32. The Trilobite Provinciality of the Tethys Sea in the Cambrian Period

By Teiichi KOBAYASHI, M. J. A.

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The Cambrian Tethys Sea is here understood as the northern seas of the Peri-Gondwana belt. In the early Cambrian period there were the Mediterranean subprovince in the west and the Zagros-Himalayan subprovince in the east of the Redlichian province (1987). In the latter *Redlichia* was most characteristic of its fauna as represented by *Redlichia noetlingi*, *R. chinensis* and *R. nobilis* which are found in the Zagros Mountains in South Iran, Salt Range in Pakistan and Spiti in the Himalayas.

The former subprovince can be distinguished from the latter by such endemic genera as follows:

- *Redlichops* in the Dead Sea Region,
- *Sardoredlichia*, *Nebidella*, *Bornemannaspis* and *Iglesiella* in Sardinia, Italy and
- *Galloredlichia* in the Montagne Noire, South France.

Spain and Morocco are the contact areas of the Redlichian province with the Olenellian province. *Realaspis* and *Perrector* in Spain, *Pareops* and *Clariodia* in Morocco and *Lemdadella* of these two areas are indigenous redlichid genera. The Vila Boim fauna in Portugal devoid of redlichids belongs to the Olenellian province (Teixeira, 1952). *Redlichia (?)* sp. indet. is reported to occur in Mauritania to the South of Morocco (Poulsen, 1960).

In the Asiatic continent there were the Himalayan geosyncline in the South and the Mongolian geosyncline in the North during the Palaeozoic era. *Kapingaspid* Chang, 1965 from Sinkiang is an endemic redlichid in the latter geosyncline.

In the Khobdo region, Western Mongolia *Eccaparadoxides oelandicus*, *E. insularis* and *E. mongolicus* show that the Paradoxian sea transgressed easterly as far as Central Asia in the early Middle Cambrian age (Dumicz, Tomozykowa and Wojcik, 1970). Likewise, *Paradoxides (Eccaparadoxides) remus*, *P. (E.) cf. pradoanus* and *P. (s.l.) pentagonalis*, n. found in the Sosinsk Formation in Southeast Turkey (Dean, 1982) reveal the easterly extension of the Bohemian-Mediterranean sea in the Middle Cambrian period.

*Pardaihania*, *Solenopleuropsis* and *Chelidonocephalus* are three Mediterranean genera. The former two are found in Southeast Turkey. The last reached as far as Iran (King, 1937) and probably died out with *Chelidonocephalus ? (Farsia)* in Afghanistan at the beginning of the Upper Cambrian age (Wolfart, 1974).

*Hundwarella* Reed, 1934 was founded on *H. personata* from Kashmir. *H. haimantensis* (Reed) is the key to the Trilobite Horizon 6 at the top of the Parahio series in Spiti. This genus is well represented in the *Manchuriella* beds in the Changpoung series on the Yunnan-Tonkin border (1944). As pointed out already (1955), *Anomocarella (Entorachis) memor* Reed from the Trilobite Horizon 5 is closely related to *A. (E.) brevifrons* from South Korea. These
Middle Cambrian faunas containing *Tonkinella* to the East from Kashmir are related to those of Eastern Asia and eastern North America. *Parahiolites* from the Horizon 4 and *Spitiaspis* in limestone conglomerate of Changnu are two endemic genera of the Himalayan fauna.

*Ptychoparia pervulgata* from the Lower *Oryctocephalus* zone (Trilobite Horizon 2) and *Ptychoparia maopoensis* from the Upper *Oryctocephalus* zone (Trilobite Horizon 5) are two similar species both having an occipital spine. Similarly, several species of *Solenoleuropsis* in Spain bear one long nuchal spine or some short ones. Thus similar specialization has occurred in the Ptychopariidae as well as the Solenoleuridae on the two sides of the Tethys suggest their parallel adaptation under the similar environment. In short the Middle Cambrian trilobites from Spiti and Kashmir are related to those of Eastern Asia and the Pacific side, whereas the coeval trilobites of Iran or probably Afghanistan and to the West therefrom are allied to the Mediterranean ones.

As discussed already in this journal (1987b, c), the Damesellidae has appeared near the end of the Middle Cambrian age and sporadically developed explosively at the beginning of the Upper Cambrian age on the west side of the Pacific basin. The Damesellian province is clearly defined by this family. The fauna of the province can be divided into two types, namely, the Kushan and the Para-Kushan types where the former reveals the near-shore facies and the latter the off-shore facies. Along the Peri-Gondwana belt the family is distributed from Queensland, Australia to Iran through Afghanistan. *Blackwelderia* and *Ariaspis* are known from the Surkh Bum area, Central Afghanistan. These two genera occur also in China and Airaspis is restricted in South China to the latest Middle Cambrian of Sichuan, Hunan, and Hubei in the Para-Kushan facies. In North Iran *Drepanura (Spinopanura) erbeni* was described from the Arborz Mountains by Kushan (1972). Subsequently Wittke (1978) called this early Upper Cambrian faunule as the Drepanura-Torifera-Eokaolishania assemblage. It is a little younger than the *Blackwelderia-Ariaspis* faunule and belongs probably to the Kushan type rather than the Para-Kushan type.
In Maloga Karatau, Central Asia, the Damesellidae is distributed in five zones from the Goniagnostus nathorsti zone to the Glyptagnostus stolidotus zone in the Para-Kushan facies. In the further interior of the continent Damesella, Prodamesella, Paradamesella and Bergeronites occur in Tienshan (Zhang Tairong, 1981). It is probable that Drepanura eremita has gone astray as far as Sweden through Central Asia.

As revised in 1967, Iranochuangia and Chuangia in South Iran are two endemic genera intimately related to Paishanian Chuangia. Maladioidella Endo, 1937 (syn. Iranella Hupé, 1953) is a Fengshanian genus. It is accompanied by Saukia and Iranaspis (Tellerina ?). In North Iran the Drepanura zone is followed upward by the Prochuangia-Paracoosia zone and then the Alborsella-Saukia zone where Alborsella is an endemic saukid. It is a remarkable fact that Koldiniella mitella Sivov of the Drepanura zone and Esseigania aff. tolli Kobayashi of the Prochuangia zone suggest the Siberian affinities of the early and later Upper Cambrian fauna of North Iran. Maladioidella is reported to occur in Central Turkey (Shergold and Sdzuy, 1984).

Bergeronites and Prochuangia recently discovered by Feist and Courtessole (1984) in the Montagne Noire warrant that the Kushanian-Paishanian fauna of the Orient reached as far as South Europe. In Spain Colchen (1967) announced the occurrence of Prochuangia and Chuangia in the Sierra de la Damanda. Lately Maladioidella (Colchen’s Prochuangia in part) and Langyashania are found in the basal part and Pagodia (Wittkindtia) (i.e. Colchen’s Prochuangia) in a higher horizon in the Najerilla Formation of the same district (Shergold, Liñán and Palacios, 1988). Langyashania is a member of the Shirakiellidae typical of the Daizanian-Fengshanian faunas of Eastern Asia. Pagodia is another Oriental genus and Wittkindtia is its subgenus found in Afghanistan. These trilobites are as a whole telling the migration of the Oriental trilobites as far as the Iberian peninsula through the Tethyan sea.

In conclusion it can be said that the Redlichian province was extended from the Himalayas to South France through the Tethyan seas, but near the western terminus the Redlichian sea was confluent with the Olenellian sea. In the Middle Cambrian period on the contrary the Paradoxidian sea flooded as far as Turkey. In the early Upper Cambrian age the Damesellian province was extended to Karatau, Afghanistan and South France, but the family was uninhibited with the Kushanian age. The Oriental trilobites have migrated later through the Tethyan sea as far as the Iberian peninsula in the later Upper Cambrian age.

References


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