrawit Beds: L.745, L.746; Gelingseh Beds: Gel, Loc. 144, Rutten; Kari Orang; Gunung Madupar, Rutten and Wanner) - UM (Antjam Beds: L.751) - M - P - Q.

Nucula (Nucula) njalindungensis Martin, 1919

Material — RGM 312 140; some damaged valves and fragments are available.

Range — Preangerian: Nj - NT (basal Menkrawit Beds: L.114; Gelingseh Beds: Gel, Sa; Tl; Gunung Madupar, Rutten and Wanner).

Comment — The species is so characteristic that the identification appears quite safe.

Corbula solidula Hinds, 1843

Material — RGM 312 141; some well preserved specimens.

Range — Early Miocene to Recent: Rr (Rl) - NT (Mandul; basal Menkrawit Beds: L.114; Gelingseh Beds: Gel, Sa; Tl; Gunung Mendong; Sekurau; Gunung Madupar, Rutten and Wanner) - P (Sungai Busu near Bontang, E. Borneo: unpublished) - N (New Guinea, Shell coll., unpublished) - Re.

Comment — The writer is not aware of any previous fossil records of this small species. It is at present available from a fair number of localities (Sumatra - Borneo - New Guinea) which fit in nicely with its Recent distribution.

Age determination

The molluscan fauna is obviously much too small for an age determination based on the percentage of living species, this method being ruled out from the onset. The composition of the fauna however seems to preclude a Westprogo or Rembang age, while the combined ranges of the species appear to give more satisfactory hints as to the probable age of the assemblage.

The distribution of the species, as far as the factual records are concerned, is as follows:

Recent	: 2
Quaternary	: 3
Pliocene	: 5
Late Miocene	: 2
Preangerian	: 9
pre-Preangerian	: 6

Taking into account the actual time ranges of the species we obtain the following picture (Table 3).

Table 3. Time range of the molluscs from the Lower Mentawir Beds.

	pre-Preangerian	Preangerian	UM	P	Q	Re	
	———	———	———	———	———	———	2
	———	———	———	———	———		1
	———	———	———	———			1
	———	———					2
		———					2
		———	———	———	———		1
(a)	6	9	5	5	4	2	(9 species)
(b)	3	6	2	2	1	0	(6 species)

(a) Number of species recorded in each zone.
(b) Ditto, when disregarding the three longest ranging species.

From the above distributions, although representing no more than nine species, it seems to follow that the age of Rutten's locality Sg. Mentawir may well be Preangerian. At any rate, all species occur in formations of Tf3 age (which is more than can be said of Tf1 - 2), *Nucula njalindungensis,* a very characteristic species, even exclusively. So does *Cerithium bayeri,* but this species has been recorded too rarely to carry much weight in this respect. In both cases, moreover, too much stress can easily be laid on the presumed stratigraphic ranges of species, as has been pointed out repeatedly by K. Martin and others who, except for a few isolated cases, refrained from designating index fossils from among the Indonesian Neogene Mollusca. On the basis of combined ranges of the nine species involved, anyway, it is most tempting to assign a Preangerian age to Rutten's type locality in the Mentawir Beds s.str. which up to now have been fairly consistently considered as Tf2.

A similar case was published by the present writer concerning the likewise small Batu Panggal fauna from Samarinda (Beets, 1950a). This fauna derives from deposits called Prangat Beds, an obsolete name for a part of the Pamaluan Beds customarily referred to as Upper Te but which to all appearances

had to be updated to "Young Miocene", presumably Tf3, and again tentatively, to a level approximately corresponding to the Mentawir Beds s. str. This conclusion was to a certain extent supported by the presence, as recorded for the first time by F.G. Keyzer (in Beets, 1950a, p. 280), of *Lepidocyclina (Nephrolepidina) epigona* Schubert, 1911, a species pointing at Tf instead of Te. The Batu Panggal fauna likewise shows striking relationships with the Njalindung/Tjilanang Beds and, as may be repeated here, "Umbgrove has stressed similar features shown by a coral fauna containing no more than 8 species, from Leupold's locality 114 (Umbgrove, 1929, p.54). His conclusions and age identification were fully confirmed by the examination of the mollusca of the same fauna (Beets, 1941)" (Beets,1950a, p. 278).

We should now consider the findings drawn from the examination of the Larger Foraminifera. Here, as above, it should be noted that no carefully measured section of the Mentawir Beds has been published, and neither the stratigraphic level indicated of the locality presently under consideration. Consequently, all we can do is try and determine the age of the locality, not that of the whole formation involved.

Starting with Leupold & van der Vlerk's resumé (1931, p. 619 and overall correlation table), Rutten's locality being especially mentioned, the Lower Mentawir Beds were considered equivalent with the Lower Balikpapan Beds and, in a restrictive sense, called Mentawir Beds s. str., classified as Tf2. The overlying Upper Balikpapan (or Gelingseh) Beds were assigned to Tf3.

Subsequently, van Bemmelen (1949, pp. 136 - 137) stated that according to W.A. Mohler, Tf in East Borneo could not be subdivided by means of Larger Foraminifera into more than two stages, the top of the lower one, Tf1, corresponding to the top of the *Lepidocyclina*-bearing deposits (see however below), and the overlying sediments, Tf2 - 3, being called "Upper part of Tf". Van Bemmelen here inserted the remark that in Java, *Lepidocyclina* and *Miogypsina* — precisely, it is to be noted, the combination known from Sg. Mentawir — occur "at least" (?) up to the top of Tf3. The truth of his cautionary footnote seems to be borne out also, unless some serious misunderstanding is involved, by Mohler's correlation table (van Bemmelen, 1949, pp. 138 - 139), both columns 3 and 4 showing the presence of the couple *Lepidocyclina/Miogypsina* above Tf1.

According to Mohler's column 5, the whole of the Balikpapan Beds would correlate with Tf2 and a little of Tf3 (somewhat confusingly so, considering the statement that Tf2 and Tf3 could not be distinguished from one another), whereas the rich molluscan fauna (shortly to be published by the present writer) from the lower portion of the Gelingseh Beds (Upper Balikpapan Beds) overwhelmingly supports a Preangerian age, Tf3, in accordance with Leupold & van der Vlerk's classification, as do, moreover, the corals examined by Gerth (1923, p.41). Consequently, taking into account also the many discrepancies in interpretation of Larger Foraminifera, the writer opts for reinstating the Upper Balikpapan Beds as Tf3.

Considering on the other hand the lower portion of the Balikpapan Beds succession, the admittedly small molluscan assemblage of Sg. Mentawir with strong Preangerian affinities and therefore probably not appreciably older than the fauna of the Lower Gelingseh Beds mentioned above, appears to update, in the writer's opinion at least, some as yet unknown part of the Lower

Balikpapan Beds to Tf3 as well. This would not necessarily be at variance with the alleged range of *Lepidocyclina sumatrensis* var. minor as opposed to the other Larger Foraminifera recorded.

Remarks on the age of the basal Menkrawit Beds, Mangkalihat

Considering the correlation problems discussed in the previous chapter it seems appropriate to add here some comments, long overdue as they are, on evident omissions or misstatements — and consequent confusion — concerning the age determination of the fauna from Leupold's locality L.114. From this locality, situated in the transition between uppermost Taballar Limestone and overlying basal Menkrawit Beds in the type section outcropping along the Sungai Menkrawit, the writer described a rich molluscan fauna (Beets, 1941), the age of the Menkrawit Beds having previously been considered Tf3 (van der Vlerk, 1929; Leupold & van der Vlerk, 1931). The writer's dating of the fauna as being intermediate between the Javanese Njalindung and Tjilanang faunas was perhaps, as realized since, cutting it too fine, but even after repeated revisions of species he still confidently adheres to a Preangerian age, the overall composition and ranges offering ample evidence that such is the case.

However, what appears to have escaped the attention of other geologists, chiefly van Bemmelen (1949, p.141) who devoted a special section to the problems involved, and more recently also T. Shuto (1975, p. 293), is that the corals of L.114 too, according to Umbgrove (1929, pp. 54 - 55) show remarkable affinities to Javanese Preangerian faunas (see previous chapter, Batu Panggal). Umbgrove's conclusions were fully incorporated in the present writer's argumentation (Beets, 1941, p.187). Consequently, on both counts the writer cannot but adhere to a Tf3 age of the basal Menkrawit Beds.

Unfortunately, Umbgrove later (1946, p.24) reclassified the coral fauna from L.114, this time confusingly quoted as a fauna of the Taballar Limestone (and erroneously located in Java), as Tf1, basing this opinion on the presence of 11% of living forms, thus seemingly completely disregarding his earlier conclusions concerning the composition of the fauna and range of its species, both of which do not tally with a Westprogo age at all. It is hard to believe that Umbgrove thus revoked his original conclusions (and without any reference to these) by means of the controversial percentage method, misapplied to a small fauna, and one of reef corals at that: it may be recalled here that Gerth (1931, pp. 148 - 149) stressed the danger of applying the percentage method to reef corals. Umbgrove's latest opinion was quoted by van Bemmelen (1949, pp.95, 141), who evidently was unaware of the background data.

The matter becomes even more complicated when taking into account Mohler's correlations dating from 1943, as communicated by van Bemmelen (1949, p. 138, column 4). According to Mohler the Menkrawit Beds should be regarded as Tf1. However, Shell subsequently claimed that both Tf1 and Tf2 - 3 were involved (Marks, 1956, p. 97).

Obviously, correlation more often than not involves a number of debatable points and the writer's personal experience with both Larger Foraminifera and Mollusca, age indicators each in their own right, made him feel that the one group is hardly more rewarding than the other if it comes to age determination of a certain precision, so that he is generally not prepared to rely overmuch on stratigraphical results obtained from the study of any one of these groups exclusively. Whatever may condition our thinking, the somewhat bitter truth is that both Mollusca and Larger Foraminifera are to a large extent susceptible to facies conditions, while also showing different rates of evolution. Again, the feeling persists that in many cases too much reliance has been attached to the ranges, or rather presumed ranges of so-called guide fossils, sometimes even to the all but complete exclusion of the overall stratigraphic distribution of fossil assemblages. One certainly should keep one's weather-eye open when encountering such apparent discrepancies as noted above.

If however, as in the present case, both such divergent elements as a very large molluscan fauna and accompanying reef corals in splendid unison point at a Preangerian age, the question may be asked whether or not the Larger Foraminifera are perhaps at fault, by apparently showing a different stratigraphic distribution in Borneo from that in other regions, notably Java. After all differences in range of the Foraminifera in the various sedimentary sequences of East Borneo itself have been observed time and again, the stratigraphy of Mangkalihat in particular being very complicated into the bargain. Also, matters of identification are involved, as they invariably are (compare the determinations listed by van der Vlerk and Marks). Finally, there is the consideration that the Taballar Limestone was formed over a submarine high and although no stratigraphic break has been reported from the area of the type section discussed here, there is at least a theoretical chance that the transition to the Menkrawit Beds may conceal one or more disconformities, while the possibility of reworked fossils should be looked into as well. The Mollusca from L.114 do not offer evidence of this but then they undoubtedly were newcomers to an environment which prior to their settling could not have fitted them at all (compare Beets, 1941, pp. 172 - 178). Research on the subject should be assiduously continued and so it is to be hoped that the transition between Taballar Limestone and Menkrawit Beds will someday be carefully restudied and resampled.

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