GEOLOGIC COLUMN AND UNIT DESCRIPTIONS

		LITUOLOGY, THICKNIESS		
AGE	ROCK UNIT	LITHOLOGY; THICKNESS WHERE KNOWN	UNIT DESCRIPTION	ECONOMIC VALUE
QUATERNARY	Alluvium	Loess, sand, gravel, and clay; thickness less than 30 meters.	Alluvium consists of Recent loess, sand, gravel, and clay. Redeposited loess at the foot of hills attains 30 m in thickness, but fluviatile sediments are generally less than 10 m thick. Near the estuary of the Ta-ling Ho [大汉河], however, the Alluvium may be very thick, although the thickness was not measured.	Au:- The Chia-shan [夾山] gold mine,
MESOZOIC	Quartz porphyry and granite	g_{a} , quartz porphyry and granite porphyry. g_{a} , quartz porphyry and granite porphyry. g_{a} , qranite quartz monzonite, quartz diorite, g_{a} , granite quartz monzonite, quartz diorite, g_{a} , distributive contact.	Quartz porphyry and granite porphyry are intrusive rocks which may have been differentiated from a magma similar to the Cretaceous granite (g3). The quartz porphyry and the dikes of lamprophyre-like rock in the district of Chia-shan [庆山] where gold ore deposits occur can be considered as ore bringers. Cretaceous granite is usually marked with predominant feldspar crystals of pinkish tinge. The granite and quartz diorite, in contact with the Cambro-Ordovician rocks, form numerous lead-silver and copper deposits, and also the molybdenite deposit of the Yang-chia-chang-tzu [楊东秋子] mines, about 30 km northwest of Hsing-ch'eng [吳城]. An intrusive mass of quartz diorite in the district of K'uan-t'ung-shan formed contact-metamorphic deposits of copper ore, within the zone of pre-Sinian dolomitic limestone.	25 km north of Sui-chung [新中], was closed a long time ago. Cu ₁ : - Hua-tung-kou [世紀] copper mine. Exploitation was started during World War II. Some geologists thought it very promising. Mo, Cu, Pb, Zn:- Yang-chia-chang-tzu mines. Primarily opened as a lead-silver-copper mine; working of molybdenite was not started until right before World War II. This is one of the most important molybdenum resources in China.
	Undifferentiated Mesozoic rocks	Sandstone, shale, tuff, conglomerate, and volcanic rocks.	Undifferentiated Mesozoic rocks probably include Jurassic volcanic complex and some Jura-Cretaceous rocks. No information on the sequence is available.	
	Upper-Middle Jurassic volcanic complex	Sandstone, conglomerate, breccia, tuff, and salesite flows, and porphyrite; thickness not known.	Jurassic volcanic complex consists of tuffaceous sandstone and thick conglomerate, intercalated with flows and sheets of andesite and porphyrite. The complex may be Middle - Lower Jurassic in age.	
	Andesite	Porphyritic andesite and diabase-porphyite.	Andesite and diabase-porphyrite are probably mainly intrusive sheets that may have been intruded at the bottom of the Jurassic volcanic complex (Mjv). Breccia is found locally.	
	Granite	## dia errusive comaci \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	Triassic granite (g2) intrudes Sinian and Paleozoic rocks, and is covered unconformably by the Jurassic volcanic complex (MJv). The intrusions of the granite formed numerous minor deposits of asbestos in the siliceous or dolomitic limestone of Sinian system, due to contact metamorphism.	
PALEOZOIC	Hamashan series	Put Coarse sandstone. Shale, sandstone and arkose. Put Basal conglomerate. (Total thickness 340-1,200 m.)	Undifferentiated Upper Falcozoic (Pu) probably contains Triassic (Puk) and Permian (Pup) rocks. The Hamashan series [哈景山縣], in the district of Yang-chia-chang-tzu, ranges from 340 to 1,200 m in thickness. The succession in descending order is; (3) thick bedded white coarse sandstone, (2) alternating reddish shale and sandstone intercalating with false-bedding white sandstone, and (1) basal conglomerate. In the area east of Yang-chia-chang-tzu the whole sequence is reported to have been observed, but in the western area the basal conglomerate seems to be directly covered by the thick bedded white quartz sandstone, due to a probable unconformity.	
	Hunlohsien series	Sandstone, shale, conglomerate, fire clay, coal, and limestone; thickness 100-200 m.	The Hunlohsien series [紅葉斑鏡] is a coal-bearing formation consisting of sandstone, shale, conglomerate, fire clay, coal, and limestone. It generally covers the Ordovicien limestone (Plo) with a presumable disconformity. Two or three seams of coal are intercalated in the lower part of the series, but coal is not promising due to discontinuous seams. Lenses of fossiliferous limestone are found below these coal seams. The bottom of the series is occasionally marked with the fire clay G-bed. Floras from these coal seams are Pecopteris sp., Cordaites sp., Tingia sp., and Lepidodendron, etc., showing a resemblance to the Permian flora of the Tai-tzu Ho [太子河] basin in South Manchuria. According to Mitsuo NODA, a bed of slaty shale resting below the coal seam at Ping-ting Shan [平原山], 10 km south of Yang-chia-chang-tzu, yielded such fauna as Chonetes cf. latesinuata Schell, Productus taiyuanfuensis Grabau, and Sanguinolites cf. olsani Grabau. The series may be Permo-Carboniferous in age.	Coal fields in the Yang-chia-chang-tzu district were worked by natives long ago; usually accompanied by fire clay beds.
	Ordovician formation	Limestone, dolomitic limestone, shale, and calcareous sandstone; thickness 700 m. Disconformity?	Undifferentiated Lower Paleozoic (Pl) probably contains Ordovician (Plo) and Cambrian (Plc) rocks. The Ordovician formation, about 700 m thick, in the district of Yang-chia-chang-tzu consists in ascending order of calcareous sandstone, white limestone, oblitic limestone, purple shale, vermicular limestone, and dark gray dolomitic limestone. The formation is injected by a batholith of granite (g3), and the silver-lead-molybdenum deposits of the Yang-chia-chang-tzu mines were formed within or near the zone of contact metamorphism. Girvanella manchuria was collected from the dark gray limestone.	
	Cambrian formation	Shale, calcareous sandstone, quartzose sandstone; and basal conglomerate; thickness 100-1,000 m. Discretional constitution of the constitution of	The Cambrian formation in the district of Kao-ch'iao [高橋] was reported as Lower Cambrian, and consists of shale, calcareous sandstone, quartzose sandstone and basal conglomerate; 100-1,000 m in thickness (see the section). The formation near Yang-chia-chang-tzu consists mainly of quartzite and is 100 - 150 m in thickness; this quartzite is resistant to erosion, results in conspicuous scarps. Limestone is found in the northwestern quarter of the map area.	
UPPER PRECAMBRIAN	Upper or Limestone formation / Lower or Quartzite formation	Siliceous limestone. Quartzite. Gray, thickly bedded limestone. Clayey limestone. Siliceous limestone. Cryptozoön limestone. Quartzite, shale. Cryptzoön limestone. Siliceous limestone. Siliceous limestone. (Total thickness 2,000-2,500 m.) Quartzite, shale. Arkose. Conglomerate. (Total thickness 1,000-1,500 m.) (Section near Kao-chiao)	The Sinian system in the district of Kao-ch'iao on the Peiping-Liaoning Railway consists in ascending order of the Lower or Quartzite formation 1,000 - 1,500 m in thickness, and the Upper or Limestone formation 2,000 - 2,500 m in thickness, according to Shutarō USHIMARU (see the section). The Sinian of this district was correlated by R. SAITŌ with the lower part of the "Sanchiatzu series" [章 章 开 赋], or the Lower Sinian of the Kai-yuan [陽 景] district. Sinian stratigraphy in the district of Ru-lu-tao [楊 春 九] was differently interpreted by various geologists because of complicated overthrusts. A section prepared by Susum MATSUSHITA (1942) in descending order is as follows: VI, slate and stliceous slate (over 800 m in thickness); V, quartzite and conglomerate (over 2,060 m thick); II, sliceous limestone (over 400 m thick); III, quartz sandstone, afkose, and compact soil rock (200 m thick); II, lack slate (250 m thick); II, arkose and fine sandstone (250 m thick). MATSUSHITA suggested its resemblance in lithology to the so-called "Tahoshangshan series" [大 和 衛 山 縣], or the Lower Sinian in the Liaotung Peninsula. On the upper reaches of the Liu-ku Ho [元 縣 別] the Sinian system seems to consist mainly of siliceous and dolomitic limestone, but no detailed information is available.	Mn:- Manganese deposits may be intercalated at the top of the Sinian system; not very promising. A:- Asbestos deposits are distributed in the thick limestone of the Sinian system; probably formed by contact metamorphism of the granite intrusion.
LOWER-MIDDLE PRECAMBRIAN	Granite gneiss	Unconformity Granite gneiss, migmatite gneiss, biotite granite, and pegmatite.	Granite gneiss consists of orthogneiss and pre-Sinian granite. The orthogneiss includes biotite granite gneiss, pegmatite and some migmatite gneiss. Pre-Sinian granite with no schistosity was reported by S. MATSUSHITA from the district of Hu-lu-tao.	
	Middle Precambrian system	Crystalline limestone, chlorite schist, and phyllite.	The Middle Precambrien system, distributed in the district of K'uang-t'ung-shan(別 切 山) on the south coast of Liao-tung-wan, consists of crystalline linestone, chlorite schist and phyllite. Thickness unknown.	-
	Lower Precambrian complex	Phyllite, crystalline schist, calcareous rocks and various gneisses.	The Lower Precambrian complex consists of phyllite, crystalline schist, calcareous rock, and various gneisses; in features, it resembles the so-called "Toishan complex". Thickness unknown.	
	(°	Column not drawn to scale		

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