GEOLOGIC COLUMN AND UNIT DESCRIPTION

AGE	ROCK UNIT	LITHOLOGY; THICKNESS WHERE KNOWN
QUATERNARY	Alluvium (Qal)	Sand, clay and gravel; thickness less than 10 meters
	~~UNCONFORMITY~~~~~~~~~~	
TERTIARY	Neogene formation (Tu)	Sandstone, clayey shale, lignite, bentonite and gravel; thickness unknown
	~~UNCONFORMITY~~~~~~~~~~	
MESOZOIC	Cretaceous andesite (MK)	Andesite, basalt, andesite porphyry, diorite porphyry and pyroclastics
	~~EFFUSIVE CONTACT~~~~~~~~~~	
	Jurassic-Cretaceous formation (MJK)	Clay shale, clay slate, sandstone, conglomerate and marl; thickness unknown
	Jurassic formation (MJ)	Clay shale, clay slate, sandstone, conglomerate and coal; thickness unknown
	~~UNCONFORMITY~~~~~~~~~~	
----------	Pre-Jurassic granite (γg2)	Biotite-hornblende granite, gneissose granite, aplite, granodiorite, diorite and quartz diorite
	Granite gneiss (γgn)	Biotite-hornblende granite gneiss
	~~INTRUSIVE CONTACT~~~~~~~~~~	
PALEOZOIC	Devonian formation (Pmd)	Limestone, clay slate, mudstone, marl and schist; thickness unknown
	Silurian formation (Pms)	Limestone, marl, sandstone, shale and phyllite; thickness unknown
	----------RELATION UNKNOWN----------	
	Paleozoic(?) crystalline schist (Psch)	Crystalline schist, quartzite and slate; thickness unknown

(Column not drawn to scale)

U N I T D E S C R I P T I O N

Alluvium, consisting of sand, clay and gravel, is distributed in the drainage basins of the Amur River and its tributaries such as the Hu-ma Ho [呼瑪河] and the Zeya River, and covers low terrace remnants and flood plains. The Amur River forms a narrow meandering gorge with cliffs 20 - 40 m in relative height.

The Neogene formation widely covers the hilly land between the Amur and the Zeya rivers. It rests unconformably upon the Paleozoic, Jurassic and Jurassic-Cretaceous formations, pre-Jurassic granite and Cretaceous andesite and is defined by Soviet geologists as a Pliocene continental deposit. It consists of white, reddish yellow or reddish gray rough porous soft sandstone, dark brown to black clayey shale, lignite, bentonite and gravel. The shale and lignite beds, 0.3 - 1 m thick, are interbedded in the sandstone at 2 to 3 m intervals. The formation is generally stratified horizontally, forming cliffs in places along the Amur River. A light blue smoke rises from several holes in the sandstone in the cliff north of Soldatka along the Amur River. The smoke has been seen for the last 300 years according to Russian records. It may be due to spontaneous combustion of the low-grade lignite.

Cretaceous andesite near Ts'ao-ti-ying-tzu [曹地営子] occurs as flows resting upon the pre-Jurassic granite, and is overlain by the Neogene formation. It consists chiefly of andesite in association with basalt, andesite porphyry, diorite porphyry and pyroclastics. The unit is defined by Soviet geologists as the Upper Cretaceous intermediate and basic effusive rocks.

The Jurassic-Cretaceous formation in the northern part of the map area consists of clay shale, clay slate, sandstone, conglomerate and, locally, marl. The formation is overlain by the Neogene formation and rests conformably on the Jurassic formation. It is defined by Soviet geologists as Upper Jurassic to Lower Cretaceous in age.

The Jurassic formation along the Amur and the Zeya Rivers is a continental deposit consisting of clay shale, clay slate, sandstone and conglomerate, locally intercalated with some coal seams. The formation near Chernyayevo and Kuznetsovo along the Amur River and and near Ust'-tygda along the Zeya River is fossilliferous, yielding many remains of ferns and conifers. The fossils collected by IVANOW, SCHMIDT and others from the formations of the map area and other localities west of longitude 126° E (refer to sheets "I-hsi-ken-ho", NN 51-12, and "Magdagachi", NN 51-9) were listed by GRABAU (1928) as follows:

FILICES	CYCADEACEA	CONIFERAE	ABIETINAE	EQUISETACEA
Thyrsopteris prisca (Eichw.)	Cycadites gramineus	Phoenicopsis speciosa Hr.	Pinus (Pityophyllum)	Equisetum sp.
Dicksonia concinna Hr.	Anomozamites (Nilssonia) schmidti Hr.	Ph. latior Hr.	nordenskiöldi Hr.	
D. saportana Hr.	A. acutilobus Hr.	Ph. angustifolia Hr.		
D. longifolia Hr.	A. angulatus Hr.	Baiera longifolia (Brgn.)		
D. glehniana Hr.	Pterophyllum helmersianum Hr.	B. pulchella Hr.		
D. acutiloba Hr.	Pt. seminovianum Hr.	B. palmata Hr.		
Adiantites schmidtianus Hr.	Podozamites lanceolatus (L. & H.)	Ginkgo flabellata Hr.		
A. amurensis Hr.	P. var. intermedius	G. sibirica Hr.		
Asplenium whitbiense Brngn.	P. var. eichwaldi Schpr.	Czechanowskia rigida Hr.		
A. var. tenue Brngn.	P. var. distans			
A. (Cladophlebis) argutulum Hr.	P. var. minor			
A. spectabile Hr.	P. plicatus Hr.			
A. distans Hr.	P. ensiformis Hr.			
Taeniopteris parvula	P. glehnianus Hr.			

The formation near Ou-p'u [鴎浦] is folded in a NNE direction, and the formation near Huai-jou-chan [懐柔站] is folded in an E-W direction.

Pre-Jurassic granite is sporadically exposed along the Amur River, the Hu-ma Ho and their tributaries. It intrudes as a batholith and laccoliths into the Middle Paleozoic formation. The age of intrusion is probably between early Paleozoic and pre-Jurassic. Soviet geologists defined it as Paleozoic. The rock is light gray, reddish gray or reddish green, subequigranular, fine- to coarse-grained biotite-hornblende granite, consisting of orthoclase, plagioclase, biotite, hornblende and a small amount of quartz. The granite is locally associated with gneissose granite, aplite, granodiorite, diorite and quartz diorite. The rocks are overlain by the Jurassic formation, the Cretaceous andesite and the Neogene formation, and are intruded by many small low-grade gold-bearing quartz veins of Cretaceous age.

Granite gneiss, forming hills between the Amur River and the Ta-ma-t'i Ho [大馬蹄河], consists chiefly of biotite-hornblende granite gneiss which grades into pre-Jurassic granite. Small masses of granite gneiss occur sporadically within the granite. The rock may be a marginal facies of the pre-Jurassic granite, but was metamorphosed into orthogneiss owing to the post-Jurassic disturbances.

The Devonian formation, consisting of limestone, clay slate, mudstone, marl and schist, is exposed near Amosovo in the U.S.S.R. Available data are very few.

The Silurian formation, consisting of limestone, marl, sandstone, shale and phyllite, is exposed on the bank opposite Ts'ao-ti-ying-tzu.

Crystalline schist in association with quartzite and slate is exposed near Hsin-chieh-chi [新街基]. Due to scarcity of data, it is not known whether it is a Precambrian schist or a Paleozoic metamorphosed schist. According to its lithological resemblance to the Paleozoic formation in the U.S.S.R., it may be a Paleozoic formation which was excessively metamorphosed into crystalline schist by the pre-Jurassic to Cretaceous disturbances.

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