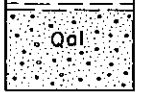
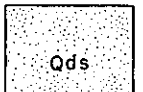


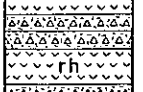
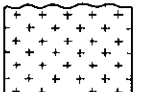
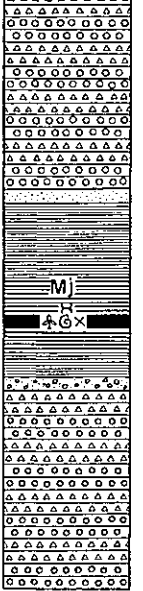

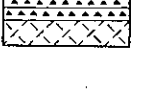
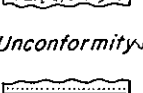
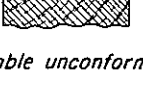
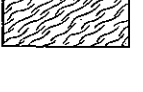


GEOLOGIC COLUMN AND UNIT DESCRIPTIONS

AGE	ROCK UNIT	LITHOLOGY; THICKNESS WHERE KNOWN	UNIT DESCRIPTION	ECONOMIC VALUE	REFERENCES
QUATERNARY	Alluvium	 Silt, clay, sand, gravel. Thickness less than 10 meters.	Covers low terrace remnants, flood plains, and playas.		
	Diluvium	 Dune sand and silt. Thickness less than 20 m.  Loess, sandy loess, sand, and clay. Thickness less than 40 m.	Dune sand and silt (Qds) deposited in lacustrine areas during late Pleistocene, subsequently exposed and wind-eroded. Interstratified sandy loess and clay of presumably lacustrine origin (Qd) predominate in the map area. There also occur interstratified aeolian sand and loess. Red clay that generally underlies aeolian loess may be a Lower Pleistocene residual clay.		
TERTIARY	~~~~~Unconformity~~~~~				
	Neogene basalt	 Olivine basalt, tuff, and sand.	Mainly flow and sheets of olivine basalt, locally attaining a thickness of several hundred meters, accompanied by tuff and sand. The basalt may have flowed through fissures during Pliocene and covered the Neogene peneplains. Mesas and buttes abound in semi-desert areas. In the coal fields of Shih-ta-fen (石塔分) and Tung-yuan-pao-shan (tung-yuan-pao-shan), dikes and sheets of the basalt are found intruded into the Mesozoic coal-bearing formation.		
	~~~~~Unconformity~~~~~				
	Rhyolite	 Rhyolite, trachyandesite, tuff, and lava breccia.	Flows and sheets of rhyolite accompanied by some trachyandesite and their pyroclastics. Some Japanese geologists call this rhyolite "Cretaceous volcanics".		
~~~~~Effusive contact~~~~~					
MESOZOIC	Granite	 Granite and granite porphyry.	Biotite granite and biotite-hornblende granite, accompanied by minor amounts of granite porphyry, quartz porphyry and diorite; may have been intruded during the Cretaceous or post-Jehol formation. These granites may have introduced the gold veins. A purple granite mass forming the northern hills of Chih-feng (赤峰) is called "Chih-feng granite" and is considered to be an intrusion of Upper Cretaceous age.	Gold veins, which were probably brought about by the Cretaceous granite, occur in the districts listed below (and numbered on the map): 1. Ho-chia-ti (何家地), 15 km east-southeast of Chih-feng, where gold was worked since nearly a century ago but the operation was suspended in 1919. In 1905 an Anglo-Chinese company was established in order to prospect thirty-odd quartz veins. Several vertical shafts were sunk by the company but in vain. 2. Chuan-shan-tzu (穿山嘴), 55 km east of Chih-feng, where gold was worked in about 1915 but the ore was exhausted before long. 3. Hung-shan-kou (红山口), 27 km southwest of Chih-feng, where gold was worked for a short period at the end of the 19th century. No reserves were found by later prospecting. 4. Shui-fen-tai-pai-kou (水风台排扣), 32 km west-southwest of Chih-feng, where gold veins were reported to occur but not promising. 5. Shui-chuan (水川), 12 km east of Hsiao-ho-yeu (小河口), where a gold quartz vein was once worked by a Chinese about 50 years ago.	
	~~~~~Intrusive contact~~~~~				
	Jehol formation	 Tuff, tuffaceous agglomerate, conglomerate, sandstone, shale, coal, and oil shale. Thickness about 1,000 m.	The Mesozoic Jehol formation can be divided into three parts: upper, middle, and lower, according to UEDA and SASAKURA (1937).  The upper part, about 150 m thick, consists mainly of tuffaceous rocks, frequently intercalated with solid lava sheets, generally covered by rhyolite flows. Fossils are not present. The middle part, more than 600 m in thickness, consists of interstratified shale, sandstone, and coal, and forms the coal-bearing beds which are observed in various coal fields of the map area. Fossils contained are <i>Bacteria</i> sp. and <i>Lycopodium johnsonii</i> var. minor Grabau from the oil shale deposits in the vicinity of Ta-miao (塔庙), and <i>Polyphyllum</i> sp. from the coal-bearing beds in the coal field of Shih-ta-fen. The lower part, about 300 m thick, consists of tuffaceous rocks of andesitic character, occasionally accompanied by andesite flows.  The age of the Jehol formation is believed to vary from Uppermost Triassic to Lower Cretaceous, although the coal-bearing beds at the coal fields of Shih-ta-fen, Hsi-yuan-pao-shan (西园堡), Tung-yuan-pao-shan, and Liu-tiao-kou-tzu-kou (柳条沟嘴), and the oil shale deposits at Ta-miao are commonly considered Upper Jurassic.		
	Andesite	 Andesite with its pyroclastics.	Consists of mainly pyroxene andesite and amphibole andesite, with their pyroclastics, and attains a thickness about 200 m. Structure varies between porphyritic and cryptocrystalline. The age is locally contemporaneous with the middle and lower parts of Jehol formation.		
	Porphyrite	 Diorite porphyry and diabase porphyry.	Intrusive sheets and flows of porphyrite, consisting mainly of diorite porphyry and diabase porphyry, with their pyroclastics. Thickness not known. Exposures east and south of Hsiao-ho-yeu (小河口) are reported as diabase porphyry, and the ones in the district of Wu-tan-cheng (吴滩城) as diorite porphyry. Eruption of this porphyrite may have been earlier than that of the andesite described above, and probably has some connection with the deeper seated Triassic granite which is not mapped here.		
	~~~~~Unconformity~~~~~				
PALEOZOIC	Linhsi series ?	 Sandstone, shale, limestone, slate, hornfels, and mica schist. Thickness more than 2,000 m.	The Upper Paleozoic formation in the map area consists mainly of sandstone and shale, locally intercalated with thick lenses of limestone, and frequently shows contact metamorphism on account of granite or diorite intrusion. Thickness is probably more than 2,000 m, and the age may be either Upper Carboniferous or Lowermost Permian. This formation may be correlated to the Linhsi series named by F. T. de Charadin for the Upper Paleozoic formation in the district of Lin-hsi (林西) (See adjacent Lin-hsi sheet, NK 50-3).		
~~~~~Probable unconformity~~~~~					
MIDDLE PRECAMBRIAN	Wutai system	 Actinolite schist, mica schist, porphyroid, and crystalline schist. Thickness not known.	The Middle Precambrian metamorphic complex in the map area can be correlated with the Wutai system, and consists of actinolite schist, mica schist, porphyroid, locally with lenses of crystalline limestone. Thickness is not known. In 1905, a large mass of limestone having a maximum width of 1.5 km and a length of 1.3 km was reported around Hsiao-shao-kou (小沙沟), in the vicinity of Shang-shao-kou (上沙沟).		
LOWER PRECAMBRIAN ?	Gneiss	 Granite gneiss, metagneiss, and crystalline schist.  (Column not drawn to scale)	The gneiss consists of granite gneiss, metagneiss, and some crystalline schists, and is considered to present a transitional feature between Wutai system and Taishan complex (which does not occur in the map area).		

BESSHO, Bankichi, 1934, Geologic report of the coal fields around the district of Chih-feng: Geol. Inst. South Manchuria Railway Co.

CHEN (陈), M. K., and HSUNG (洪), Y. H., 1935, Notes on some thrusts in the western hills of Feiping: Bull. Geol. Soc. China, v. 10, no. 4.

DE CHARDIN, F. T., 1924, Geology of Northern and Eastern Mongolia: Bull. Geol. Soc. China, v. 3.

FULLER, M. L., CLAP, F. G., and others, 1915, Reconnaissance maps on the oil fields survey in China: Standard Oil Co., U. S. A. (unpublished).

Geol. Inst. South Manchuria Railway Co., 1938, Geologic map of Manchuria, scale 1:1,500,000.

GRABAU, A. W., 1923-1928, Stratigraphy of China, v. 1 (1923-24), v. 2 (1928).

KATAYAMA, Ryohel, 1911-1917, Reports on the mineral resources in East Mongolia, v. 4.

KOBAYASHI, Teichu, 1912, Stratigraphic relation among the Mesozoic fossil-beds in the Korea-Manchurian land and their ages: Proc. Imp. Acad. Tokyo, v. 18.

_____, SUZUKI, KIKI and TAKAI, Fuyuji, 1912, A preliminary report on the four distinct suites of Mesozoic faunas in the Korea-Manchurian land: Jour. Fac. Sci. Imp. Univ. Tokyo, sec. 2, v. 6, pt. 4.

MIYA, Shuichi, 1952, The coal fields of Yuan-pao-shan (元堡山), Meng-ni-te-yu-i-chi (蒙尼特伊旗), Jehol: Compilation Committee of the Geology and Mineral Resources of Far East, Tokyo Geog. Soc.

OSAKI, Hiroshi, 1937, Geology of the Ta-miao natural asphalt deposits, Chih-feng Hsien, Jehol: Bull. Geol. Inst. South Manchuria Railway Co. no. 68.

SAITO, Rintzi, 1910, Geologic map of Manchuria and adjacent areas, scale 1:3,000,000: Geol. Surv. Manchoukuo.

SATO, Sutezo, 1936, Geology and petrography of Jehol: Report of the First Scientific Expedition to Manchuria (Jan.-Oct. 1933).

TAN, H. C., 1931, Geology of Eastern Jehol and Western Liaoning: Bull. Geol. Surv. China, no. 16.

UEDA, Fusao, SASAKURA, Naoto, and others, 1937, Geology and geography of the Southwestern Manchuria: Geol. Inst. South Manchuria Railway Co.

YABE, Shigeru (compiled by), 1955, Geologic map of Lin-yu, scale 1:250,000: Compilation Committee of the Geology and Mineral Resources of Far East, Tokyo Geog. Soc.

_____, (compiled by), 1955, Geologic map of Yeh-pai-shou (叶柏寿), scale 1:250,000: Compilation Committee of the Geology and Mineral Resources of Far East, Tokyo Geog. Soc.

YAMANE, Shinji, and OKAMURA, Gao, 1917, Geologic report on the mineral deposits in Southwestern Mongolia.