GEOLOGIC COLUMN AND UNIT DESCRIPTION

AGE	ROCK UNIT	LITHOLOGY; THICKNESS WHERE KNOWN	UNIT DESCRIPTION
WARY	Alluvium	Qal: sand, clay, silt and gravel; thickness less than 15 meters Qas: aeolian-lacustrine sand; thickness unknown	Alluvium (Qal) covers flood plains of the Ussuri River that forms the boundary between Manchuria and the U.S.S.R., and of the tributaries on both sides of it, namely, the Pieh-la-hung Ho [別 知 知], the Nao-li Ho [股 力 河], the Nung Chiang [添 江], the Khor River, the Podkhorenok River and the Bira River. These flood plains correspond to the southeastern part of the vast lowland that comprises such rivers as the Amur, the Ussuri and the Sungari. Japanese geologists considered this vast lowland a low peneplain formed during the Early Pleistocene. The flood plains are largely occupied by swamps and marshes composed of grass and black peaty mud containing Recent deposits of sticky clay and silt. Sand and gravel generally predominate along the streams of hilly regions. The thickness of the alluvium (Qal) is usually less than 15 meters. K. KAWADA (1951) reported an aeolian-lacustrine sand dune, probably of older Alluvium (Qas), south of Hai-ch'ing (元 文 along the Ussuri River, and considered it a transported sand dune. Diluvium (Qd) in the Manchurian territory consists of clay and silt, accompanied by some sand. It covers the elevated terraces that fringe the large flood plains, and is usually covered by thin Recent fluvial deposits. Diluvium around the remnants of mountains is composed of gravel, sand and clay, as is observed in the vicinities of Nan-t'um (元 Tia-p'ing-chen[元 本 和 and Hsiao-ho-yen[小 河 浩]. Its age is considered Upper Pleistocene. Diluvium is widely distributed in the U.S.S.R., especially in the areas east of Kuo-fu-chen[元 本 和 and Haio-t'ung-chen[元 本 和 and northeast of Hai-ch'ing[元 和]. No detailed information is available with regard to the Diluvium of the U.S.S.R., but the total thickness may attain scores of meters.
QUATERNARY	Diluvium	Qd: sand, clay, silt and gravel; thickness less than 100 m Qds: dune sand; thickness unknown	K. KAWADA (1951) discovered the dunes of aeolian-lacustrine sand (Qds) along the Pieh-la-hung Ho, each about 5 km by 2 km in area and 7 to 8 m in height. The dune sand is composed chiefly of homogeneous quartz grains 0.3 to 0.15 mm in diameter, and is rarely associated with pebble and clay. Upon upheaval at the end of the Pleistocene epoch, the soft sand bed may have been subjected to wind and river erosion, resulting in the present dune-like configuration. The region of sand dunes is now subsiding gently, and the aeolian sand occurs as inliers within the Recent swamps. The aeolian sand collected from the bank of the Pieh-la-hung Ho was mechanically analyzed by K. KAWADA; the results follow: Iithology Size (mm) Ratio (%)
TERTIARY	Neogene? basalt	UNCONFORMITY Flows of augite-olivine basalt; thickness unknown	Flows of black, compact augite-olivine basalt, probably Neogene in age, constitute small isolated mounds scattered along the Pieh-la-hung Ho. According to K. KAWADA, the mounds are as follows: Name * Height (m) Rock (1) Han-t'sung Shan [汗 卷 山] 78.3 Basalt or andesite (2) Li-hsiao Shan [汗 巻 山] 78.3 Andesite (or andesitic basalt?) (3) Ma-chia-hsiao Shan [馬 加 小山] 71.3 Basalt (4) Shih-t'ou Shan [西 加 山] 83.4 Basalt These mounds may be relics resulting from immense erosion of the Neogene lava flows, that have become exposed as inliers of the Recent swamp deposits. In the U.S.S.R., the basalt is widely exposed in the vicinities of Sheremet'yevo, Vyazemskaya and Verino, although no details are available. * Not shown on map.
TE	Paleogene formation	Conglomerate, sandstone, shale and coal; thickness unknown	The occurrence of the Paleogene formation has lately been disclosed by the Geological Map of the U.S.S.R. (NALIVKIN, 1955). The formation consists of soft conglomerate, sandstone and shale, intercalated with lignite or brown coal, and is accompanied by acidic pyroclastics. From its stratigraphic succession the formation may be correlated with the Posyet series in the southern Ussuri region. Thickness and other details are not known.
	Granite	Granite, granodiorite and quartz porphyry	The granite associated with granodiorite and quartz porphyry intruded the Upper Paleozoic, Jurassic, Upper Cretaceous and some Paleogene formations during the period starting in Late Cretaceous and ending in Early Tertiary.
	Upper Cretaceous volcanic complex	Tuffaceous sandstone, conglomerate, shale and pyroclastics; thickness unknown	The Upper Cretaceous volcanic complex, consisting of tuffaceous sandstone, conglomerate and shale, accompanied by intermediate to basic pyroclastics, is closely related to the "Tuffaceous Nikan series" in the southern Ussuri region. The thickness and other data are not available.
MESOZOIC	Jurassic formation	Sandstone, conglomerate, shale and coal; thickness unknown	The Jurassic formation is divided into the upper (Mj3), the middle (Mj2) and the lower (Mj1). Available data are very few. However, from the distribution of coal localities indicated in the Geological Map of the U.S.S.R., it can be inferred that both Mj2 and Mj1 are coal-bearing. The formation may be closely related to the "Mongugai series" in the southern Ussuri region (T. KOBAYASHI, 1942), the stratigraphy of which is as follows: Formation Thickness(m) Probable Map Equivalent Probable Manchuria Equivalent Super-Mongugai Goo Upper coal-bearing formation Aj2 Mishan series Upper Jurassic? Upper Mongugai Upper Lower 50 Easal conglomerate Lower Mongugai Upper Lower 950 Conglomerate, tuffaceous sandstone and Halobia shale Mj1 Peipiao series Jurassic
	Pre-Jurassic granite	OBABLE UNCONFORMITY Biotite-hornblende granite INTRUSIVE CONFACT	Pre-Jurassic granite consists of biotite-hornblende granite that intrudes only the Upper Paleozoic formation (Pu), and contact-metamorphosed it as is observed at T'ai-p'ing-chen.
PALEOZOIC	Upper Paleozoic formation	Chert. slate. limestone and	The Upper Paleozoic formation, probably Permo-Carboniferous, occurs in the hilly land between the Nao-li Ho and the Pieh-la-hung Ho west of Tung-an-chen [東 京 始]. It consists chiefly of chert and slate, and the slate is intercalated with thin beds of limestone and graywacke. The formation closely resembles the fossiliferous Permo-Carboniferous formation on the Khabarovsk sheet (NM 53-ll) adjacent on the north.
f	(Column not drawn to scale	•

REFERENCES

- AHNERT, E. E., 1935, Geologic map of Siberia: Unpub. rept.
- KAWADA, Kiyosuke, 1951, Some problems on the topography and geology of the northeastern Manchuria, in Geology and mineral resources of the Far East, Manchuria, II-5-1: Comp. Comm. Geology and Mineral Res. Far East, Tokyo Geog. Soc.
- KOBAYASHI, Teiichi, 1943, (i) The Akiyoshi orogenic cycle in the Mongolian geosyncline; (ii) The Sakawa orogenic cycle in the Amur geosyncline; (iii) The relation among the Mesozoic fossil beds in Koreo-Manchurian land and their ages: Tokyo Imp. Acad. Proc., v. 18.
- KRYSHTOFOVITCH, A. N., 1926, Geology: Pac. Russian Sci. Inv.
- LEONTOVICH, A., PINADA, B., and PECK, A., 1932, Report of the geological expedition in the Khabarovsk district in 1930: USSR United Geol. Prosp. Survey Trans., fasc. 191.
- MASLENNIKOV, D. F., 1937, The Permian of the Far East: Internat. Geol. Cong., 17th USSR, 1937, Abs.
- NALIVKIN, D. V., editor, 1955, Geological map of U.S.S.R., scale 1:5,000,000: U.S.S.R. Ministry of Geology.
- NODA, Mitsuo, 1950, The Carboniferous and the Permian periods of Manchuria, in_Geology and mineral resources of the Far East, Manchuria, III-5: Comp. Comm. Geology and Mineral Res. Far East, Tokyo Geog. Soc.
- OBRUTSCHEW, W. A., 1926, Geologie von Sibirien.