

GEOLOGIC COLUMN AND DESCRIPTION: MANCHURIAN SEQUENCE ONLY

AGE	ROCK UNIT	LITHOLOGY, THICKNESS WHERE KNOWN	REMARKS
CENOZOIC	Recent alluvium	Sand, gravel, and clay; 1 to 5 m thick	Alluvium, composed of sand, gravel and clay; includes terrace deposits along rivers.
	Pleistocene basalt	Olivine basalt, volcanic ash and sand	The youngest olivine basalt occurs in association with volcanic ash, sand, and bombs, and constitutes the dead volcanos near Kuan-tien (宽甸).
MESOZOIC	Quartz porphyry	Quartz porphyry and orthophyre	Porphyries occur as dikes or intrusive sheets; orthophyre near Sai-ma-chi (赛马集) is intruded into the Jurassic coal-bearing beds.
	Diorite	Diorite and porphyrite	Diorite and porphyrite occur as dikes and stocks in granite, gneiss, and other formations; a copper deposit (Wan-pao-kai-tzu (万宝盖子) mine) near Ta-ching-kou (大青沟) on the north bank of the Yalu River occurs in close relation with diorite intrusion.
	Cretaceous granite	Granite and porphyritic granite	Mostly biotite granite which is commonly leucocratic and coarse-grained; locally it grades into porphyritic granite which contains large phenocrysts of pink orthoclase. Near Hun-chiang-kou (浑江口), the granite cropping out along the Yalu River is intruded into the Cretaceous formation (Mk <sub>2</sub> ) and can be correlated to the granite of the Upper Cretaceous Bukkokuji series of Korea.
	Cretaceous formation	Andesite, andesitic tuff, tuff breccia in the upper part; tuffaceous sandstone and shale in the lower part; approximate thickness 1,000 m	The upper part (Mk <sub>2</sub> -a) mainly consists of andesite, andesitic tuff and tuff-breccia, interstratified with some tuffaceous sandstone and shale; the lower part (Mk <sub>2</sub> ) consists of alternating beds of tuffaceous sandstone and shale, with some volcanic rocks which occur with greater frequency higher in the column.
	Jura-Cretaceous formation	Sandstone, shale, some conglomerate; thickness more than 700 m	Alternating beds of green sandstone and green- to pale-brown shale, with some conglomerate and agglomerate; contains only fragmental fossil plants. The corresponding formation across the Yalu River, near Sinuiju (新宾州) in Korea, contains such fossils as <i>Lycoptera</i> , <i>Estheria</i> , <i>Cladophlebis</i> , and <i>Sphenopteris</i> , giving a range in age of Upper Jurassic to Lower Cretaceous.
	Jurassic formation	Conglomerate and tuffaceous sandstone; approximate thickness 150 m Sandstone, shale, and coal; approximate thickness 100 m	Thin alternating beds of conglomerate and tuffaceous sandstone. Coal-bearing beds crop out around Sai-ma-chi, intercalated within sandstone and black shale. Fossil plants from the coal seams have been identified as <i>Schizoneura</i> , <i>Todites</i> , <i>Ctanis</i> , and <i>Ginkgo</i> .
	Ordovician formation	Limestone, dolomite and marl in the upper part; crystalline dolomite and collenia limestone in the lower part; approximate thickness 600 m	Thick black limestone, associated with dolomite and marl, rests disconformably upon the upper series of the Cambrian; <i>Actinoceras</i> and <i>Maclurea</i> are the common animal fossils. The so-called <i>Collenia</i> -bed, a limestone characteristic with large-sized <i>Collenia</i> usually occurs near the base.
	Cambrian formation	Limestone in the upper part; shale and sandstone in the lower part; approximate thickness 500 m	The Cambrian formation in the map area can be divided into three parts. The upper part is mostly limestone, including vermicular limestone and bedded limestone with some dolomite and marl; fossils include <i>Illae-nurus</i> . The middle part consists of green shale, black limestone and oolitic limestone; fossils include <i>Lingulella</i> and <i>Obolus</i> . The lower part is characterized by red shale associated with green micaceous sandstone; fossils include <i>Redlichia</i> and <i>Ptychoparia</i> .
LOWER PALEOZOIC	Upper Precambrian formation (Sinian system)	Quartzite, siliceous slate, and marly shale; thickness ranges between 300 and 500 m	The upper Precambrian formation (Sinian system) in the map area consists exclusively of the so-called Heiho (红河) series which occurs almost everywhere in the sequence, from lower to upper: Tiaoyutai (豹峪台) quartzite, Nanfen (南芬) shale (red and green marly shale), and Chiaotou (豹头) quartzite (quartzite and siliceous slate). This series corresponds strikingly to the lower half of the Yotoku series which is considered lower Cambrian in Korea. The bedding planes of the quartzite show ripple marks and sun cracks.
	Pre-Sinian gneiss	Granite gneiss and migmatite gneiss	The mica schist of the middle Precambrian (see pGn below) gradually grades downward into migmatitic and quartz-dioritic gneisses which consist of quartz, oligoclase, and micas, with or without orthoclase. Where the rock becomes more granitic, it is closer to leucocratic, and microcline and orthoclase increase. These gneisses are commonly intruded by another schistose granite which is characterized by predominance of microcline. Along the bank of the Suiho Reservoir, the gneisses seem to become more paragneissic, and not rarely contain large crystals of garnet.
	Middle Precambrian formation (Lioho system)	Mica schist, amphibole schist, graphite schist, crystalline dolomite, and gneisses; magnesite deposits; thickness more than 4,000 m	The middle Precambrian formation (Lioho system) consists mostly of crystalline schist and crystalline dolomite. The crystalline schist shows various grades of metamorphism ranging from chlorite-sericite schist to garnet-sillimanite-mica schist or gneiss and staurolite-garnet-mica schist or gneiss. Magnesite deposit on a small scale occurs in association with dolomite, west of An-tung (安图), north of Feng-cheng (凤城), and in the vicinity of Ta-hsi-cha (大西岔) about 30 km northeast of the Suiho Dam on the Yalu River.

(COLUMN DRAWN NOT TO SCALE)

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