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PALAEOWORLD online submission:

<http://ees.elsevier.com/palwor/>

PALAEOWORLD full-text (Volume 15 –) available at:

<http://www.sciencedirect.com/science/journal/1871174X>

TRILOBITE FAUNAL SUCCESSIONS ACROSS THE CAMBRIAN-ORDOVICIAN BOUNDARY INTERVAL IN KOREA

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In Korea, the Cambrian-Ordovician boundary lies within the Choson Supergroup, a thick (1400–2000 m) siliciclastic-carbonate sequence of late Early Cambrian to early Late Ordovician age. The Cambrian-Ordovician boundary has been traditionally placed at the boundary between the Hwajol and Tongjom formations in the Taebaek Group and between the Wagok and Mungok formations in the Yongwol Group (Kobayashi, 1966; Lee, 1987). Recently the global boundary stratotype section and point for the Cambrian-Ordovician boundary has been proposed for the level of the first appearance of the conodont *Iapetognathus fluctivagus* in the section at Green Point, Newfoundland (Cooper and Nowlan, 1999). At present, little information has been known on the conodont assemblages across the putative Cambrian-Ordovician boundary intervals in Korea. On the other hand, recent studies on trilobites were quite successful in documenting previously unknown faunal assemblages in the Upper Cambrian and Lower Ordovician of the Taebaeksan Basin. The Cambrian-Ordovician trilobite faunal successions of the Taebaek and Yongwol groups will be dealt with separately, as their faunal contents are somewhat different from each other.

TAEBAEK GROUP

The Hwajol Formation has been known to comprise the *Prochuangia*, *Chuangia*, *Kaolishania*, *Dictyites*, and *Eoorthis* zones in ascending order (Kobayashi, 1966). The uppermost *Eoorthis* Zone appears to yield trilobites of latest Cambrian age (Kobayashi, 1935), but poor preservation of the material hampers the taxonomic assessment with clarity. The *Pseudokainella* Zone of the Tongjom Formation was assigned to the lower Tremadoc based on the sole occurrence of *Pseudokainella iwayai* (Kobayashi, 1935). The trilobite faunas of the overlying Tumugol Formation has been differentiated into the *Asaphellus*, *Protopliomerops*, and *Kayseraspis* zones (Kobayashi, 1934; Kim *et al.*, 1991). The *Asaphellus* Zone (late Tremadoc) occupies approximately the lower half of the Tumugol Formation and has been known to yield *Asaphellus tomkolensis*, *Asaphellus coreanicus*, *Kainella euryraxis*, and *Hystericurus* sp. The succeeding

Protopliomerops Zone also contains a trilobite fauna of late Tremadoc age, including *Shumardia pellizzarii*, *Apatokephalus octopoides*, *Dikelocephalina asiatica*, *Protopliomerops seisonensis*, *P. punctatus*, and *Seisonia sphaericauda*. The overlying *Kayseraspis* Zone may be assignable to the Arenig and has been known to yield *Hystricurus megalops*, *H. eurycephalus*, *Kayseraspis laticauda*, *Iliaenus hinomotoensis*, *Dikelocephalina asiatica*, *Chosenia laticephala*, *Koraipsis spinus*, and *Asaphopsoides nakamurai*.

Recently Lee and Choi (2001) reported the occurrence of sauikiid-dominated and kainellid-dominated trilobite assemblages from the transitional interval across the Hwajol and Tongjom formations. Of note is the discovery of *Yosimuraspis*, an earliest Ordovician trilobite endemic to Korea and China. The presence of *Yosimuraspis* in the Taebaek Group helps to clarify the Cambrian-Ordovician boundary in the area, but also supports the paleogeographic model that during the early Paleozoic the Taebaeksan Basin was connected through contiguous shallow waters to the Sino-Korean block.

YONGWOL GROUP

The *Pseudoyuepingia asaphoides* Zone of the Machari Formation was the youngest Cambrian zone recognized in the Yongwol Group, until Sohn *et al.* (2000) reported the occurrence of a *Fatocephalus*-dominated fauna from the Osangchon area. The upper part of the Machari Formation and the overlying Wagok Formation are in general poorly fossiliferous. The stratigraphic position of the *Fatocephalus* fauna is still unclear, but apparently provides the first biostratigraphic reference point for the uppermost Cambrian interval in the Yongwol Group. The fauna is dominated by *Fatocephalus hunjiangensis*, constituting more than 60% in abundance. Other species include *Micragnostus* sp., *Pseudorhaptagnostus* sp. cf. *P. kantauensis*, *Koldinioidia* sp., *Hysterolenus* sp., and *Amzasskiella* sp.

The *Yosimuraspis* Zone, of earliest Ordovician age, occurs in a very narrow stratigraphic interval at the basal part of the Mungok Formation. The *Yosimuraspis* Zone consists predominantly of *Yosimuraspis vulgaris* together with less common *Jujuyaspis sinensis*, *Elkanaspis jilinensis*, and pliomereid gen. and sp. indeterminate (Kim and Choi, 2000a). The occurrence of *Jujuyaspis* is significant, as the genus has a very narrow stratigraphic range within the basal Tremadoc and provides a basis for correlating the *Yosimuraspis* Zone with other parts of the world. The succeeding *Kainella* Zone has been recognized from the lowermost bed of Chommal Member of the Mungok Formation (Kim and Choi, 2000b). It comprises *Kainella euryrachis*, *Leioestegium* sp., and agnostid gen. and sp. indeterminate. The *Shumardia* Zone occurs in a relatively thick stratigraphic interval, occupying the lower two-thirds of the Tumok Member of the Mungok Formation. It contains nine trilobite species: *Micragnostus coreanicus*, *Shumardia pellizzarii*, *Apatokephalus hyotan*, *Hystricurus* sp. cf. *H. megalops*, *Dikelocephalina asiatica*, *Asaphellus* sp., *Hukasawaia cylindrica*, *Koraipsis spinus*, and pliomereid gen. and sp. indeterminate (Kobayashi, 1960; Kim and Choi, 2000b). The *Shumardia* Zone is dated as late Tremadoc.

An early Arenig fauna was recently recovered from the Yongwol Group in the Tanyang area (Choi, 1998). The fauna is composed of trilobites (mostly *Kayseraspis* sp. cf. *K. laticauda* and *Asaphopsoides maepoensis*), bellerophonoid gastropods and ostracods, and is correlated with the *Kayseraspis* Zone of the Tumugol Formation.

CORRELATION

Although the sauikiid-dominated fauna of the Taebaek Group has not been studied in detail yet, the fauna may be comparable to the uppermost Cambrian *Mictosaukia* Zone of North China (Zhou and Zhang, 1985). The *Fatocephalus* fauna of the Yongwol Group can be correlated with the *Mictosaukia* Zone of North China and *Mictosaukia striata-Fatocephalus* Zone of South China (Peng, 1984). The early Tremadoc *Yosimuraspis* Zone is well represented in North China. *Yosimuraspis* has also been reported from South China (Peng, 1990), which provides the correlation of the *Yosimuraspis* Zone with part of the *Apatokephalops yanheensis-Songtaioia cylindrica* Assemblage Zone of the Yangtze Platform. Recent documentation of *Yosimuraspis* and *Jujuyaspis* in the Bonaparte Gulf Basin of Australia (Shergold, 2000) suggests that Australia also had a close faunal affinity with Korea and North China during the early Tremadoc. Trilobite faunas comparable to the *Kainella* Zone have not been known in China and Australia. Interestingly, both *Kainella* and *Leioptegium* occur in the lower Tremadoc of Argentina and North America, supporting an early Tremadoc age for the *Kainella* Zone of the Taebaeksan Basin. The upper Tremadoc trilobite zones (*Asaphellus*, *Protopliomerops*, and *Shumardia* zones) of the Taebaeksan Basin are dominated by cosmopolitan taxa such as *Asaphellus*, *Protopliomerops*, *Hystericurus*, *Apatokephalus*, and *Shumardia*. On the other hand, *Koraipsis* and *Dikelocephalina* have a relatively restricted distribution in the upper Tremadoc of Korea, China, and Australia. The early Arenig trilobite fauna of the Taebaeksan Basin includes *Kayseraspis*, *Asaphopsoides*, *Iliaenus*, and *Chosenia*. *Kayseraspis* has been mainly reported from the Arenig sequence of Australia, Argentina, and North America, and also from the Tremadoc of North China and Australia. *Asaphopsoides* has been known from the Tremadoc to Arenig of China, Vietnam, Australia, Siberia, and France.

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