## GEOLOGIC COLUMN AND UNIT DESCRIPTION

TO SAME DESCRIPTION

LITHOLOGY; THICKNESS AGE ROCK UNIT UNIT DESCRIPTION GROUND WATER REFERENCES WHERE KNOWN Geological Institute, South Manchuria Railway Co., 1938, Ground water in the northern part of the map area is superior both in quality and quantity The surface soil distributed north of the Wu-yu-erh Ho [烏 魚 东 河] is "tschernosem" which is fertile black to that in the southern part. Drillhole 6 at Ning-nien station revealed the following Geological map of Manchuria, scale 1:1,000,000. muck, 0.5 to 2 m thick. The surface soil south of said river is "leached tschernosem" which is 0.3 to sequence in descending order: muddy earth (5 m), first aquifer consisting of sand and gravel 2 m thick, consists of black muck and very fine sand in various proportions, and is less fertile than (6.5 m), quartz sand (1.5 m), clay (4.5 m), second aquifer consisting of sand (20 m). The HIRAI, Keizō, 1935, Study on soils in Manchoukuo: Kyushu aquifers are composed of fluvial deposits of the Neng Chiang; the water is transparent and Imp. Univ. Agricultural Dept. Alluvium is widely distributed in the drainage basins of the Nen Chiang [to II], the Wu-yu-erh Ho, and their odorless, but contains iron and manganese. Drillhole 7, 60 m deep, near Fu-hai revealed a Gravel, sand and clay; tributaries, covering vast flood plains and low terrace remnants. The alluvial regions are characterized by good aquifer at a depth of about 30 m. Water pumped through a 300 mm casing attains 400 tons SATTŌ, Rinji, compiler, 1940, Geological map of Manchuria Alluvium thickness less than playas and swamps which are especially abundant in the lower reaches of the Wu-yu-erh Ho where streams disand adjacent areas, scale 1:3,000,000: Manchoukuo per day. A drillhole, 118 m deep, near Tai-an disclosed four aquifers. The first aquifer, 15 meters appear into the Pleistocene aeolian-lacustrine sand and become subsurface flows, or pour into inland lakes. 7 m thick at a depth of 3-6 m, consists of fine-grained sand and gravel. Water obtained The alluvium comprises fluvial, lacustrine, and aeolian deposits. A fluvial deposit exposed in the upper through a 300 mm casing amounts to 800 tons per day. The water is transparent and odorless, reaches of the Wu-yu-erh Ho and the Shuang-yang Ho [双 陽 河] consists of clay, sand, and gravel, and is less USHIMARU, Shūtarō, and others, 1937, Geology and geography but contains manganese. The second aquifer occurs at a depth of 13 m and is 3 m thick. The than 5 m thick. A fluvio-lacustrine deposit in the western part of the map area consists chiefly of clay, third aquifer lies at a depth of 60 m and is 8.8 m thick. The fourth aquifer occurs at a of northern Manchuria: Geol. Inst., S. Manchuria locally associated with aeolian sand and rarely with gravel. The thickness gradually increases westward Ry. Co. depth of 105 m and is 5 m thick, consisting of crossbedded fine-grained sand interbedded in where it is measured as less than 15 m. Natural salt is found in playa deposits. thick clay. Water from shallower wells is light yellow and turbid, containing ammonia and suspending impurities. The results of water analyses made in 1943 are tabulated below. Diluvium consists of aeolian-lacustrine deposits (Qdl) and fluvial or fluvio-lacustrine deposits (Qdg). Hardness Properties Qdl is aeolian-lacustrine deposits rarely associated with fluvial sand. It is distributed in the southwestern Drinkable Well Depth Turbidity of(by German Volatile Bacteria Remarks part of the map area, and is covered by thin Recent deposits. It consists chiefly of lacustrine sand and clay, or not method) matter(per l c.c. Location  $_{
m type}$ (m) accompanied by aeolian sand which increases westward. Due to wind erosion, the Qdl distribution area shows a characteristic undulation, and there are some playas which produce natural salt. Drillholes revealed the fol-7.8 270 Contains Casing Transparent | Odorless | Alkaline | 7 | tr. | tr. | n.d. | n.d. | 5.2 | n.d. | 3.6 10 Not drinkable Qdl: aeolian-lacustrine sand Ning-nien station lowing sequences in descending order\*. (1) Tao-k'ou [道口], 38 km west-northwest of Lin-tien: black earth and clay; thickness more (water-supply tower) manganese well (0.3 m), yellow mud (1.7 m), yellow fine sand (6 m). (2)\*\* Huang-wo-p'eng [黄 窩 棚], 20 km northwest of Linthan 17 m tien: black earth (0.8 m), yellow mud (2.2 m), yellow fine sand (8 m). (3)\*\* Chao-hsiang-wu [超 祥五], 12 km 50 | Transparent | Odorless | Alkaline | 10 | tr. | tr. | n.d. | tr. | 4.9 | 2.2 | 1.3 Ning-nien (well of the Casing 7.8 250 20 Not drinkable Contains northwest of Lin-tien: black earth (0.5 m), yellow mud (3 m), yellow fine sand (4.4 m). (4) Lin-t'ien [林 句] Japanese Army barracks) well manganese Primary School: black earth (1 m), yellow mud (1.5 m), yellow mud with fine sand (4.3 m), yellow fine sand and iron (1.2 m). (5) Kuo-yu-t'un [郭 有 电], 39 km northeast of Lin-tien: black earth (0.9 m), yellow mud (2.1 m), Drinkable 4.7 Transparent | Odorless | Slightly | 17.7 | tr. | pr. | tr. | n.d. | 3.2 Ning-nien (well of a Wooden 9.8 -fine sand with mud (3 m), yellow fine sand (12 m). wall native house) alkaline Diluvium Qdg, consisting of fluvial sand, clay, and gravel, is distributed in the northern part of the map area, under-Tai-an station 114.5 Transparent | Odorless | Slightly | 1.2 Drinkable Casing 5.3 | tr. | n.d. | n.d. | n.d. | ---lying the thin Recent deposits. (water-supply tower) well alkaline Qdg, consisting chiefly of fluvio-lacustrine clay in the upper part and sand in the lower part, is exposed in the southeastern part of the map area. Drillholes revealed the following sequences in descending order. Tai-an station (locomo-Transparent Odorless Slightly tr. | n.d. | n.d. | 3.6 | 0.1 | --2.3 150 140 Casing Drinkable (I) Fluvial deposits: (6) Ning-nien (事年): muddy earth (35 m), sand and gravel (6.5 m), sand (1.5 m), clay tive-engine house) well alkaline (4.5 m), sand (20 m). (7) Fuhai [富海]: muddy earth (3.5 m), sand and gravel (4.5 m), sand (22 m), coarse Qdg: fluvial to fluviosand (30 m). (8) Tai-an [表 安]: dark gray sandy mud (5.1 m), sand and gravel (7.2 m), fine sand with gravel (1.8 m). (II) Fluvio-lacustrine deposits: (9) I-an (well #4): black soil (2 m), grayish-yellow silt (1.5 m), yellow clay (16.5 m). (10a) Shuang-yang-chen (well #5): black soil (1.7 m), yellow clay (3.3 m), clay with lacustrine sand, clay 120 Casing 50 | Transparent | Odorless | Slightly | 2.3 Drinkable Tai-an station (S. tr. | n.d. | n.d. | n.d. | 3.2 | and gravel; thickness Manchurian Railway Co. well alkaline more than 50 m residence) fine sand (3 m). (10b) Shuang-yang-chen (well #4): black soil (2.5 m), yellow clay (5.5 m). Shuang-yang-chen (Police Odorless | Slightly | 17.7 | tr. | tr. | tr. | tr. | --Hexagonal Slightly 12.0 --The yellow clay in the fluvio-lacustrine deposits is used in brick manufacture. station), 20 km eastwell turbid alkaline northeast of I-an \* Numbers refer to drillhole sites shown on map. Fu-ch'iang-chen (Police Hexagonal Slightly Muddy Slightly {14.2 | tr. | tr. | tr. | ----\*\* Not shown on the map. odorstation), 30 km east of alkaline yellow Ch'ien-yuan-chen [乾 元 鎮] , Hexagonal -- Slightly Slightly | 14.2 | tr. | tr. | tr. | tr. | ---Odorless 58 km northeast of I-an alkaline yellow The Neogene formation crops out at Feng-t'ien-t'un [奉 天 屯] 10 km north of Tai-an station. The upper part, 40-45 m thick, consists of clay, clayey shale, gravel and lignite. The lower part, more than 60 m thick, I-an (Prefectural -- Transparent Odorless Slightly 20.8 pr. pr. pr. Wooden consists of sand, soft sandstone, clayey shale and lignite. Drillholes in the vicinity of Tai-an station Government official wall alkaline revealed the following sequences in descending order: residence) I-an (Central cross Odorless | Slightly | 21.3 | pr. | pr. | tr. | Wooden Slightly road) wall turbid alkaline number (n.d. .. not detected tr. .... trace pr..... prominent) Water-supply tower #1, Water-supply tower #2, Tai-an Upper part: clay, clayey shale, Well at Tai-an station Tai-an station station (200 m west of tower #1) gravel and lignite; thickness Location more than 40 m Lithology Depth | Thickness | Depth Thickness Lithology Depth Thickness Lithology (m) (m) (m) (m) Pleistocene 10.9 6.0 Diluvial 12.3 12.3 Diluvial 18.5 18.5 Diluvial deposits deposits deposits Fine sand with 1.8 Fine sand with 23.03 gravel Neogene formation gravel Clay Lignite (seam 1) 23.57 20.7 1.0 Lignite (seam 1) 3.7 Clay 60.19 36.62 | Clay 1.7 1.8 Clay 21.7 2.1 | Lignite (seam 2) 24.2 Lignite (seam 2) 27.1 5.4 Fine sand 25.4 1.2 Sandy clay 31.8. 58.9 Clay Clay Sandy clay Fine sand Lower part: sand, soft sandstone, 99.7 44.9 Clay 72.2 Sandy clay 0.8 Sandy clay clayey shale and lignite; thick-100.8 1.1 Sandy clay 104.0 31.8 4.8 Clay Clay 66.85 ness more than 60 m 109.6 Fine sand 114.9 68.55 10.9 Fine sand 1.7 Fine sand 112.6 3.0 | Lignite (seam 3) | 118.0 Sandy clay 3.1 119.6 7.0 Fine sand Seam 1 of drillhole 8a is muddy peat; both seam 2 and seam 3 contain much woody matter and ash. Seam 1 and seam 2 of drillhole 8b are better quality than those of drillhole 8a. No lignite seams are found in drillhole 8c. Because of variable quality even within a distance of 200 m, lignite is thought to occur in lenses. Thick lignite was once worked but the business was not profitable because of mine water and inferior quality of the lignite. Column not drawn to scale

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