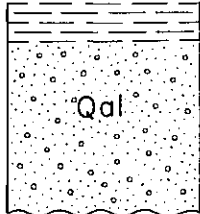
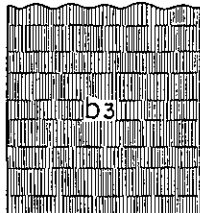
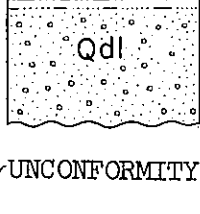

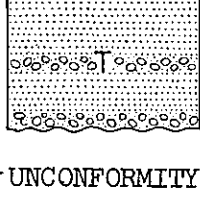
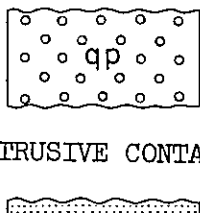
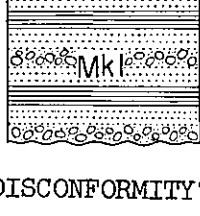
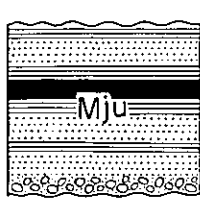
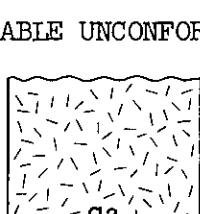
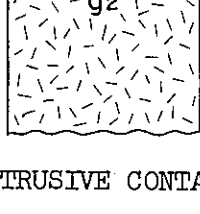
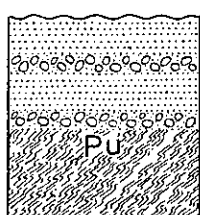
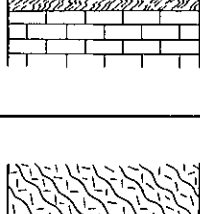


# GEOLOGIC COLUMN AND UNIT DESCRIPTIONS

AGE	ROCK UNIT	LITHOLOGY; THICKNESS WHERE KNOWN	UNIT DESCRIPTION	ECONOMIC VALUE	REFERENCES	
CENOZOIC	Quaternary	 Alluvium	Alluvium, consisting of sand, gravel and clay, covers flood plains and terrace remnants at the foot of cliffs. The thickness is generally less than 12 m, but rarely attains a maximum of 30 m or more. According to the records of borings and wells, the alluvium in the flood plain at Hai-lin-t'sun [海林村] is more than 30 m thick; it is 8 to 13 m thick around the city of Ma-tan-chiang [牡丹江], about 10 m thick at Ning-an [宁安], and over 20 m thick at Yeh-ho [亚河] where it consists in descending order of soil, 0.5 m; gravel, 4.5 m; fine sand, 1 m; yellow earthy matter, 10 m; gravel, 1 m; and clay, 4 m. The lower 15 m, including the yellowish earthy matter, however, may be more reasonably assigned to the diluvium.	Au:- Placer gold is found mainly in the alluvial deposits. Around 1919 to 1920 a gold rush took place mainly in the basin of the Wu-ho-lin Ho (Wu-ho-lin Ho), a large tributary of the Ma-tan Chiang in the northeastern corner of the map area. At that time the mining concession was held by a Chinese placer mining firm "Wu-ho-lin Chin Chiang" [五河林舍限]. Listed below are the placer localities of that time. (A <sub>1</sub> ) Hu-chia-kou [胡家溝], a creek which joins the Wu-ho-lin Ho 1 km northwest of Wu-ho-lin station (Ch'ing-lin-t'sun on the map). Spoil from the placer field stretches for 3 km. At the time of the gold rush 4,000 to 5,000 Chinese gold diggers gathered there. (A <sub>2</sub> ) Ma-ch'iao Ho [馬橋河] / Ka-ya-k'u Ho on the map, a fairly large stream, whose mouth is 1 km northeast of Wu-ho-lin station. A gold rush is reported to have occurred there, also. The gold-bearing gravel, 0.5 m thick, lies at the bottom of alluvium 5 m thick. (A <sub>3</sub> ) Hei-hsia-tzu [黑瞎子], a creek opening on the west bank of the Ma-tan Chiang, about 9 km north of Ma-tan-chiang station. It is said that more than a thousand miners swarmed there in the gold rush days.	ENDŌ, Seidō, 1943, On the distribution of the Tertiary formations in Manchuria: Lecture given at the Kyōto meeting of the Paleontol. Soc. Japan (unpublished).  Geological Institute, South Manchuria Railway Co., 1938, Geological map of Manchuria, scale 1:1,000,000.  IMAIZUMI, Rikizō, 1952, The Tertiary of Manchuria, in Geology and mineral resources of the Far East, Manchuria, III-9a: Comp. Comm. Geology and Mineral Res. Far East, Tokyo Geog. Soc.  MONDEN, Shigeyuki, 1938, Geology in the vicinity of the dam site at Ching-po Hu [鏡泊湖] in the upper reaches of the Ma-tan Chiang: Manchoukuo Geol. Inst. Bull., no. 49.	
		 Pleistocene basalt	Flows of olivine basalt; thickness 5 to 60 m	Pleistocene basalt, 5 to 60 m thick, consists of olivine basalt flows that filled up an old valley which extends in an east-west direction through the district of Tung-ching-ch'eng [通城], and dammed up the old course of the Ma-tan Chiang [牡丹江], producing the lake of Ching-po Hu [鏡泊湖]. The basalt may be a product of fissure eruption. Something like small craters or the so-called "Maars" were reported by Shigeyuki MONDEN (1938) from south of the Yu-ch'uan-p'ao [魚圈泡]. Drill tests on a proposed dam-site north of Lung-chuan-chuang [龍泉莊] disclosed that the basalt consists of stratified layers of lava, each varying in texture from cavernous to compact, and is intercalated in the lower part with a few layers of fine sand, presumably diluvium.		
		 Diluvium	Sandy clay, sand and gravel; thickness less than 30 m	Diluvium, generally less than 30 m thick, may be fluvial and fluviolacustrine deposits of Pleistocene age. It consists chiefly of yellowish sandy clay, sand, and gravel. Large exposures of the diluvium are known in such districts as south of Ma-tan-chiang, around Ning-an and Tung-ching-ch'eng, south of Hai-lin-t'sun, and at Huang-ti [荒地]. No fossils were reported from the diluvium, so distinction between Qa and Qd is only provisional.		
	Tertiary	 Neogene basalt	Olivine doleritic basalt, tuff, sand and gravel; thickness less than 400 m	The Neogene basalt is a plateau basalt distributed mainly on the east side of the Ma-tan Chiang; it consists of superposed horizontal sheets of olivine-doleritic basalt lava intercalated with some pyroclastic matter, sand and gravel. The accumulated lava sheets, each being 5 to 20 m thick, may attain a maximum thickness over 400 m in places. The lava might have been erupted from fissures by mass eruptions during various stages of the Neogene.		NAGAO, Suteichi, 1950, On the Mesozoic coal-bearing formation in eastern and northeastern Manchuria, in Geology and mineral resources of the Far East, Manchuria, VII-2c: Comp. Comm. Geology and Mineral Res. Far East, Tokyo Geog. Soc.  SAITŌ, Rinji, 1940, Geological map of Manchuria and adjacent areas, scale 1:3,000,000: Manchoukuo Geol. Inst.
MESOZOIC	Cretaceous	 Tertiary formation	Tuffaceous sandstone and conglomerate; thickness less than 100 m	The Tertiary formation, consisting chiefly of unconsolidated tuffaceous sandstone and conglomerate, is less than 100 m thick. Exposures are known east of the Ha-ma Ho [哈嗎河], south and north of the Hai-lin-t'sun basin, and 4 km south of Ch'ing-lin-t'sun [清林村]. The last-mentioned outcrop is reported to contain plant fossils including <i>Cyperites</i> sp., <i>Carpollites</i> sp., and <i>Styrax</i> sp. according to Seidō ENDŌ who assigned these fossils to the Neogene age. No information is available on the stratigraphic sequence of these exposures.		
		 Quartz porphyry		Quartz porphyry, presumably of Cretaceous age, is found at a number of localities in the granite region, although descriptions are not available. (Refer to the Ching-po Hu sheet, NK 52-2).		
	Upper Jurassic	 Talatzu series	Tuffaceous shale, sandstone and conglomerate; thickness unknown	The Talatzu series [大拉子統] or the Lower Cretaceous formation consists chiefly of reddish and whitish shale and sandstone, and conglomerate. The strata are fragile, tuffaceous, swell somewhat on hydration, and are very gently folded. From the lithologic features the strata are correlated with the Hua-shan series [華山統] of the Mi-shan [密山] district (refer to the Tung-an sheet, NL 52-9, and the Sui-fen Ho sheet, NL 52-12). The total thickness is unknown.		
	Triassic (?)	 Maleng formation	Sandstone, shale, conglomerate and coal; thickness unknown	The Maleng formation [穆稜統] or the Upper Jurassic formation is exposed in fairly large areas around Yeh-ho, east of the Ma-tan Chiang. It consists of sandstone intercalated with a few conglomerate layers and occasional coal beds. No particular field survey was made for the coal localities. The total thickness of the formation is unknown.	Coal Old native coal pits are found at the following two localities, although detailed information is not available. (A) San-tao-ling-tzu [三套嶺子], 3 km south of Yeh-ho. (B) Yeh-ho-nan-kou [亞河南溝], 11 km south of Yeh-ho.	
	Permian-Carboniferous	 Pre-Jurassic granite	Hornblende-biotite granite and biotite granite	The pre-Jurassic granite consists predominantly of hornblende-biotite granite and biotite granite. It has metamorphosed the Touman Formation along the contact. Its lit-par-lit intrusion of some crystalline schist has locally resulted in metagneiss. In places the granite near the schistose rock is porphyritic in texture. A biotite granite in the drainage basin of the Wu-ho-lin Ho [五河林河] may be the ore-bringer of the gold deposits, as it abounds in dikes of felsite, pegmatite and silicite. The granite batholith forming such mountain ranges as Iao-yeh Ling [老嶺] and Hsiao-pai Ling [小白嶺], generally known as Chang-kuang-t'sai Ling [長崗才嶺] may be residual mountains that once stood above the Tertiary peneplains, and which have since been rejuvenated by rapid uplift and are now in a youthful or mature stage of the erosion cycle. These mountain ranges constitute a thickly forested and sparsely-populated corner of the country.	Auriferous quartz veins are found in crystalline schist near Ma-tao-shih [磨刀石]. The ore bringer is probably the pre-Jurassic granite.  Placer gravels in the basin of the Wu-ho-lin Ho abound in fragments of felsite, pegmatite and vein-quartz; these rocks are probably acidic differentiated facies of the pre-Jurassic granite.	
AGE UNKNOWN	 Touman formation	Sandstone, hornfels, conglomerate hornfels, phyllite, schalstein, chert and limestone; thickness unknown	The Touman, or Upper Paleozoic formation occurs along the Ch'ang-ch'un Railway at two localities between Heng-tao-ho-tzu [恒道河子] and Leng-shan [冷山], and consists chiefly of sandstone and hornfels, intercalated with some conglomerate hornfels. An exposure of a metamorphic complex south of Ma-tan-chiang, consisting of phyllite, diabase, tuff, chert and crystalline limestone, may be the upper part of the Touman formation. The total thickness and the stratigraphic sequence are unknown.			
	 Granite gneiss	Metagneiss and granitic gneiss	Granite gneiss of unknown age consists of various kinds of metagneisses accompanied by granitic gneiss. Views concerning the age of the gneiss are diverse: some geologists are of the opinion that it may be a Precambrian gneiss, while others maintain that it may be an intensely foliated facies of the Touman formation which was subjected to lit-par-lit injection of the granite (G <sub>2</sub> ). The granite gneiss is widely distributed in the drainage basin of the Wu-ho-lin Ho in the northeastern corner of the map area and in an area south of Tung-chin-ch'eng. Minor exposures of the granite gneiss probably occur in the vast unexplored granite region.			
	 Schist	Chlorite-albite-mica schist, quartz schist and limestone	The schist of unknown age consists mainly of chlorite-albite-mica schist and quartz schist, intercalated with some crystalline limestone. It is widely exposed in the district comprising Yeh-ho and Ma-tao-shih-t'sun [磨刀石村]. Whether the schist is a Precambrian schist or a schistose facies of the Touman formation remains unknown.	Lime kilns:- (1) several beds of limestone, each over 10 m thick, are found at a locality 8 km southwest of Ma-tan-chiang, where the rock is exposed for a distance of 2 km and is interbedded with chert. Lime kilns were operating there around 1940 with annual yields of 30 car-loads of lime. (2) limestone lenses, about 6 km east of Ma-tou-shih-t'sun, were formerly worked for calcination.		

(Column not drawn to scale)