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## **CAMBRIAN STRATIGRAPHY OF THE TAEBAEKSAN BASIN, KOREA AND ITS CORRELATION WITH CHINA AND AUSTRALIA**

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The Cambro-Ordovician sedimentary rocks in Korea, which constitute the Choson Supergroup, occur in the Taebaeksan Basin, mid-eastern part of the Korean Peninsula. The lower Paleozoic sediments are shallow marine in origin and consist predominantly of carbonates with lesser amounts of sandstones and shales. The Choson Supergroup ranges from late Early Cambrian to early Late Ordovician in age and has been differentiated into five groups based on distinct lithological successions and geographical distributions: namely, Taebaek, Yongwol, Yongtan, Pyongchang, and Mungyong groups (Choi, 1998). The Taebaek and Yongwol groups are regionally extensive and stratigraphically relatively well understood thanks to the prolific occurrence of trilobites and conodonts, whereas the latter three groups are poorly fossiliferous and thus their stratigraphy is still unclear.

### **TAEBAEK GROUP**

The Taebaek Group is distributed in the eastern half of the Taebaeksan Basin and comprises the Changsan/Myonsan, Myobong, Taegi, Sesong, Hwajol, Tongjom, Tumugol, Makkol, Chigunsan, and Tuwibong formations in ascending order. The lower five formations are attributed to the Cambrian, whereas the upper five are attributed to the Ordovician. The Changsan Formation consists of milky white to light-brown, coarse-grained quartzite with cross-beds and well-rounded gravels. The contemporaneous Myonsan Formation, exposed in the southeastern corner of the Taebaeksan Basin, comprises conglomerate and dark gray sandstone/shale. The Myobong Formation is composed largely of dark-gray to greenish-gray slate, phyllite, and shale with intercalations of sandstone and limestone beds in the middle part. Four biozones were recognized within the Myobong Formation (Kobayashi, 1966); i.e., *Redlichia*, *Elrathia*, *Mapania*, and *Bailiella* zones, ranging in age from late Early Cambrian to early Middle Cambrian. The overlying Taegi Formation is characterized by milky white to light-gray, massive to thin-bedded

limestone and oolitic and dolomitic limestone, and includes the Middle Cambrian *Megagraulos*, *Solenoparia*, and *Olenoides* zones. The Sesong Formation comprises dark gray slate and fine-grained sandstone with thin limestone beds. Two Late Cambrian trilobite zones, *Stephanocare* and *Drepanura* zones, are recognized within the formation. The Hwajol Formation is divided into three members: the lower member is an alternating sequence of limestone and shale, showing banded structures; the middle member is characterized by an alternation of sandstone and limestone beds; and the upper member comprises ribbon rock, marlstone/shale, and limestone conglomerate. Kobayashi (1935, 1966) recognized five Late Cambrian biozones in the Hwajol Formation including the *Prochuangia*, *Chuangia*, *Kaolishania*, *Dictyites*, and *Eoorthis* zones in ascending order.

## YONGWOL GROUP

The Yongwol Group is divided into the Sambangsan, Machari, Wagok, Mungok, and Yonghung formations in ascending order. The lower three formations are assigned to the Cambrian, and the upper two formations are assigned to the Ordovician. The lowermost Sambangsan Formation consists exclusively of clastic sediments, whereas the upper four formations are predominantly composed of carbonates. The Sambangsan Formation consists of purple and green siltstone and shale in the lower part and greenish-gray and yellow, fine-grained, micaceous sandstone in the upper part. Middle Cambrian trilobites, such as *Metagraulos* and *Megagraulos*, occur commonly in the greenish-gray sandstone beds. The Machari Formation yields diverse and abundant Middle to Late Cambrian trilobites with some brachiopods and gastropods (Kobayashi, 1962). The lower part of the Machari Formation comprises dark-gray argillaceous limestone, thick-bedded bioclastic grainstone to packstone, dark-gray dolomitic limestone, shale, and limestone breccia. The middle part is dominated by laminated dark-gray to black shale with occasional intercalations of thin dolomitic limestone beds, and yields diverse trilobites of Late Cambrian age. The upper part is an alternating sequence of light-gray dolomitic limestone and laminated black shale beds, but is poorly fossiliferous. The *Tonkinella* Zone at the basal part of the formation is assignable to the middle Middle Cambrian and the occurrence of *Lejopyge armata* suggests an uppermost Middle Cambrian age (Hong *et al.*, 2000). The abundant occurrence of Late Cambrian trilobites in the middle part allows the recognition of eight biozones, namely the *Glyptagnostus stolidotus*, *Glyptagnostus reticulatus*, *Proceratopyge tenue*, *Hancrania brevilibata*, *Eugonocare longifrons*, *Eochuangia hana*, *Agnostotes orientalis*, and *Pseudoyuepingia asaphoides* zones in ascending order (Lee, 1995). The Wagok Formation is a thick sequence (up to 250 m thick) of light-gray to gray massive dolostone, and is assigned a latest Cambrian based on the occurrence of trilobites and brachiopods (Kobayashi, 1966). Recently an uppermost Cambrian trilobite fauna dominated by *Fatocephalus* has been documented from the Wagok (?) Formation at Osangchon (Sohn *et al.*, 2000).

## CORRELATION

Trilobites are among the most abundant fossil groups in the Cambrian of Korea. To date, no Cambrian trilobite species of the Taebaek Group have been known to occur in the Yongwol Group (Kobayashi, 1966). These contrasting faunal contents resulted in two separate biostratigraphic schemes for the lower Paleozoic of Korea (Kobayashi, 1966; Fig. 1). Figure 1 summarizes the up-to-date stratigraphy of the Taebaek and Yongwol groups, and provides correlation with China and Australia.

The earliest biozone recognized in the Taebaeksan basin is the *Redlichia* Zone of the Myobong Formation, which is underlain by the unfossiliferous Changsan/Myonsan Formation of the Taebaek Group. The genus *Redlichia* has been employed as a zonal taxon for the upper Lower Cambrian (Longwangmiaoan) of China and lower Middle Cambrian (Ordian/early Templetonian) of Australia. The Middle Cambrian trilobites of the Taebaeksan Basin are not numerous except in the *Solenoparia* and *Tonkinella* zones. Most of these Middle Cambrian faunas have not been studied in detail yet, and thus their correlation with Chinese and Australian

AGE		YONGWOL		TAEBAEK		NORTH CHINA	SOUTH CHINA	AUSTRALIA
		Formation	Biozone	Formation	Biozone			
C A M B R I A N	Late	Wagok	<i>Fotocephalus</i>		<i>Eoorthis</i> <i>Dictyites</i>	Fengshanian	Taoyuanian	Datsonian
					<i>Kaolishania</i>			Payntonian
		Machari	<i>P. asaphoides</i> <i>A. orientalis</i> <i>E. hana</i> <i>E. longifrons</i> <i>H. brevilimbata</i> <i>P. tenue</i> <i>G. reticulatus</i> <i>G. stolidotus</i>	Hwajol	<i>Chuangia</i> <i>Prochuangia</i>	Changshanian		Iverian
				Sesong	<i>Drepanura</i> <i>Stephanocare</i>	Kushanian	Youshanian	Mindyallan
	Middle		<i>L. armata</i>	Taegi	<i>Olenoides</i> <i>Solenoparia</i> <i>Megagraulos</i>	Changian	Wangcunian	Boomerangian Undillan
			<i>Tonkinella</i>					
		Sambangsan	<i>Megagraulos</i> <i>Metagraulos</i>	Myobong	<i>Bailiella</i> <i>Mapania</i> <i>Elrathia</i> <i>Redlichia</i>	Hsuchuangian		Floran/ Late Templetonian
						Maochuangian		
						Lungwang-miaoan	Lungwang-miaoan	Early Templetonian/ Ordian
	Early			Changsan				
							Tsanglangpuan	
							Chiungchussuan	
							Meishucunian	

Fig. 1. Stratigraphic summary of the Yongwol and Taebaek groups, Korea and correlation with the Cambrian sequences of China and Australia.

ones have to be explored. On the other hand, the Upper Cambrian trilobite faunas of the Taebaek and Yongwol groups are well known and show close affinities with the Hwangho (North China) and Jiangnan (South China) faunas, respectively (Kobayashi, 1967). In particular, the occurrence of cosmopolitan Late Cambrian trilobites in the Machari Formation provides a refined biozonation (Lee, 1995), part of which can be traced to South China (Peng, 1992), Australia (Shergold, 1980, 1982), Kazakhstan (Ergaliev, 1980), and North America (Pratt, 1992). The paucity of pandemic fossils in the uppermost Cambrian sequence in Korea does not allow reliable correlation with other parts of the world.

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