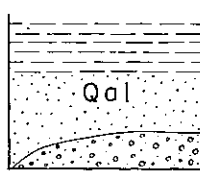
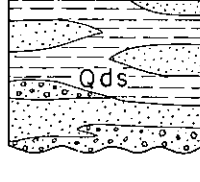


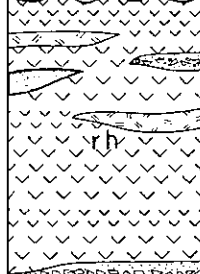
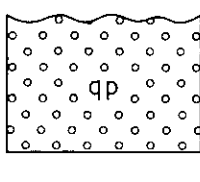
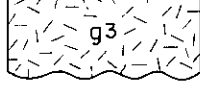


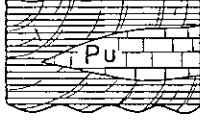
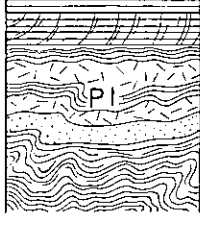


## GEOLOGIC COLUMN AND UNIT DESCRIPTION

AGE	ROCK UNIT	LITHOLOGY; THICKNESS WHERE KNOWN	UNIT DESCRIPTION	ECONOMIC VALUE	REFERENCES
QUATERNARY	Alluvium	 Qol Sand, clay and gravel; thickness less than 10 meters	Alluvium consisting of sand, clay and gravel is distributed in the drainage basins of the Hai-la-erh Ho [海拉爾河] and its tributaries, covering flood plains and low terrace remnants. It is less than 10 m thick, and is locally covered by black muck 0.3 - 2.0 m thick. The ground water occurs in the gravel bed under the black muck. The level of the ground-water is rather shallow, such as 1.0 m deep at T'ien-ni-ho, 3 - 4 m deep in the flood plain along the Hai-la-erh Ho proper, and 8 m deep on the hilly Pleistocene area along the Hai-la-erh Ho.	<p><b>SPRINGS</b></p> <p>The fresh-water springs flow forth here and there in the map area. Some of them gush out from the mouth of inclined plane between base rock and talus breccia bed 1 - 5 m thick in the case of Na-jen-pu-la-k'o [那珍布拉克], and others from fissures or joints of andesite as at Haji, T'ien-ni-ho, and ten springs are scattered between the Cha-lo-mu-t'e [札魯木特] and Mien-tu-ho stations.</p>	<p>Geological Institute, South Manchuria Railway Co., 1938, Geological map of Manchuria, scale 1:1,000,000.</p> <p>1938, Map of North Manchurian mineral resources, scale 1:500,000. (Unpub.)</p> <p>HARAGUCHI, Kuman, and others, 1937, Geology and geography of northwestern Manchuria: Geol. Inst., S. Manchuria Ry. Co.</p> <p>MONDEN, Shigeyuki, 1943, Fluorite and fluorite deposit: Kyoritsu Publ. Co., Tokyo.</p> <p>SAITŌ, Rinji, compiler, 1940, Geological map of Manchuria and adjacent areas, scale 1:3,000,000: Manchoukuo Geol. Inst.</p>
	Diluvium	 Qd Sand, clay and gravel; thickness less than 50 m	Diluvium, consisting of sand, clay and gravel of aeolian-fluvio-lacustrine origin, is distributed along the Hai-la-erh Ho, especially on the southern bank where some fertile farms were established by the South Manchuria Railway Company. Diluvium is covered by Recent sand dunes or black muck 0.4 - 2.0 m thick.		
TERTIARY	UNCONFORMITY				
	Neogene(?) basalt	 Nb2 Cryptocrystalline basalt	The Neogene(?) basalt, consisting chiefly of black to dark gray cryptocrystalline compact trap-type basalt, is sporadically exposed in the western part of the map area.		
	EFFUSIVE CONTACT				
	Cretaceous andesite	 Mka Biotite andesite	The Cretaceous andesite occurs as flows exposed in the southern part of the map area. It consists chiefly of biotite andesite associated with brecciated biotite andesite. The rock is dark or light green, massive, compact and porous andesite, showing a fluidal structure. Brecciated andesite is found near Ya-k'o-shih [牙克石]. The Cretaceous andesite is overlain by the Neogene basalt, and rests on the Cretaceous rhyolite (rh) and Jurassic volcanic complex (Mjv).		
	EFFUSIVE CONTACT				
	Cretaceous rhyolite	 rh Rhyolite, cryptocrystalline rhyolite, obsidian and tuff	The Cretaceous rhyolite is widely exposed throughout the map area, resting on the Cretaceous granite (g), the Jurassic andesite (Mja), the Jurassic volcanic complex and the quartz porphyry (qp). It consists chiefly of an aggregation of rhyolite proper and cryptocrystalline rhyolite, locally associated with obsidian. The rhyolite proper is light yellow, light brown, or reddish brown, with visible quartz phenocrysts and a vitreous groundmass which rarely contains microphenocrysts of feldspar and biotite. The cryptocrystalline rhyolite is similar in color, but is without visible phenocrysts. Under a microscope it consists of vitreous groundmass and microphenocrysts of quartz, feldspar, and rarely biotite. The rock is locally brecciated. The obsidian is exposed near Hsin-ch'un Shan [新春山] in the upper reaches of the T'ien-ni Ho [田尼河]. It is generally black to light gray, shows a conchoidal fracture, and consists chiefly of glass, rarely associated with microphenocrysts of feldspar and quartz. It is locally intercalated with brecciated tuff.		
	EFFUSIVE CONTACT				
MESOZOIC	Quartz porphyry	 qp Quartz porphyry and granite porphyry	Quartz porphyry associated with granite porphyry is exposed in the upper reaches of the Uriyatsuya, Pei-t'ou Ho [北頭河] and the Kuridōru-ka. It is generally reddish brown to yellowish brown, consisting of a holocrystalline groundmass and phenocrysts of quartz and orthoclase, and a small amount of colored minerals. It may be a marginal facies of the Cretaceous granite. It is intruded by quartz veins which gave birth to some fluorite deposits.	<p><b>FLUORITE</b></p> <p>Fluorite deposits occur at three localities as follows:</p> <p>(1) The fluorite deposit 3 km SW of Haji is numerous small fluorite-quartz veins 15 - 20 cm in width which fill irregular fissures in the Jurassic dacite flow. The fluorite is purple, light blue, or white. The reserves are small.</p> <p>(2) A fluorite-quartz vein 6 km south of Haji lies in quartz porphyry. The vein strikes N 15° E and dips vertically; it ranges in width from 5 m to 50 m, and stretches to 400 m in length. The quartz is white compact saccharoidal, comby, cockade, or amorphous in texture, and grades gradually into chalcedony in the last stage. The fluorite ore is purple, blue, or reddish purple, and its crystals sparingly fill the cavities in quartz, or occur in lenticular or nodular ore bodies. The reserves are small and access is difficult.</p> <p>(3) A fluorite-quartz vein 3 km north of Haji lies in the Jurassic andesite flow. It strikes north, ranging in width from 5 cm to 30 cm. It is superior in quality, but reserves are small.</p>	
	Cretaceous granite	 g Porphyritic granite	The Cretaceous granite is exposed in places throughout the map area. It consists chiefly of porphyritic granite or granite porphyry. The phenocrysts are reddish idiomorphic microcline, idiomorphic to hypidiomorphic quartz, and a small amount of colored minerals.		
	INTRUSIVE CONTACT				
	Jurassic andesite	 Mja Hornblende andesite, hornblende-biotite andesite, biotite andesite and dacite	The Jurassic andesite, occurring as flows and sheets, is exposed in the northwestern part of the map area. It consists of black to gray compact cryptocrystalline hornblende andesite, hornblende-biotite andesite and biotite andesite, occasionally associated with dacite. Under a microscope, it shows an andesitic structure consisting of groundmass and microphenocrysts of hornblende, biotite and quartz. The hornblende andesite crops out near T'ien-ni-ho, the biotite andesite in the upper reaches of the Uriyatsuya-ko, and the dacite near Haji, at the confluence of the Shwiruya and the Uriyatsuya. They are locally associated with the Jurassic volcanic (greenstone) complex.		
	Jurassic volcanic complex (Greenstone complex)	 Mjv Andesite porphyry, diorite porphyry, diabase, dolerite, propylite, andesite, tuff, sandstone and volcanic breccia	The Jurassic volcanic complex, or "greenstone complex", is a complicated assemblage of black, purple, or dark green intermediate to basic igneous intrusives and extrusives, consisting of andesite porphyry, diorite porphyry, diabase, dolerite, propylite, andesite, tuff, sandstone, and volcanic breccia. The extrusive rocks of the complex are unconformably overlain by the Jurassic andesite (Mja), the Cretaceous rhyolite and the Neogene(?) basalt, and are intruded by the Cretaceous granite and the quartz porphyry.		
EFFUSIVE AND INTRUSIVE CONTACT					
PALEOZOIC	Upper(?) Paleozoic formation	 Pu Clay slate and limestone; thickness unknown	The Upper(?) Paleozoic formation is exposed in the cliff 6 km east-southeast of Mien-tu-ho [免渡河] station. It consists of bluish black clay slate and light gray limestone, intruded by many small secondary calcite veins. The formation is intricately folded, and was metamorphosed by the intrusion of the Cretaceous granite and the Jurassic volcanic complex.		
	DISCONFORMITY				
	Lower(?) Paleozoic formation	 pl Shale, siliceous slate, clay slate, phyllite, schist and amphibolite; thickness unknown	The Lower(?) Paleozoic formation is a complicated assemblage of shale, siliceous slate, clay slate, phyllite, schist and amphibolite. These rocks were probably derived from metamorphism of sandstone and shale of the Lower Paleozoic due to the intrusion of granite. The formation contains no calcareous rock nor fossils that would help determine the geologic age. The formation along the Kazurōwayaya valley in the upper reaches of the T'ien-ni Ho consists of black clay slate, dark gray sandy slate and phyllite. It strikes N 40° - 45° E, dips almost vertically, and is intricately folded. The formation near Haji, in the northwest corner of the map, consists chiefly of amphibolite intruded by biotite granite and quartz porphyry. The amphibolite is greenish black, medium-grained and sporadically contains pyrite. Its schistosity strikes N 10° E and dips 70° E.		

(Column not drawn to scale)