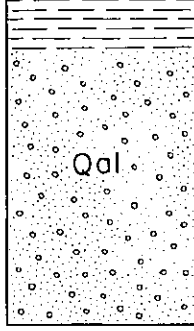
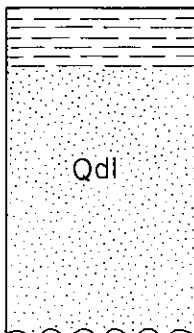
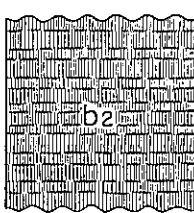
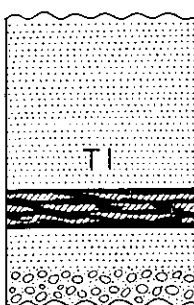
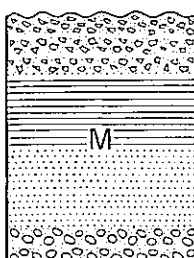
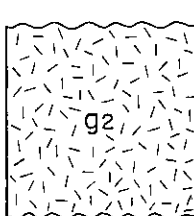
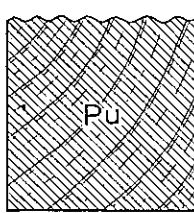
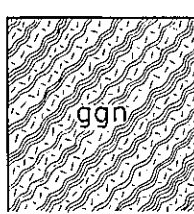


GEOLOGIC COLUMN AND UNIT DESCRIPTIONS

AGE	ROCK UNIT	LITHOLOGY; THICKNESS WHERE KNOWN	UNIT DESCRIPTION	ECONOMIC VALUE	REFERENCES
QUATERNARY	Recent	 Alluvium	Alluvium is composed mainly of flood plain deposits, including fan and talus deposits. Alluvium occupying the flood plain of the Sung-hua Chiang (松花江) is generally less than 10 m thick, consisting of sand and sandy clay; around the granite mountainlands east of T'ung-ho (通河), the Alluvium often becomes so thin that the granitic bedrock is exposed at some shallows in the river course. The Alluvium on the Mu-tan Chiang (牡丹江) plain consists chiefly of gravel of granite pebbles and coarse sand, is particularly narrow in distribution, and is supposed to be 2 to 5 m thick. The Alluvium on the flood plain of the Ma-i Ho (玛尔河) is widely distributed, and consists of an aggregation of clay, sand and gravel layers; a drill test at T'ung-pin (同庆) has confirmed a thickness of over 32 m. As a rule the boundary between Alluvium and Diluvium is obscure.		AHNERT, E. E., 1934, Materials for the historic geology of North Manchuria: Club Nat. Sci. and Geography, Y.M.C.A., Ann., v. 1 (1933), p. 93-102. ENDŌ, Seidō, 1941, Paleozoic plant fossils in Eastern Asia: Geol. Soc. Japan Jour., v. 48, no. 570. Geological Institute, South Manchuria Railway Co., 1938, Geological map of Manchuria, scale 1:1,000,000. IMAIZUMI, Rikizō, 1952, The Tertiary period 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. SAITŌ, Rinzji, compiler, 1940, Geological map of Manchuria and adjacent areas, scale 1:3,000,000: Manchoukuo Geol. Inst. SAKAMOTO, Takao, and others, 1937, Geology and geography of northeastern Manchuria: Geol. Inst., S. Manchuria Ry. Co. SHIKAMA, Tokio, 1951, The Quaternary period of Manchuria, in Geology and mineral resources of the Far East, Manchuria, III-10: Comp. Comm. Geology and Mineral Res. Far East, Tokyo Geog. Soc.
	Pleistocene	 Diluvium	Diluvium mainly constitutes terraces more than 20 m high (above the flood plain) along the Sung-hua Chiang. It predominates especially in the Fang-cheng (方正) district on the south bank of the river, and it also forms all terraces on the north bank. It consists, in descending succession, of fine sand and an alternation of sand and clay. The total thickness may be more than 50 m. Diluvium of this area is generally correlated with the "Kusiangtun series" (屈乡屯系) of Harbin. Ku-hsiang-tun is a well-known locality of Pleistocene fossils in the suburbs of Harbin, whence Russian and Japanese paleontologists collected more than 61 species of Mammalia, more than 28 species of Mollusca, 5 species of Pisces, 2 species of Aves, 1 species of Insecta, 1 species of Reptilia, and some plant fossils. On the basis of these fossils, the Kusiangtun series has been assigned to the Upper (-Middle) Pleistocene.		
TERTIARY	Neogene	 Basalt	Basalt is distributed north of the Wu-sū-hun Ho (乌苏浑河), a tributary of the Mu-tan Chiang in the northeastern part of the map. Although no detailed information is available, the basalt is generally considered as flows of olivine basalt erupted in the Neogene period.	Coal ①: The Liang-chu-ho coal field lies about 12 km north of Liang-chu-ho along the T'ung-liang-chu Ho. Coal was worked in about 1921. According to the record at that time the coal-bearing formation consists, in descending sequence, of soft black shale (0.6 m thick), a coal seam (0.15 m), soft black shale (6 m), a coal seam (0.45 m), dark-brown hard sandstone (3.8 m), and dark-brown sandstone (5.7 m). Analysis of the coal revealed the following properties: water, 14.81%; volatile matter, 44.33%; fixed carbon, 36.07%; ash, 4.79%; color of ash, dark; sulphur, 0.65%; calorific value, 5,828; and it is non-coking. The possible coal reserves were estimated at 80,000 tons. It is reported that the rocks around old pits are arkose and conglomerate. The age of the coal-bearing formation is generally correlated with the Hsulan formation of the Hsu-lan and Kan-yao coal fields.	
	Paleogene	 Wuchimiho formation	The Paleogene formation, or the "Wuchimiho formation", is distributed near I-mien-p'o (一面坡), and consists of sandstone and conglomerate, possibly intercalated with lignite seams. The thickness of the formation in the map area was not measured. The formation is a west margin of the Wuchimi formation of the Wu-chi-mi (乌吉密) coal field, or a northern extension of the Hsulan formation which constitutes the Hsu-lan (舒兰) and Kan-yao (坎腰) coal fields in Chilin Province. Seidō ENDŌ (1941) assigned the Hsulan formation to the Paleogene on the basis of the plant fossils he collected. The Paleogene formation distributed in a district north of Liang-chu-ho (亮珠河) along the Tung-liang-chu Ho (东亮珠河) consists of conglomerate and arkosic sandstone, containing an alternation of lignite and shale.	Coal ②: The Kao-li-mao coal field. No data are available with regard to the coal-bearing formation.	
	Mesozoic	 Undifferentiated Mesozoic beds	Undifferentiated Mesozoic beds are distributed south of the Sung-hua Chiang in the northwestern corner of the map area. No detailed information is available; the thickness is not known. The coal-bearing formation around the old pits near the Pan-chieh Ho (平截河) and Kao-li-mao (高丽帽) was formerly reported by E. AHNERT (1933) as Jurassic in age; later some Japanese geologists (1937) correlated it with the Mulleng formation (穆棱层) or the Upper Jurassic coal-bearing formation. In a distant view southward from Mu-lan (木兰) on the north bank of the Sung-hua Chiang is seen a range of hills composed of the "red formation", indicative of the Sungari series which is probably Upper (or Middle) Cretaceous in age.		
Triassic (?)	 Pre-Jurassic granite	Biotite granite and biotite-hornblende granite	The pre-Jurassic granite occurs as a batholith constituting the vast mountainous region in which no geologic field work has been reported so far. Generally the granite seems to consist of biotite granite and biotite-hornblende granite. The granite around I-mien-p'o contact-metamorphosed the rocks of the Touman formation (通满层). The granite south of the Sung-hua Chiang unconformably underlies the Mesozoic formation (M).		
Paleozoic or Permian or Carboniferous	 Touman formation	Slate, chialstolite hornfels and chialstolite-mica hornfels	The Touman formation, or Upper Paleozoic formation, is distributed in the I-mien-p'o district in the southwestern corner of the map area. It consists chiefly of slate, accompanied by chialstolite hornfels and chialstolite-biotite hornfels near the contact with the intruded granite (G ₂).		
AGE UNKNOWN	 Gneiss	Metagneiss	Gneiss of unknown age is mainly metagneiss and is distributed in the northeastern corner of the map area. It is not known whether the metagneiss was derived from the Touman formation or was altered from a Precambrian crystalline schist.		
	(Column not drawn to scale)				