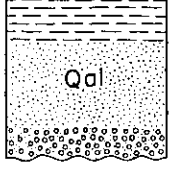
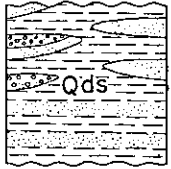
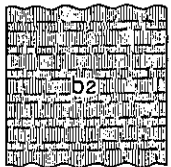
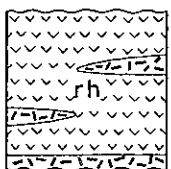
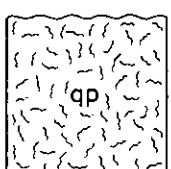
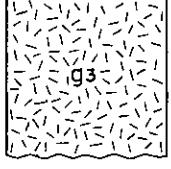
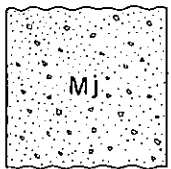
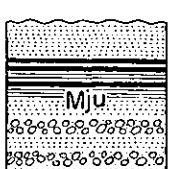
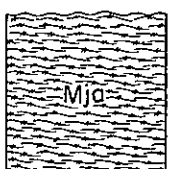
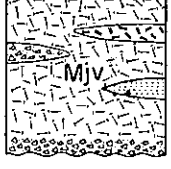
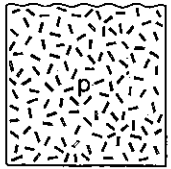
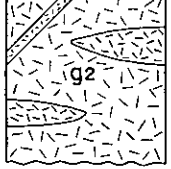
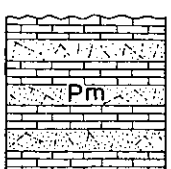
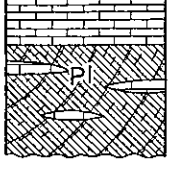


GEOLOGIC COLUMN AND UNIT DESCRIPTION

AGE	ROCK UNIT	LITHOLOGY; THICKNESS WHERE KNOWN	UNIT DESCRIPTION
QUATERNARY	Alluvium	 Sand, clay and gravel; thickness less than 10 meters	The surface soil, covering the Recent and Pleistocene deposits, is known as "tschernosen", and consists of fertile black muck and fine sand with a total thickness of 0.4 to 2 m.
	Diluvium	 Sand, clay and gravel; thickness more than 50 m	Alluvium, consisting of sand, clay and gravel, is distributed in the drainage basins of the Argun River and its tributaries, covering flood plains and low terrace remnants.
TERTIARY	Neogene basalt	 Epidote basalt and olivine-augite basalt	Diluvium, consisting of sand, clay and gravel of aeolian-fluvio-lacustrine origin, is distributed in the southeastern part of the map area. It is covered by Recent sand dunes 0.5 - 3 m thick or by black clayey muck 0.4 - 2 m thick.
	Cretaceous rhyolite	 Rhyolite and cryptocrystalline rhyolite	Neogene basalt is exposed in the eastern part of the map area. The rock between the Ken Ho (肯河) and the Te-erh-pu-erh Ho (德爾布爾津河) is doleritic epidote basalt having many lenticular cavities filled with milky white chalcedony. It abounds in fissures and joints through which springs issue. The rock near Pa-yen-lu-k'o (Pa-ch'ia, 八家) is a trap-type olivine-augite basalt. The basalt in the hills west of the Argun River was defined (NALIVKIN, 1955) as Quaternary in age.
MESOZOIC	Lower Cretaceous(?) formation	 Conglomerate, shale, sandstone and coal; thickness unknown	The Cretaceous rhyolite near Hu-yü-erh-ho-ch'i (Ch'i-chia) consists of rhyolite and cryptocrystalline rhyolite. It rests on the Lower Cretaceous formation (MkL), the pre-Jurassic granite (G ₂), the Lower Paleozoic formation (Pl) and the Precambrian granite gneiss (Ggn).
	Quartz porphyry	 Quartz porphyry and granite porphyry	The Lower Cretaceous(?) formation on the Manchurian side is exposed only in the hill 7 km south of Ch'i-chia. It consists chiefly of tuffaceous conglomerate interbedded with reddish brown shale, sandy shale, and tuffaceous sandstone. It strikes N 20° E and dips 40° SE, unconformably resting on the pre-Jurassic granite. The formation in the U.S.S.R. is widely exposed along the Uruylunguy river and in the vicinity of Bura, but few data are available. The formation exposed in the south-central part of the map area is intercalated with some coal seams, although details are unknown.
	Cretaceous granite	 Porphyritic granite	Quartz porphyry associated with granite porphyry is exposed in the hill south of the Ken Ho. It may be a marginal facies of the Cretaceous granite.
	Jurassic(?) formation	 Tuffaceous sandstone; thickness unknown	Cretaceous granite is exposed in a small area on the southern bank of the Te-erh-pu-erh Ho. The rock is porphyritic granite intruding the Jurassic volcanic complex (Mjv), and is overlain by the Neogene basalt.
	Upper Jurassic formation	 Sandstone, shale, conglomerate and coal; thickness unknown	The Jurassic(?) formation, consisting of tuffaceous sandstone, is exposed near Harujago. It may be Cretaceous in age, although details are unknown.
	Middle-Lower Jurassic formation	 Sandstone, shale, conglomerate and coal; thickness unknown	The Upper Jurassic formation, consisting of sandstone, shale, conglomerate and coal, occurs only in the U.S.S.R., and available data are few.
	Jurassic andesite	 Cryptocrystalline biotite-hornblende andesite	The Middle to Lower Jurassic formation, consisting of sandstone, shale, conglomerate and coal, is exposed along the Kalga River. Available data are very few.
	Jurassic volcanic complex (Greenstone complex)	 Diorite porphyry, andesite porphyry, diabase, dolerite, propylite, tuff, breccia and sandstone; thickness unknown	Jurassic andesite occurs as flows resting on the Jurassic volcanic complex. It is distributed between the Ken Ho and the Te-erh-pu-erh Ho. The rock is black, compact, cryptocrystalline biotite-hornblende andesite. Fluorite occurs where calcite veins intersect quartz veins. A fluorite deposit is exposed in the cliff 6 km northwest of Suetokörei along the Ken Ho. Fluorite is light red, white, light blue or light green, and occurs as aggregates of transparent crystals.
	Porphyrite	 Porphyrite, granite porphyry, diorite porphyry and andesite porphyry	The Jurassic volcanic complex, or "greenstone complex", is exposed on the hills between the Ken Ho and the Te-erh-pu-erh Ho. It is a complicated assemblage of purple or dark green intrusive and extrusive rocks, containing visible phenocrysts of biotite and plagioclase in the holocrystalline groundmass. It rests on or intrudes the pre-Jurassic granite. The complex in the U.S.S.R. is defined by Soviet geologists as Upper Jurassic effusives, including diorite porphyry, andesite porphyry, diabase, dolerite, propylite, tuff, breccia and sandstone.
	Pre-Jurassic granite	 Biotite granite, two-mica granite and aplite	Porphyrite, consisting of gray porphyrite, granite porphyry, diorite porphyry and andesite porphyry, occurs in association with the Jurassic volcanic complex. It may be a marginal facies of the pre-Jurassic granite.
PALEOZOIC	Middle(?) Paleozoic formation	 Limestone and quartzite; thickness unknown	The pre-Jurassic granite occurs as batholith which is widely exposed in the northeastern part of the map area. The rock between Hsiao-ho-tzu (小河子) and Ch'i-chia (八家) consists chiefly of coarse-grained biotite granite containing light pinkish orthoclase phenocrysts. Locally two-mica granite occurs accompanied by fine-grained aplite. The granite on the eastern slope of Ch'üan-shan-tzu (关山子), 20 km north-northeast of Hsiao-ho-tzu, is intruded by a quartz vein, 10 m wide, which strikes N 40° W and dips vertically, in association with dikes of diorite porphyry. The granite near Hsiao-ho-tzu was formerly quarried to build a fort at Tung-ti-ying-tzu (团地营子). The granite exposed on the U.S.S.R. side was defined by Soviet geologists as Paleozoic acidic intrusives including granite, granodiorite and quartz diorite. It is probably correlated with the pre-Jurassic granite.
	Lower Paleozoic formation	 Limestone and slate; thickness unknown	The Middle(?) Paleozoic formation is exposed in the following two places: (1) The formation near Hsi-shan-tou (黑山头), southeast of Tung-ti-ying-tzu, consists of grayish black massive limestone locally accompanied by white crystalline limestone which was metamorphosed by intrusion of diorite porphyry. The formation strikes N 60° - 70° W and dips 50° - 60° NE. The limestone is calcined for lime. (2) The formation north of Hsiao-ho-tzu consists chiefly of white saccharoidal crystalline limestone metamorphosed by intrusion of the pre-Jurassic granite. The formation is locally interbedded with thin layers of quartzite. It strikes N 60° W and dips 70° NE. The limestone is calcined for lime. The formation widely exposed in the U.S.S.R. is defined by Soviet geologists as Ordovician and Silurian.
PRECAMBRIAN	Precambrian granite gneiss	 Biotite orthogneiss, biotite schist and two-mica schist	The Lower Paleozoic formation is exposed on the eastern bank of the Argun River, stretching southwestward from Ch'i-chia to a village 20 km west-northwest of Hsiao-ho-tzu. The formation consists chiefly of limestone and slate intruded by biotite metagneiss which was metamorphosed from clay slate. It is overlain by the Cretaceous rhyolite and is intruded by the pre-Jurassic granite. The formation exposed on the U.S.S.R. side of the Argun River was defined by Soviet geologists as a Cambrian-Ordovician formation, and the formation exposed in the southwestern part of the map area was defined as a Lower Cambrian formation.

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(Column not drawn to scale)