GEOLOGIC COLUMN AND UNIT DESCRIPTION

AGE	ROCK UNIT	LITHOLOGY; THICKNESS WHERE KNOWN	UNIT DESCRIPTION
QUATERNARY	Alluvium	Qal — Sand, clay and gravel; thickness less than 15 meters	Alluvium, consisting of sand, clay and gravel, is distributed in the drainage basins of the Argun River and its tributaries. Except for a broad flood plain 10 km wide in the vicinity of Ch'i-kan [奇乾], the alluvium is distributed along narrow steep valleys surrounded by the Cambro-Ordovician massive limestone, which has been corroded by water containing carbon dioxide. Flood plains less than 3 km wide occur in the granite region of the Ta-hsing-an-ling Shan-mo, where the ground water level is comparatively high.
	UNCONFORMITY		
TERTIARY	Neogene basalt	b_2 — Olivine-augite basalt	Neogene basalt, locally associated with the Quaternary basalt (not shown on map), is exposed on the western bank of the Argun River. It consists of a trap-type olivine-augite basalt, which is defined by Soviet geologists as Quaternary.
	EFFUSIVE CONTACT		
MESOZOIC	Cretaceous granite	g_3 — Granite, granodiorite and quartz diorite	Cretaceous granite intruding the pre-Jurassic granite (g_2) is exposed in the northwestern part of the map area. It includes granodiorite and quartz diorite and was defined by Soviet geologists as Jurassic to Lower Cretaceous acidic intrusives.
	INTRUSIVE CONTACT		
	Upper Jurassic formation	Mju — Sandstone, clay slate and conglomerate; thickness unknown	The Upper Jurassic formation is exposed in the northeastern part of the map area. It rests unconformably on the pre-Jurassic granite and the Precambrian granite gneiss, strikes E, and dips N. It consists of sandstone, clay slate, and conglomerate. The sandstone is dark blue to dark gray, medium- to fine-grained, showing marked jointing. The clay slate is black to blackish brown, having a silky luster on the weathered surface, and shows marked jointing. It is intercalated with lenticular nodules of sandstone. The conglomerate is exposed locally, contains quartz pebbles 5 cm in diameter, and is intruded in places by numerous small quartz veins which are considered the source of placer gold in the neighborhood.
	UNCONFORMITY		
	Pre-Jurassic granite	g_2 — Biotite granite, two-mica granite, hornblende granite, quartz diorite and graphic granite	Pre-Jurassic granite is widely exposed throughout the map area. It consists chiefly of coarse-grained biotite granite, and locally of two-mica granite, hornblende granite, quartz diorite, and graphic granite, which is exposed in a small area along the Pei-erh-tz'u Ho [贝尔次河]. It intrudes the Precambrian and the Lower to Middle Paleozoic formations, and is intruded by the Cretaceous granite and quartz veins. Soviet geologists define it as the Middle Paleozoic acidic intrusives including granite, granodiorite and quartz diorite. It is overlain by the Upper Jurassic formation (Mju) and the Neogene basalt (b_2).
	Diorite	d	Diorite is exposed in a small area near Chu-erh-chien-ts'un [珠尔建村] along the A-pa Ho [阿巴河]. It is considered a marginal facies of the pre-Jurassic granite.
	INTRUSIVE CONTACT		
PALEOZOIC	Undifferentiated Middle Paleozoic formation	Pm — Limestone and phyllitic slate; thickness unknown	The undifferentiated Middle Paleozoic formation consists of limestone and phyllitic slate. It is remarkably metamorphosed by granite intrusion, and yields no fossils.
	Upper Devonian formation	Pmd — Phyllitic slate; thickness unknown	The Upper Devonian formation consists of phyllitic slate.
	Ordovician and Silurian formation	Pms — Limestone and clay slate; thickness unknown	The Ordovician-Silurian formation consists of limestone and clay slate.
	Cambrian-Ordovician formation	Plo — Limestone and clay slate; thickness unknown	The Lower Paleozoic formation, widely exposed in the central part of the map area, forms a great synclinal structure with axis plunging to the north along the Argun River. Stratigraphically the formation can be divided into two parts as follows: The Upper part (Plo) consists of massive limestone occasionally interbedded with thin layers of clay slate and siliceous slate. It was defined by YAMASHIMA (1935) as Cambrian in age, and by Soviet geologists (NALIVKIN, 1955) as Upper Cambrian and Ordovician.
	Lower Cambrian formation	Plc — Clay slate and sandstone; thickness unknown	The Lower part (Plc) consists of an alternation of reddish brown clay slate and dark green muscovite sandstone. Along the Irigichi Ka it strikes N 50° E and dips 40° NW. It is also exposed limitedly in the northwest corner of the map area. Soviet geologists define it as Lower Cambrian in age.
	DISCONFORMITY		
PRECAMBRIAN	Precambrian formation	pC — Sandstone, clay slate and quartzite; thickness unknown	The Precambrian formation is exposed along the A-pa Ho and the Urou River, striking NE and dipping 40° NW. It consists of dark green muscovite sandstone with clay slate in the upper part, and quartzite, locally containing hematite, in the lower part. The formation may be Proterozoic to Cambrian in age, and can be correlated with the "Sinian formation" of South Manchuria. A formation, probably contemporaneous, is exposed in the hill southeast of Ma-tien [马甸]. It seems to be part of the western limb of the above-mentioned syncline, although the rocks are disturbed by granite intrusion.
	UNCONFORMITY		
	Precambrian granite gneiss	pCgn — Biotite granite gneiss, hornblende granite gneiss, muscovite granite gneiss and mica schist	The Precambrian granite gneiss, extending northeast along the A-pa Ho, consists chiefly of white to dark gray biotite granite gneiss, occasionally associated with hornblende granite gneiss and muscovite granite gneiss. Lenticular thin layers of mica schist are found locally. The granite gneiss is unconformably overlain by the Precambrian quartzite, and is intruded by the pre-Jurassic granite. Its schistosity strikes N 20° E, and dips 70° - 80° SE in the vicinity of Chu-erh-chien-ts'un.

(Column not drawn to scale)

ECONOMIC VALUE

Mineral spring

A mineral spring is found in the upper reaches of the Suan-shui-ch'üan Kou [酸水泉沟], a tributary of the Wu-ma-ta Ho [乌玛大河], and another along the Arukima River in the northwestern part of the map area. Water of these springs flows from the fissures of the pre-Jurassic granite, and contains acidic substances.

Gold

Placer gold occurs in the Recent deposits along the following rivers which flow through granite regions: Purokūjiba-ka (7 km south of Chu-erh-chien-ts'un), Wu-ma-ta Ho, Wu-lung-kan Ho [乌龙干河], A-li-ya Ho [阿利雅河], Ta-t'ien-kan Ho [大天干河], Mostovka River (in U.S.S.R.), Uryumkan River (in U.S.S.R.), and the Kureya River (in U.S.S.R.). The source of the placer gold is probably decomposed gold-bearing quartz veins which intrude the pre-Jurassic granite and the Upper Jurassic formation. Gold was formerly worked, but the business was unsuccessful due to inferior quality, difficult access and permanently frozen ground.

Limestone

The Cambrian-Ordovician massive limestone near Ch'i-kan along the Amur River may be useful for local production of lime.

REFERENCES

Geological Institute, South Manchuria Railway Co., 1938, Geological map of Manchuria, scale 1:1,000,000.

HARAGUCHI, Kuman, and others, 1937, Geology and geography of northwestern Manchuria: Geol. Inst., S. Manchuria Ry. Co.

NALIVKIN, D. V., editor, 1955, Geological map of U.S.S.R., scale 1:5,000,000: U.S.S.R. Ministry of Geology.

SAITŌ, Rinji, compiler, 1940, Geological map of Manchuria and adjacent areas, scale 1:3,000,000: Manchoukuo Geol. Inst.

UCHINO, Toshio, 1935, Placer gold in the vicinity of Mo-ho [漠河]: Unpub. rept., Geol. Inst. S. Manchuria Ry. Co.

YAMASHIMA, Sadao, 1935, Geology of the northern part of the Great Hsing-an Range: Shina Kōgyō Jihō (Manchuria Geol. and Mining Rev.), no. 83, Geol. Inst., S. Manchuria Ry. Co.