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SPECIAL REPORT

STRATEGIC ENGINEERING STUDY

NO. 80

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TERRAIN INTELLIGENCE

CHITA OBLAST (U.S.S.R.)

PREPARED BY
U.S. GEOLOGICAL SURVEY

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STRATEGIC STUDIES SECTION
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Prepared by:

Section of Military Geology
U.S. Geological Survey
Department of the Interior

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Strategic Studies Section
Intelligence Branch
Office, Chief of Engineers
July, 1943

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T A B L E O F C O N T E N T S

Page

INTRODUCTION

A. GENERAL

The following folio of maps and explanatory tables outlines the principal terrain features of the Chita Oblast. Each map and table is devoted to a specialized set of problems; together they cover such subjects as terrain appreciation, rivers, surface-water and ground-water supplies, construction materials, fuels, suitability for temporary roads and airfields, mineral resources, and geology. These maps and data were compiled by the United States Geological Survey.

B. TERRAIN APPRECIATION

The terrain appreciation sheet, based on map reconnaissance, appraises the effects of topography and kind of ground on movement, cover, and concealment of troops and supplies. Climate, effects of shell fire, movement, water supply, observation, concealment and cover, and camouflage problems are summarized for Chita Oblast as a whole. The area is divided into 18 physiographic provinces. The topography of each is summarized as to average altitude and relief; nature and extent of hilltops, hillsides, and plains; and the character of streams and their valleys. Brief mention is made of the kind, amount, and distribution of soil and bare rock. Type of vegetation, settlements, and existing roads and railroads are briefly summarized to complete the terrain setting; for proper appraisal of these factors the reports of other intelligence units should be consulted.

C. WATER SUPPLY

Existing and potential water supplies are reviewed primarily for use in planning operations but also to assist geologists attached to water supply battalions in locating ground water supplies. A map showing permeability of bedrock is supplemented by information on wells, and springs. An attempt is made to appraise the potential ground water resources, and to indicate the most promising sources of supply. Surface water supplies are discussed in a separate table.

D. SUITABILITY FOR TEMPORARY ROADS AND AIRFIELDS.

Feasible transportation routes through the oblast at various seasons are briefly reviewed, and seasonal construction problems inherent in regions of permanently frozen ground are outlined. Description of each of five areas within the oblast includes such features as topographic barriers, extent of level areas, type of ground, and drainage problems, and their effect on problems of road and airfield construction. The occurrence of useful construction materials is indicated. Roads, railroads, and rivers already available for transportation are briefly mentioned.

E. RIVERS

The Rivers sheet describes the principal valleys and streams of the Chita Oblast. Valley characteristics, such as width, drainage, and slope; and river characteristics, such as discharge, gradient, and dates of freezing and thawing are discussed. Ease of travel along and across rivers and valleys is discussed, as well as the possibility of using rivers as transportation routes.

F. CONSTRUCTION MATERIALS

This sheet shows the distribution of rocks suitable for building stone, lime, cement, concrete aggregate, road metal, ballast, riprap, and brick.

G. MINERAL FUELS

The principal coal deposits and undeveloped oil shale deposits and oil-bearing areas are shown on this sheet. The text outlines quality, mining methods, reserves, past production, and geology.

H. MINERAL RESOURCES

This sheet outlines the distribution, mining methods, past production, geology, and estimated reserves of mineral resources other than fuels. Lead, zinc, iron, tungsten, tin, fluorite, bismuth, and gold are the principal metals produced.

I. GEOLOGY

The basic data from which much of the foregoing was derived is summarized on the geologic map. This sheet is intended primarily for geologists who may be assigned to specific problems in the Chita Oblast to give them a general picture of the regional relations of the rocks in order to permit better interpretation in small areas where geologic advice may be needed.

J. MISCELLANEOUS

Climatic factors are summarized on a series of small maps. Views of typical terrain features are also included.

Method of compilation and reliability of data

These data have been assembled from published reports and maps of the geology of the area as listed on the geologic map of this set. The data presented necessarily involve more or less interpretation on the part of the compilers and the reliability depends very largely on the adequacy of the original reports and maps of the area. Each compilation is given a reliability rating as judged by the compilers. These ratings are:

Class A:	Original data so complete that the compilation involves little or no interpretation by the compilers.
Class B:	Original data seem accurate but incomplete for this purpose, and have required much interpretation.
Class C:	Less accurate and less complete than B, better than D.
Class D:	Original data very sketchy; inaccurate as well as incomplete.

Original source maps are rated in three classes for each scale of map as follows:

Surveyed map:	The original map represents an actual instrumental survey and should be entirely reliable for the scale.
Reconnaissance map:	The original map was not surveyed but seems to have been carefully prepared. General features are correctly shown but the details are incomplete and inaccurate for the scale.
Sketch map:	The original map is highly diagrammatic and may contain gross errors.

* Articles have been most useful in preparation of this report.

Translation of title in parentheses () indicates that translation was given in original publication.

Translation of title in brackets [] indicates translation by U. S. Geological Survey.

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Maps:

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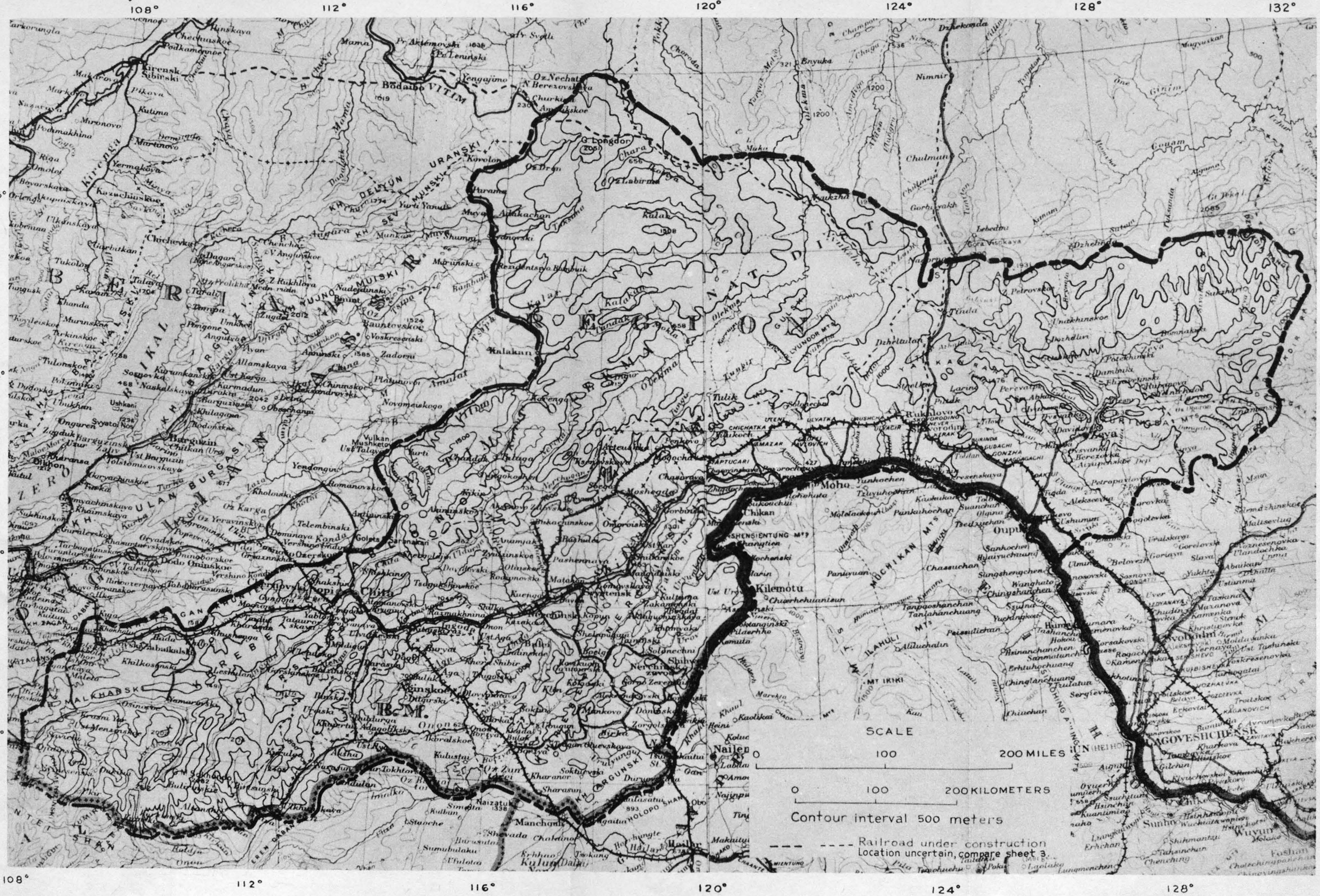
SHEET I, TOPOGRAPHIC MAP

CHITA OBLAST



Geographical Section, General Staff No. 2957.

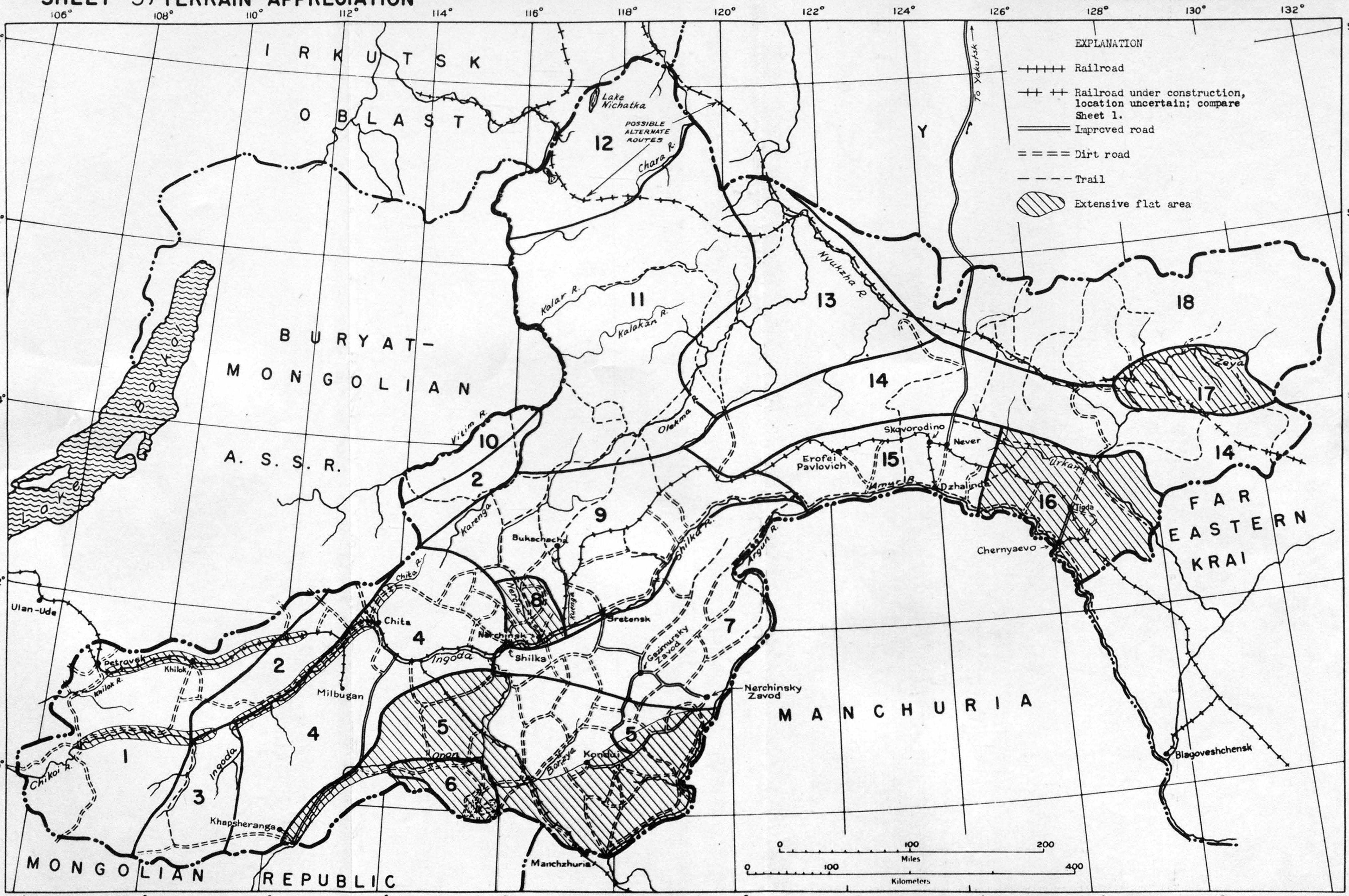
3rd Edition, 1939. reprinted A.M.S. 1942.

Model photographed with dominant light from the northwest to avoid pseudo-stereoscopic effect.

Modeled by U.S. Geological Survey

SHEET 3, TERRAIN APPRECIATION

CHITA OBLAST



Reliability rating Reconnaissance map
Compiled by U. S. Geological Survey

Introduction

Most of the Chita Oblast is made up of arcuate ridges, which roughly parallel the Argun and Amur Rivers. The intervening valleys constitute a relatively small proportion of the total area. In the south central part along the Onon and Borzya Rivers (areas 5 and 6), are treeless steppes, a northern extension of the Mongolian steppes. Dissected plateaus form level but broken uplands in several places: north of Nerchinsk (area 8), on the Olekma River (area 13), between the Amur and Zeya Rivers (area 16), and on the Upper Zeya (area 17). The whole region, except the treeless steppes on the Onon and upper Argun Rivers is covered by forest, broken only by small areas of swamp and meadow. In the eastern part (east of Never), the forest is thin and consists mostly of deciduous trees, but in the west it is dense northern forest called taiga [a]. The climate is damp and warm in summer, intensely cold and dry in winter, and the ground is permanently frozen below an average depth of 2 to 10 feet.

Although the Chita Oblast may be subdivided topographically into 18 areas, most of these areas are similar in climate, vegetation, and kind of ground. In much of the region, the similarities between the areas in climate, forest cover, frozen ground in winter and boggy ground in summer have more effect on military and engineering operations, and on movement, observation, concealment and cover than do the topographic differences.

Climate

The climate is continental. Winters (October to March) are clear, dry, and still; summers (June through August) are moderately warm, but short, cloudy, and windy. The mean annual temperature is about 25° F.; average temperature in summer is 65° F.; and in winter -20° F. Temperatures sometimes reach -60° F. in winter, and 100° F. in summer. The warmest month is July, and the coldest January. From December through January temperatures rarely rise above freezing. Ice on rivers attains an average thickness of about 40 to 50 inches, and on lakes about 60 inches.

The mean annual precipitation is low, and most of it falls in summer in the form of torrential rains. Snow cover is not continuous owing to the small snowfall, and to dry winds. Maximum fogginess is in summer, except in the western part where fogs are frequent in winter. Cloudiness is greatest in summer. Summer winds generally are stronger than winter winds. Upper winds are southeast in summer and northwest in winter, but lower winds are largely controlled by topography, and usually blow northeast or southwest. Gales are common in spring and summer, blizzards are common in fall and spring. (See climatic maps).

Kind of Ground and Effect of Shell Fire

Large parts of the Chita Oblast are soil-covered, but bedrock is exposed on many ridge tops and high peaks, and in steep-walled valleys. The most common rock, especially on the mountain ridges is hard, massive granite, or tough foliated crystalline rock which would permit only slight penetration and fragmentation by shells. Softer rocks, which probably shatter more easily, form hills and terraces in many of the valleys. In many places the bedrock is covered by heaps of broken rock, and valley walls may be lined by coarse talus. This kind of material may greatly increase the danger from shell bursts because of flying rock fragments.

The valley floors and plateaus generally are underlain by sand, gravel, bouldery soil or peat. This soil layer is almost completely frozen from October to April. During April the top of the soil starts to thaw, and by September is usually thawed to depths of about 2 to 10 feet; at greater depths the ground is permanently frozen. During the summer the valley floors and level surfaces, even on plateaus, are in most places wet or swampy. At this season penetration by shells would be relatively deep, but the explosive force would generally be damped. Flying pebbles and boulders would add to shrapnel effect in extensive areas mantled by gravel. When the ground is frozen it is not easily shattered, and during the winter shell penetration would probably not be deep.

Movement

Movement in most parts of the Chita Oblast is difficult partly because there are many topographic barriers, partly because of the dense forest that covers the western part of the oblast, and partly because of the boggy condition of much of the area in summer. In general, travel is restricted to the large streams (by boat in summer and over the ice in winter) and to established trails and roads.

Vegetation and ground as barriers to movement: West of the meridian of Never broad plateau surfaces, mountain ridges, and many valley floors are covered by dense forest, called taiga [a] which can probably be traversed only by laborious cutting of trails. The taiga is interrupted by numerous extensive treeless areas, particularly on wide valley floors. Most of these are swampy, and passable only with difficulty from April to October, but can be crossed anywhere during winter. This is particularly true of the Amur and Zeya Valleys. Some wide valleys, particularly on the west have large dry meadows. Small, dry open patches of meadow are scattered on south-facing mountain slopes but are too discontinuous to be corridors for movement.

Ridge tops and high mountain slopes in places rise above timber line, and are moss-covered and rocky, but rugged enough to be important barriers to movement.

The deciduous forests, which are extensive in the far eastern part of the oblast are probably easily passable in winter.

In the southern and also the eastern parts of the oblast are several treeless areas. The largest of these is in southeast Transbaikal (areas 5 and 6), where the grassy steppes of the Mongolian desert extend northward into the Chita Oblast. In this area, except for swampy lake basins in summer and some rocky ridges, movement is unrestricted. In winter, swamps and lakes are frozen and easily passable. Treeless areas are also found on some plateaus, particularly in area 16. These are swampy in summer, but in winter are firm and easily traversed.

Topography as barrier to movement: Topography probably does not affect movement on foot or by pack train as much as does vegetation and ground, but it is an important factor in the construction of roads (see report on suitability for temporary roads). The long ridges which cross the Chita Oblast are rugged and steep and movement is generally much easier in valleys. On the plateau areas, which are deeply dissected (areas 8, 13, 16, 17), movement is probably easier on the uplands than in the valleys.

Natural routes of travel: The only natural routes of travel are rivers. The Zeya, Amur, Shilka, and Argun are navigable streams. During summer the Amur and Shilka are navigable for steamboats up to Sretensk, and can be navigated by rafts to points above Chita (see Rivers sheet for data on other streams). Owing to frequent low water stages, however, this is not a reliable nor rapid means of transport, and owing to the swampy character of most of the valleys or to their dense vegetation, the river valleys are not good land routes during summer. Movement is not easy even along minor streams because the beds are narrow, winding, and rocky, or littered with windfall.

In winter the rivers are frozen and the large ones form good natural roadways which can be used by pack trains or by vehicles (see rivers sheet).

Except for rivers, travel must follow existing roads and trails, or new roads and trails.

Existing trails and roads: Many pack trails cross the area between mining towns and other isolated settlements. Where possible, they follow open areas, or the banks of minor streams.

Surfaced roads are few. In places dirt roads are numerous, but because the ground will not bear heavy traffic except in winter, they probably are used chiefly during the winter season (see report on suitability for temporary roads).

The Trans-Siberian Railroad crosses the area from east to west and is the only continuous route of travel across it. A new railroad is reported to be under construction, from the Lake Baikal area to the Lower Amur, and its route probably crosses the northern and northeastern part of the Chita Oblast.

Snow cover: The snow cover during winter lasts 140 to 200 days, but its thickness averages only 4 inches in the southern part and 16 inches in the northern part. It does not completely cover the ground. Snow alternates with bare patches, even in the taiga.

Water Supply

During summer water is easily obtainable from numerous streams, springs, and shallow wells; in winter most streams are completely frozen and most springs and shallow wells are frozen so that water is scarce. Some springs flow throughout the year and in some areas deep wells or large streams continue to supply water throughout the year. Large areas are devoid of water supplies, and in others water can be obtained only by expensive drilling operations. (See water supply sheet).

Observation

Observation is limited in most parts of the Chita Oblast, because the vegetation is so thick that movement can be concealed. The straight wide valleys (as much as 7 miles wide) in the western part, such as the Ingoda, Khilok, and Chikoi, are open and movement can be observed from valley walls, but good observation points are few as thick taiga grows on the slopes. The area of steppe in southeast Transbaikal (areas 5 and 6) is completely open, and observation is limited only by the high, parallel ridges in the northern part, and by the rows of low hills in the southern part, which break the region into compartments. The forest in the eastern part of the oblast is thin, and trees are deciduous, so that in winter, observation of valleys from valley walls is probably good.

Plateau areas, such as 8, 16, and 17 are, in part, open. In most places they are cut by deep, narrow valleys which can be observed from the valley walls.

Concealment and Cover

The thick taiga which covers most of the area provides excellent concealment, probably for large forces, from air and from ground observation except in open valleys in the western part. On the Amur, the largest stream of the region, the forest extends down to the banks in most places. In the eastern part, however, the forest is mostly thin and consists of larch, or deciduous trees, and probably affords little concealment, especially in winter.

Areas 5 and 6, and parts of other areas, are treeless, and provide no concealment from the air. The only concealment from the ground is provided by the rolling topography, or by mountain ridges.

Cover from rifle fire is provided on many mountain and ridge slopes by large boulders and coarse talus blocks. Troops on steep slopes in the forest areas can obtain both cover and concealment.

Trenches and fox holes can probably be constructed only with difficulty. During winter the ground is solidly frozen, and during summer the areas of suitably thick soil are generally wet and boggy.

Camouflage

The western part of the Chita Oblast is mostly thick evergreen forest. Larch and deciduous forest, common in the eastern part is light green in summer, but in fall and winter the trees shed their leaves and expose the ground surface to view. Patches, or large stretches of open grass and swampland are abundant in some areas, and are green in summer but turn brown in fall and winter.

Bedrock is exposed on steep slopes and on many ridge tops and is pinkish-gray, gray, or black, in part covered by green moss. In areas of thin forest, such as the eastern deciduous forest, the ground between the trees is probably gray boulders interspersed with patches of light green grass in summer and covered with brown leaves and snow patches in winter.

The winter snow cover is incomplete. Snow probably is thickest and lasts longest on forested slopes.

Number, Name of Area	Topography	Kind of Ground	Vegetation	Communications and Settlement Incomplete - See other intelligence reports
1 Western Transbaikal	Parallel ridges extend east-northeast, with wide, flat, straight valleys between. The main ridges are massive and wide and have flat level crests above which rise isolated, rounded hills. Secondary ridges are rougher, cut by narrow, winding valleys and gorges. North facing slopes are steeper in most places. The wide, flat main valleys have low foothills at their edges, a few isolated hills on the valley flats. These may have rugged topography, many small narrow gorges, and abrupt walls. The valley bottomlands are wide terraces incised by the present streams. The terraces are poorly drained and in places, swampy. Most tributary valleys trend north-northeast, and are narrow and crooked, becoming gorges in their upper reaches. The altitude of the main valleys is 3,000 to 3,600 feet and their width is as much as 7.5 miles. Peaks reach altitudes of 4,000 to 5,250 feet.	On ridges hard bedrock is generally exposed although flat-topped ridges may have thin cover of clayey soil. Slopes in places covered by broken rock and jagged boulders. Wide valley bottoms are covered with loose sand and gravel, in part clayey, but have small areas of peat swamps. Terrace slopes and hills on valley plains consist of bedrock, in part softer than bedrock of ridges.	Most ridges covered with thick taiga [a] forest (pine, larch, and birch). Parts of ridges along the west edge of area and in the southwest part, are bare. The Chikoi, and most of the Khilok Valley are grassy steppe.	The double-track Trans-Siberian Railroad extends nearly the length of the Khilok Valley. Dirt roads follow Chikoi Valley and some other valleys. Trails follow or cross the ridges in places. Several industrial towns are situated along the railroad. The largest (Khilok, and Petrovsk) have populations between 10,000 and 50,000. Smaller towns in the area are all situated in valleys.
2 Yablonovi Range	Mountain range extending north-northeast. Forms part of Pacific - Arctic Ocean drainage divide. Crest is wide and flat, indented by shallow, broad, swampy saddles where rivers of both slopes have their source. Altitude 4,000 to 5,000 feet. East slope is precipitous and has gorge-like, steep-walled to sheer-sided transverse valleys. West slope descends gently from crest and has wide, swampy valleys with low, sloping walls. The headwater areas of the westward-flowing streams contain many small lakes and mires.	Range consists of hard bed rock, on gentler slopes bedrock is covered by sand, on moderate to steep slopes by bouldery talus. In valleys of east slope bedrock exposed in many places. Valleys of west slope are filled with loose, clayey sand and gravel. Swamps and lake shores on the uplands have peaty soil.	The east slope of range is covered by forest of pine and deciduous trees. The west slope has a thin forest of stunted deciduous trees and spruce.	In the southern part, the Trans-Siberian Railroad and several dirt roads cross the range. Except for a small station on the railroad, there are no settlements. The northern part has few inhabitants and is little explored. Two trails cross this part of the range.
3 Upper Ingoda Mountainous Province	High, dissected mountain ranges, trending in various directions. The ridges are massive and generally rather flat-topped. A number of bare, rocky peaks rise above the ridges, the highest to an altitude of 8,384 feet. The Ingoda, Chikoi, and tributaries of the Onon rise in the mountains in level, swampy basins and pass into narrow gorges in their middle courses and thence through wide, flat, generally swampy valleys in their lower courses.	Hard crystalline bedrock is exposed on many of the peaks but elsewhere is commonly covered by wet, sandy and bouldery soil, or in places by mossy swamps. Scattered fields on steep, south-facing slopes (called solnopeki, "sun-bakes") have dry soil. The gorges have rock walls and bouldery bottoms. The large wide valleys are filled with bouldery sand and gravel which in places is 25 feet deep and is covered by thin, wet soil, which is peaty near swamps.	Most of the area is covered by thick forest, containing wide stretches of windfall. Birch, aspen and pine grow on lower slopes. Between altitudes of 4,500 and 6,000 feet is light-colored forest, mostly larch and pinyon. Above timber line (at 6,000 feet) spreading pine (Pinus pumula) and mountain tundra are characteristic. At lower altitudes on south-facing slopes are scattered treeless areas.	The area is thinly settled and has been little explored. The Ingoda and Chikoi Valleys are followed by trails. An east-west dirt road crosses the southern part of the area. Along this road and in the Chikoi Valley are a few towns, containing less than 500 inhabitants. Opening of a large tin deposit in the southeast part has probably caused some development and settlement.

(Cont.)

Number, Name of Area	Topography	Kind of Ground	Vegetation	Communications and Settlement Incomplete - See other intelligence reports
4 Trans-Yablonya	Northeast trending rounded ridges. Near the Ingoda Valley above Chita the altitude of the ridges is 1,600 to 2,000 feet. To the south and east they become lower. To the northeast they rise to altitudes of more than 3,000 feet (about 1,000 feet above the Ingoda Valley). The upper part of the Ingoda Valley and the Chita Valley are straight and have wide, terraced floors. Terraces are wider on the north than on the south sides, rising gradually to foothills. East of Chita the Ingoda Valley cuts through successive mountain ridges in narrow deep valleys. South of Chita, tributaries of the Ingoda and Onon also cut through mountain ridges. Some of the smaller streams are dry except after rains.	Hard, crystalline bedrock is exposed on valley walls and peaks, but most slopes are covered with wet sandy soil, broken rock, and boulders, many slopes are swampy. Softer bedrock (sandstone, conglomerate, shale) crops out in places on the terrace slopes and in hills near the edges of the valleys, but the valleys are mostly floored by sand and gravel and contain swamps (peaty soil) and lakes.	Thick taiga covers the northern part with the exception of the upper Ingoda and Chita Valleys in which wide bottomlands are grassy steppe, and in places bare sand. Taiga cover is broken by treeless areas in the southern part.	Population concentrated in valleys. Chita (1939 pop. 102,555), the capital of the oblast, is situated on the Trans-Siberian Railroad. Several smaller towns (population from 500 to 10,000) are along the railroad, in the Ingoda and Chita Valleys and along a surfaced road which runs southward from the railroad to the Onon River. The Chita and Ingoda Valleys have dirt roads and most other valleys have dirt roads or trails.
5 Southeastern Trans-baikal	Broad plains, or steppes, separated by hills or ridges. In the northern part the plains are separated by northeast trending ridges 2,000 feet or less in height. The ridges have flattish tops, steep slopes, and alluvial fans at their bases. The plains are drained by meandering rivers which flow in swampy, ill-defined valleys. In the southern part, the plains are separated by conical hills and rocky knolls of fantastic shape. The plains are drier, and there are numerous dry lake beds or salt lakes. In places large streams such as the Onon and Borzya Rivers are incised 30 to 65 feet below the surface of the plains.	Ridges are bare or have thin sandy soil. Bedrock consists of massive crystalline rock and softer rocks, such as sandstone and shale. Alluvial fans and low plains are covered by sand, gravel, and some clay, generally salty.	Entire area is steppe. Lowlands covered by salt grass meadow, slopes by dry steppe, and uplands by meadow grass, sage, and groves of birch and aspen.	Single tracked Chita - Manchuria Railroad crosses area. Many dirt roads. Northeast portion is a rich lead-zinc mining district and contains a system of surfaced roads. Surfaced road follows upper Onon Valley and leads from western part of area to Chita. Two towns having populations between 2,000 and 10,000 are located on the railroad. Several smaller towns away from the railroad.
6 Onon Plain	Wide, level plain about 2,200 feet in altitude. Bounded on north by the Onon River whose valley is 150 to 200 feet below the plain; bounded on the south, east and west by higher land. The southern part of the plain contains two large enclosed lake basins (Zun-Torei and Barun-Torei) 150 to 200 feet below the general level. The basins have areas of 116 and 168 square miles. They are almost dry, but so shallow that a rise in water level of 15 feet would fill them. At the basin edges are several terraces. Dry, .5 to 12 miles wide troughs open into the lakes. They have gentle slopes, irregular and indefinite margins, and rolling hummocky floors. Numerous smaller lakes dot the plain.	Mostly gravel and sand; some clay. Hard massive crystalline and foliated bedrock crops out in the highlands at the edges of the area. The plains are covered by chestnut brown, sandy soils, and the basins by saline soils.	Open, grassy steppe, except for pine forest in northeast corner.	Several dirt roads cross the area and meet at springs which form the focus for stock herding. A few towns, which have population less than 2,000.
7 East Trans-baikal	Series of northeast trending ridges. Rise to an even level about 3,000 to 3,500 feet in altitude. Individual peaks reach altitudes as much as 5,000 feet. The ridges are rounded and flattened at the top. Valleys between ridges are narrow and deep (1,000 to 1,600 feet). Most are parallel to the ridges. Valley slopes are steep, in places steep cliffs. Many valley bottoms swampy.	Ridges composed of hard crystalline rock and softer rocks such as shale and sandstone. Bedrock is covered in most places by thin, rocky, sandy or clayey soil. Valley bottoms contain boulders and gravel, and in wider, flat portions, clayey sand. Ground generally moist. Swampy areas with peaty soil are numerous.	Area is covered by pine-larch forest except for one ridge extending northeast, through the middle of the area (Ononski Ridge), which has dry soil, and birch-aspen forest. Patches of dry, open meadow in some valleys.	Mostly a mining region. The numerous mines and mining towns are connected by dirt roads, along valleys. A surfaced road in southeast part connects Gazimursky Zavod and Nerchinsky Zavod (mining centers which had populations less than 2,000, in 1940). Roads lead south from both these towns. A railroad connecting the area with Sretensk may be under construction. River ports with populations less than 500 are scattered along the Shilka and Argun Rivers.
8 Nerchinsk Plain	Basin-like plateau at an altitude of 2,000 to 2,200 feet. Surrounded by hills rising to altitudes of 2,500 to 2,800 feet. The plateau is dissected by valleys as much as 650 feet deep. Its surface is quite level in the northeast part but elsewhere is gently rolling. The valleys are steep-sided and narrow, but in places are as much as a mile wide. Some valleys tributary to the Kuenga River have no streams. On the south the plateau slopes steeply to the Shilka River, is dissected, and from the river, has the appearance of a mountain ridge.	The plateau surface is bouldery sand and gravel, some clay. The sandy soil is dry and strongly alkaline. Bedrock is hard crystalline rock and softer shale and sandstone; crops out in valley walls.	The area is covered by dry grassy steppe.	The double-tracked Trans-Siberian Railroad runs along the south and east edges. Towns of Nerchinsk and Shilka (population between 10,000 and 50,000) are located on the railroad in the Shilka Valley. Dirt roads connect these towns, and several roads lead north.
9 Mountainous area north of Shilka River	Northeast trending ridges, about 3,300 feet in altitude. Ridges are rounded, flat on top. The Shilka tributaries in their upper courses flow between the ridges, but cut through them to join the Shilka River. Valley heads are deep furrows; the upper courses of the valleys are wide, straight and have rounded slopes and flat bottomlands; the lower courses are narrow, winding and deep, and in places are gorges.	Similar to area 7.	Mountain tops are bare or covered with moss, rhododendron, and in places groves of larch. Valleys and slopes mostly covered with larch taiga. Part of the upper Nercha Valley is open, and a wide strip along the north side of the Shilka is open steppe, a continuation of the dry soil area of the Nerchinsk Plain (area 8). Open dry patches ("sun bakes") common within the taiga on south-facing slopes.	Area crossed by Trans-Siberian Railroad, which follows long valleys between mountain ridges. Spur line extends north to Bukachacha, a large coal mining center. Several dirt roads. Mining towns and other small towns scattered in area, but most have population under 500. Two large towns on railroad have population between 10,000 and 50,000.
10 Vitim Plateau	The southern part of the wide Vitim Plateau which extends far to the north of the Chita Oblast. In this area, its surface has an altitude of about 3,300 feet but is sharply dissected to a depth of about 300 feet by the Vitim River and its tributaries. The valleys of these streams are narrow, rocky, and winding.	The plateau has much exposed hard, crystalline rock. In places it is overlain by thin bouldery soil, or on slopes by broken rock and boulders. The Vitim Valley is floored by boulders and coarse gravel.	The entire area is covered by dense taiga.	Area not well explored. Contains two settlements that have populations less than 500. Crossed by two trails which lead from the Vitim River across the Yablonovi Ridge (area 2).
11 Vitim-Olekma Divide	Mountainous province made up mostly of high, broad mountain masses, above which rise jagged peaks. The northern part contains the highest land in the Chita Oblast, rising to altitudes over 10,000 feet. Maximum altitudes in the southern part are about 5,600 feet. The valleys are deep, steep-sided, flat-floored, U-shaped troughs which contain lakes and swamps.	Mountain areas made up mostly of hard crystalline rock covered in part by thin bouldery soil, or, on slopes, by coarse talus. Valley bottoms are covered with sand, gravel and some clay and peat.	Most of the area is covered with thick taiga forest but several patches of ground in the Kalar Valley and on adjacent slopes are open. Peaks and upper mountain slopes are barren.	Settlements few; many unexplored areas. b/ The only settlement in the northern part is at a gold mining district between the headwaters of the Kalar River and the Olekma River, and has less than 500 inhabitants. A trail leads from this place, down the upper course of the Kalar River. In the southern part, trails follow several of the valleys, and there are at least two small settlements, one of which is at the junction of the Vitim and Kalakan Rivers.
12 Middle Vitim Mountainous Province	Area of rounded and rugged mountain masses, above which rise small peaks. The mountains in the central and northern parts, have steep, sharp, jagged summits, of alpine type and are distinctly more rugged than the mountains of the rest of the oblast. The summits generally reach altitudes more than 5,800 feet. The highest peak is 6,700 feet, and the low portions of the interstream divides are about 2,600 feet. Valleys are wide-bottomed, steep-walled, and U-shaped. They contain bouldery fill with hummocky surface, which is in places piled into ridges as much as 150 feet high oriented parallel to or across the valleys. Most valleys contain swamps and lakes, and extensive level boulder strewn areas, which are the basins of former lakes. The largest lake is Lake Nichatka (23 miles long and 1 to 2.5 miles wide).	Mountains mostly bare, foliated, metamorphic rock (schist). Valley bottoms contain bouldery clay, sand, and gravel. Peaty soil in extensive swampy areas.	The upper mountain slopes rise above timber line. Thick taiga covers most of the area, but swamps are open and clear of trees.	Much of area is unexplored. Uninhabited except for a town with less than 500 inhabitants near the head of the Chara River, and a few native dwellings. A short trail on the uplands parallels the Chara River. The proposed Baikal - Amur Railroad may cross the north end of the area and may be under construction at the present time. b/
13 Dissected Olekma Plateaus	Plateau area 3,000 to 3,300 feet in altitude, dissected and terraced by the Olekma and Nyukzha Rivers and their tributaries to depths of 1,000 to 1,150 feet. Individual low hills and peaks rise 300 to 500 feet above the general level of the plateau. A rock terrace borders many of the streams about 500 feet below the plateau surface, and in places along the main streams widens into a lower plateau. In the headwater areas there are wide valleys with gentle slopes, but a short distance downstream the valleys are steep-sided, deep valleys which are bordered by rock terraces as much as 250 feet above river level.	The rocks exposed on hills and slopes are hard, massive granite and foliated metamorphic rock (schist). Plateaus covered with bouldery soil. Valley bottoms and terraces are covered with gravel, sand, boulders, and some clay.	The highest hills and ridges are bare or have scattered groves of larch, aspen, or pine. The rest of the area is taiga-covered except for occasional open meadows in valley bottoms.	Many unexplored areas; few settlements. Trading post at the junction of the Olekma and Nyukzha Rivers. Gold mining district and warehouse between Olekma and Kalar Rivers. The proposed Baikal-Amur Railroad may cross this area and possibly extend southeast along the Nyukzha Valley. b/ A pack trail parallels the Olekma River, starting from the Trans-Siberian Railroad, and probably leading to the head of navigation on the Olekma River.
14 Stanovik - Tukuringra Range	Long, massive mountain range, trending east. Altitude is about 1,700 to 2,500 feet. Some ridges and peaks rise to altitudes of 3,000 to 4,000 feet. These have steeper slopes than the lower mountains but have flattened summits. Valleys on south slopes of the range, are tributary to the Amur and Urkan and are mostly longer than those on the north. In the east part, the range is cut by the Zeya Gorge. Most valleys have steep gradients, winding, rocky bottoms, and steep, rocky slopes. Some valleys head in shallow, swampy basins.	The rock exposed on the ridges is hard, massive granite and foliated metamorphic rock (schist), covered in many places by boulders and broken rock, which on steep slopes descend into the valleys. The wet valley bottoms are filled with boulders and coarse gravel.	Lower mountain slopes and valleys covered in western part by thick pine-larch forest, and in eastern part by thin deciduous forest (larch, birch, aspen, alder). Steep, debris-covered slopes are bare. High ridges and peaks are bare or have patches of moss and lichen.	Hard-surfaced highway crosses the range, connecting Never, on the Trans-Siberian Railroad, with Tommot on the Aldan River, north of the Chita Oblast. The only other routes of travel are trails and river boat on the Zeya. No settlements except at gold mines. The proposed Baikal-Amur Railroad may cross this area. b/
15 Upper Amur region	Region of low mountains rising to altitudes of 1,750 to 2,000 feet. The uplands are south-trending ridges which descend from the mountains of area 14 toward the Amur River. They are parallel, even-topped and have wide, flat, or rounded summits. Rivers flow in valleys about 500 feet below the ridge tops. All valleys have flood plains and terraces (up to 30 feet above river level) and are wet and swampy. The Amur Valley is generally narrow but in places widens to more than 2 miles, and its flood plain is covered with swamps and lakes.	Ground mostly foliated hard rock (schist) and sandstone covered by thin sandy soil. Valleys filled with sandy gravel, 10 feet deep. Ground everywhere wet and boggy; in places top soil is peaty.	Area covered mostly by pine-larch taiga, broken by scattered grassy meadows in valleys. Ground covered by moss and peat.	Trans-Siberian Railroad crosses area along northern edge. A spur line, probably originally constructed to obtain water for locomotives, extends to Dzhalinda on the Amur River. Several dirt roads lead from the railroad to the Amur, and small river ports are connected by trail. Most of these ports have populations of less than 500. Largest towns are situated on the Trans-Siberian Railroad, Skovorodino and Erofei Pavlovich have populations between 10,000 and 50,000.
16 Lower Zeya - Amur Plain	Flat, swampy plain at altitude of 1,000 to 1,500 feet forming divide between Zeya and Amur Rivers. Dissected by narrow, steep-walled valleys, as much as 800 feet deep. Most valley walls are so steep and dissected that the region seems mountainous when viewed from the rivers. Tributary valleys widen upstream and pass almost imperceptibly into the plain. Bottoms, slopes, and valley heads are swampy. In places the Zeya and Amur Valleys widen to broad floodplains.	The plain and upper valley walls: sandy, gravelly, and some clayey soil to depths of 7 to 12 feet. Ground is wet and swampy and in places covered with peat. Where the valleys are wide, they have sand and gravel floodplains bordered by slopes that have soil similar to the upland soils. Where valleys are constricted the walls are rocky.	Mostly thin deciduous forest (birch, larch, aspen, alder). The drainage divide, however, is a wide stretch of swampy, treeless country which has moss and swamp vegetation.	The Trans-Siberian Railroad follows the flat, Amur-Zeya divide. Several dirt roads, a surfaced road, and a railroad spur, connect the railroad with the Amur River. A dirt road follows the left bank of the Zeya River and joins the railroad in the eastern part of the area. A poor trail follows the Amur River. The largest of several railroad towns is Tigda which has between 2,000 and 10,000 inhabitants. Several river ports are on the Zeya and Amur, most of whih are smaller than Tigda.

(Cont.)

Number, Name of Area	Topography	Kind of Ground	Vegetation	Communications and Settlement Incomplete - See other intelligence reports
17 Upper Zeya Plain	Level, swampy, upland plain about 1,500 feet in altitude is incised 200 to 300 feet by the Zeya River and its tributaries. Valley bottoms are wide and swampy; valley walls are gentle; and the tributary valleys pass imperceptibly onto the upland plain. A terrace 70 feet high borders the Zeya River.	The ground is mostly coarse sand and gravel covered by wet and swampy peaty soil.	In the valleys is mostly mossy swamp and scattered larch trees. There are small patches of soil, which support grass, brush and mixed woods. The upland plain is covered with thin forest of larch, birch, aspen and alder.	Several gold mining settlements and connecting trails at eastern end of area. A few river ports on the Zeya River have populations less than 500. The main access to the area is by river boat on the Zeya. The proposed route of the Baikal-Amur Railroad may cross the area. b/
18 Stanovoy Range	East-trending range along the northeastern boundary of the Chita Oblast; lies on the Pacific - Arctic Ocean drainage divide. The range is complex with long spurs, and high peaks extending southward from the crest. The average altitude is 3,500 to 4,000 feet, but individual peaks attain 6,300 feet. Saddles are as low as 3,000 feet. The south slope is mostly steep and in places abrupt, but the lower slopes are flatter and hilly. Most saddles are gentle; some contain swamps and lakes. The valleys in the range head in deep gorges, but 3 to 6 miles downstream they become shallow and wide, and their floors contain many swamps. Farther downstream they again become narrow and swamps become rare.	Bedrock is massive granite and hard, foliated rock (schist). The mountains have much exposed bedrock, but in many places broken rock and talus cover the slopes. Valleys are wet or swampy, and floored by boulders, gravel, and sand.	The highest parts of the range are bare. The south slope is covered with thin deciduous forest in the eastern part, and with thick taiga in the western part. Valleys are also forested, but swampy areas are mostly open. Close to the divide the treeless swamps on the valley floors widen and in places extend part way up the valley walls.	Never - Tommot Highway crosses the Stanovoy Range (see area 14). The only other crossings are several pack trails. The area is unsettled and in part unexplored. Several wintering huts are along the trails. The proposed route of the Baikal-Amur Railroad may cross the area. b/

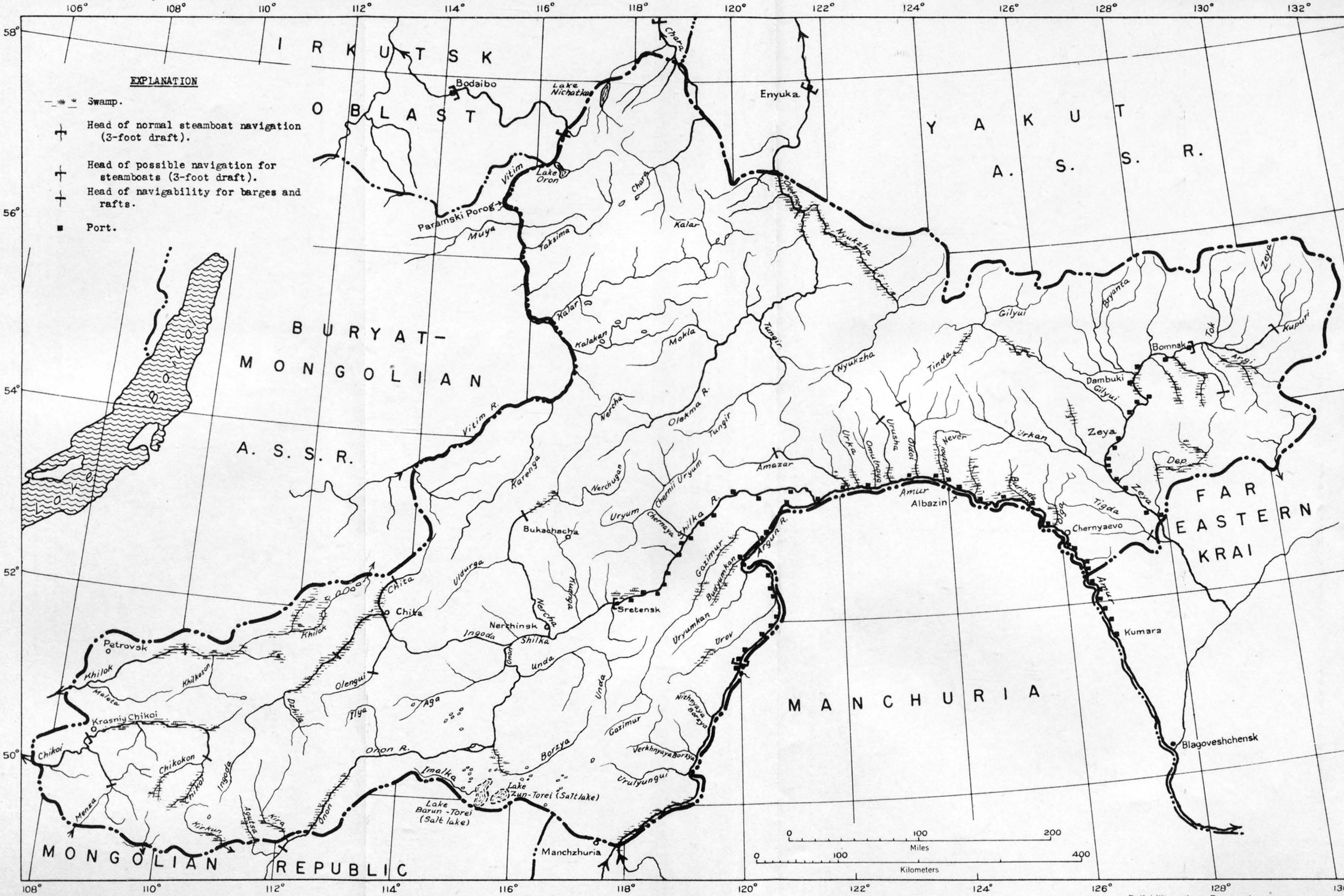
a/ Taiga is dense forest, characteristic of these latitudes. It consists principally of pine, larch, fir, spruce, birch, and alder. Trees reach height of 100 feet and have slender trunks. Underbrush is mostly berry-producing shrubs. Windfalls make dense tangle of dead trees. In summer ground is wet and air damp.

b/ The location of the railroad that is under construction in northern Chita Oblast is very uncertain; few maps agree as to its position. The location indicated on sheet 3 is based on appraisal of the topography and scattered preliminary geological surveys for the railroad and represents only one of several possible estimates of its positions.

Reliability rating: Class C.
Compiled by U. S. Geological Survey.

SHEET 4, RIVERS

CHITA OBLAST



Reliability rating Reconnaissance map
Compiled by U. S. Geological Survey

Introduction

Stream Regimen

The rivers of the Chita Oblast fluctuate greatly in discharge and velocity. This is because of the continental climate which is very cold and dry in winter, but relatively warm and rainy in summer, and because of the presence of impervious frozen ground, which increases runoff. Rivers contain most water during July and August when rain falls in the form of showers and torrential rains. The fall season is dry, and the volume of water in streams sharply decreases in September. Smaller streams dry up by the end of October.

In winter all but the largest streams freeze from top to bottom. The volume of water added to the streams in winter is slight, because the fall season is dry, and because the ground also freezes, reducing subsurface water sources. Streams freeze at the end of October or in November; the maximum depth of freezing is reached in January and lasts until April.

The ice breaks up usually at the end of April and in the first part of May. Because winter snow cover is light, the spring thaws are not accompanied by floods, but the melting snow and ground moisture are sufficient to fill the river beds. Maximum discharge is not reached until the summer rainy season.

Most of the streams are subject to floods in summer. Minor streams often have short-lived but violent floods. The Zeya River has the largest floods of the major streams, probably because the flood crests of its tributaries are apt to arrive at the Zeya at about the same time.

Rivers and Valleys as Transportation Routes

The rivers of the Chita Oblast may be used as roadways during winter when frozen. The larger ones are navigable in summer and river valleys form the principal routes of travel. The valleys in the east third of the oblast are wooded with thin, easily penetrated birch, larch, and aspen forest. In the rest of the oblast, with the exception of the steppe area in the south central part, the valleys are covered with thick taiga, a coniferous forest, full of windfalls, growing in moist ground. The entire region is mountainous and most of the minor streams have narrow, rocky, mountain valleys, some in gorges. Flat uplands and floodplains in many places are swamps and mires during the summer rainy season, and during spring thaws. Because most of the land is so impenetrable, the beds of smaller streams are used as trails and larger streams are navigated.

Only the Amur, Zeya, Shilka, and Argun Rivers are navigable by large boats, and only for the part of the time that they are ice-free. Navigation is interrupted during low water periods (most often in spring and fall); and rapids, bars and shifting channels make navigation difficult. Steamboats generally have a draft of 3 feet. Barges and rafts are used in low water and on unnavigable streams. Some streams can be followed on horseback by crossing from side to side of the stream bed.

Rivers are better transportation routes in winter. A few days after they freeze the ice is firm enough to support the weight of vehicles. Travel on ice, however, is not without difficulties. Many springs break through the river ice, forming sheets or mounds of ice (called "naledi") at their points of issue (see Water Supply Sheet). These naledi are difficult and dangerous to cross, as the ice breaks through easily and slush freezes to horses feet and to the runners or wheels of vehicles. Units of caravans have at times been lost. Such places are avoided where possible by detours on the banks.

Fords

During winter, all streams can be crossed on the ice, which reaches 35 to 80 inches in thickness. In summer small streams can be forded. Large streams with rock bottoms are fordable at some rapids, whereas those with alluvium in the channel in most places must be crossed by ferries or bridges.

River	Valley Characteristics	River Characteristics	Ease of Movement[a]	
			Valley	River
		AMUR DRAINAGE BASIN (Drainage into Pacific Ocean)		
Amur	In the upper course above Albazin, the valley is straight, narrow, with steep, rocky slopes close to the water edge. Slopes rise 1,500 to 2,000 feet above stream. Terraces and the floodplain are wet and swampy. In places the valley widens and the river becomes winding. Below Albazin the valley is cut about 500 feet into a plateau and has steep and hilly slopes; it is more winding, in places has a floodplain 3 or more miles wide, and in others narrows and has rocky slopes close to the water. The middle part of the valley within the oblast is open country. In the lower course the valley is covered by thin larch forest; in the upper part by taiga forest.	The river contains numerous islands. Below Albazin it alternately breaks up into several channels, in places attaining a width up to 2 miles, and narrows in places to as little as 660 feet. Total drainage area is 756,811 square miles. Its length within the oblast is about 350 miles. Between the mouth of the Shilka and the town of Albazin, a distance of 148 miles, the fall is 180 feet (1.2 feet per mile), mean annual flow 42,360 second-feet (cu. ft. per sec.), minimum flow 4,412 second-feet. Between Albazin and Chernyaevo (118 miles) the fall is 161 feet (1.4 feet per mile), mean annual flow 52,950 second-feet, minimum flow 5,825 second-feet. Between Chernyaevo and Kumara (132 miles) the fall is 128 feet (.97 feet per mile), mean annual flow 60,000 second-feet, minimum flow 7,060 second-feet. The first ice appears on the river between the 10th and 20th of October. The river freezes between the 29th of October and the 13th of November. The ice breaks up between the 10th and 16th of April at Blagoveshchensk, and about a week later farther upstream. Mean maximum ice thickness is about 52 inches in the upper course, 48 inches at Albazin, and 62 inches at Kumara. In summer the shallowest places are normally deeper than 3 feet, but in July and August, the flood season, the water usually rises about 7 feet above normal stage.	Trail along left bank. Floodplain and terraces are swampy and almost impassable during summer.	Entire river is navigable, though rapids, bars, and shifting channels create some difficulty. Average number of navigable days per year is 140. From May through August boats with 3.5 foot draft can be used up to Sretensk (on the Amur and Shilka). In September only 3 foot draft is feasible. Mosquito boats, gunboats, and river monitors are used on the Amur and Argun. In low water passengers are sometimes carried on barges towed by tugs. Fording is not possible. Easiest crossing is by boats and rafts. Bridges difficult to construct because of great width, or depth. Planning of ponton bridges should take into account the soft banks and bottom in the slower, wide parts of the stream.
Zeya	From the headwaters to the tributary Tok, the valley is a gorge with rocky walls and bottom. The next lower section to Dambuki is in the Upper Zeya Plain. The valley widens somewhat but is cut into the alluvium-covered plain to a depth of about 200 to 300 feet. There are terraces about 70 feet high along the river. Both valley bottoms and upland are swampy. In next lower section, the valley cuts through a mountain ridge and becomes a deep, narrow gorge with rocky cliffs at the water edge. River leaves the mountains at the town of Zeya, below which it flows in a winding valley cut into a plateau to a depth of about 400 to 500 feet. Here the river has low banks, a wide sand and gravel floodplain, with lakes and abandoned channels, but in places rests against a steep, rocky valley wall or is constricted between cliffs with little or almost no floodplain on either side. The entire valley is more or less covered with thin larch forest, except where the river cuts through the mountain ridge and in portions of the plain of the Upper Zeya. Lakes and swamps are open. The length of the valley (including the part outside the oblast) is 835 miles.	Uppermost portion is a mountain stream with rapid flow. In the Upper Zeya Plain the stream is wide, even at low water; flows slowly, and breaks up into shifting channels with bars and islands between. At the mountain ridge above Zeya, the river becomes narrow and flows swiftly on a steep gradient. There are more than 20 rapids and in places the channel is blocked by boulders. Below Zeya the river widens, flows more slowly, and contains islands, cut-off channels, and lakes. Width varies, attaining 1,600 feet. The gradient from Zeya to the oblast boundary is slightly more than one foot per mile. Drainage area of entire river is 88,105 sq. mi. Mean annual discharge at the town of Zeya is 40,000 second-feet and the minimum is 780 second-feet. The upper portion freezes to the bottom. At Bomnak the mean maximum ice thickness is 47 inches, at Zeya, is 54 inches. River is ice free 157 days a year at Zeya. Floods occur in July and August, and sometimes in June. Over a period of 72 years, destructive floods have occurred in 30 percent of the years. Some have reached catastrophic proportions. During floods, discharge at the mouth approaches 1,000,000 second-feet, whereas the mean annual discharge is 70,000 second-feet.	A dirt road follows right bank up to the town of Zeya. In places the valley bottom is wet and difficult to pass. The narrow, rocky valley at the ridge above Zeya is impassable for vehicles. The flat valley bottom in the Upper Zeya Plain is swampy. Short trails exist in that area but are usable only during dry periods in summer. The uppermost part of the valley is narrow and steep. Forest thin and easily passable.	When ice free the river is navigable in high water up to the River Argi; in normal water Dambuki can be reached, although navigation is difficult through the mountain ridge, because of rapids; in low water Zeya cannot always be reached. The frozen river has naledi-forming springs in several places, particularly at the confluence with the Tok. The uppermost course, and the gorge through the mountain ridge can be forded at rapids in low water. Elsewhere boats or bridges must be used. During floods, crossing is difficult.
Tributaries of the Zeya	The heads of all tributaries have wide valleys with low slopes, passing imperceptibly into the divides, which are covered with weathered material and which are usually swampy and open. Little bedrock is exposed. The northern tributaries, such as the Bryanta, Gilyui, and Tok, descend into rocky mountain gorges, which widen only near their mouths. The southern tributaries in the Upper Zeya Plain are cut into the plain but are wide and swampy in the lower courses as well as at their headwaters. The Urkan, Tigda, and Dep Valleys are much like the part of the Zeya into which they empty, being winding streams cut into a plateau. The Dep has areas of wide, flat, floodplain covered with swamps and cut-off channels, separated by stretches in which the river is confined between steep, rocky walls, with little or no floodplain. The Urkan is a deeply incised valley, narrow and rocky along most of its course and has a wide floodplain only at its mouth. The Tigda has a floodplain along most of its course. The lower half of the Gilyui and parts of the lower Tok and Bryanta are open. The rest of the valleys are covered by thin larch forest.	The streams are small, swift, and have numerous rapids. Upper portions are dry in dry periods and all freeze to the bottom during winter, except near their mouths. Tok River: Drainage area, 2,706 sq. mi.; length 128 mi.; falls 3,477 ft. (27 ft. per mi.); mean annual discharge, 2,725 second-feet; mean minimum discharge 53 second-feet. Bryanta River: Drainage area, 537 sq. mi.; length, 154 mi.; falls 3,936 ft. (26 ft. per mi.); mean annual discharge, 540 second-feet; mean minimum discharge, 106 second-feet. Gilyui River: Drainage area 8,781 sq. mi.; length, 325 mi.; falls 2,526 ft. (8 ft. per mi.); mean annual discharge, 8,030 second-feet; minimum, 159 second-feet. Urkan River: Drainage area 6,284 sq. mi.; length, 191 mi.; falls 4,231 ft. (22 ft. per mi.); mean annual discharge, 4,596 second-feet; minimum, 106 second-feet. Argi River: Drainage area, 2,988 sq. mi.; length, 143 mi.; falls 1,279 ft. (9 ft. per mi.); mean annual discharge 2,993 second-feet; minimum, 70 second-feet; average maximum ice thickness near mouth, 25 inches. Dep River: Drainage area, 4,277 sq. mi.; length, 200 mi.; falls 1,502 ft. (7.5 ft. per mi.); mean annual flow. 3,131 second-feet; minimum, 88 second-feet.	Swamps make passage very difficult, particularly in the headwaters areas where even horses mire. Narrow, rocky portions require excavation in bedrock for passage of vehicles. A mining trail in the Argi Valley is usable only in dry periods during summer.	Not navigable by steamboat. Small boats and rafts can navigate a short distance from the mouths but rapids soon make it difficult or impossible. During normal water streams can be forded at rapids. During floods even smaller streams cannot be forded.
North Tributaries of the Amur	Valleys are incised into a high plateau; heads are wide and swampy. Along almost entire length, valley bottoms are wide, and rivers flow in small channels. One or more rock terraces covered with thin alluvium border stream beds. Valley bottoms and terraces are wet and swampy. Except for the lower part of the Urka, which is open, the valleys are covered by thick taiga.	Upper courses are dry in dry periods. Streams freeze top to bottom during winter, except at mouths of larger ones. Bolshoi Never River: Drainage area, 800 sq. mi.; length, 68 mi.; falls 1,617 ft. (24 ft. per mi.); mean annual discharge, 476 feet/second; minimum, 14 second-feet. Oldoi River: Drainage area, 3,964 sq. mi.; length, 144 mi.; falls, 2,388 ft. (17 ft. per mi.); mean annual discharge, 1,811 second-feet; minimum 78 second-feet. Urusha River: Drainage area, 1,447 sq. mi.; length, 109 mi.; falls, 2,427 ft. (22 ft. per mi.); mean annual discharge, 660 second-feet; minimum, 18 second-feet. Omutnaya River: Drainage area, 800 sq. mi.; length, 165 mi.; falls 1,154 ft. (7 ft. per mi.); mean annual discharge, 364 second-feet; minimum, zero. Urka River: Drainage area, 722 sq. mi.; length, 99 mi.; falls 3,096 ft. (31 ft. per mi.); mean annual discharge, 332 second-feet; minimum, zero.	Thick forest and swampy ground make movement difficult. A railroad spur of the Trans-Siberian Railroad follows the Bolshoi Never Valley. At its head the Bolshoi Never crosses the Never-Yakutsk highway. Trail in the lower part of the Oldoi Valley.	Not navigable by steamboats. Small boats and rafts can be used for short distances on several streams. Rivers are shallow in many places but fording is difficult due to soft bottoms.
Argun River	The upper course is flat and wide (1 to 6 miles), with low, gently sloping walls. The river meanders considerably and swamps and cut-off channels are widespread in the valley bottom. Vegetation is grassy steppe, and valley and uplands are treeless. The lower course has a deep, narrow, rocky valley with narrow floodplain. In places cliffs descend to the river edge and the valley is straight. The thick taiga cover is almost complete.	The upper course is a sluggish river which deposits much alluvium and meanders over the floodplain in shifting channels with islands between. The climate is warmer and drier than in the lower course. In the lower course, the river flows more swiftly (velocity, 2.3 to 5 ft. per sec.) is narrower (300 to 650 feet) and erodes its channel. The total drainage area is 48,250 sq. mi. Length below the Urulyungui River is 531 mi.; falls 662 feet in this distance (1.25 ft. per mi.); mean annual discharge is 9,778 second-feet; minimum is 1,660 to 880 second-feet. The river freezes in the early part of November.	The lower course, being thickly wooded, narrow and steep, is difficult to traverse. The upper course has a dirt road along the left bank. The relief is low and the valley is open, permitting good observation. Swamps are numerous.	The river is navigable by steamboat in the lower course. The upper course with its many bars, and shallow, shifting channel, is not navigable. No bridges, and the river can be bridged only with difficulty because of wide, swampy floodplain.
Northwest Tributaries of the Argun	The upper and lower tributaries contrast as much as the two parts of the Argun. The upper tributaries flow in wide, alluvium-filled valleys in an open steppe, of low relief. The lower tributaries flow in deep, narrow (as much as .3 to .6 mi. wide), rocky valleys. The Verkhnyaya Borzya, and Urulyungui Valleys are in the steppe region and are completely open. The others are in the area of taiga forest, but only the Budyumkan Valley is completely forested. The head of the Urov, the the middle course of the Uryumkan, and all but the mouth of the Gazimur are more or less open. The valley bottoms of the lower tributaries are swampy in places.	The total drainage area is 15,440 sq. mi. The streams are small, the largest being narrower than 160 feet. The upper tributaries head in dry regions where runoff is low, especially in the upper part of the Urulyungui. Torrential showers cause flooding in July and August. In dry years, small streams dry up. In winter the streams freeze from top to bottom. In spring, water flows over the ice and there is no drift ice except in the lower parts of the Gazimur and Uryumkan. Gazimur River: Drainage area, 4,593 sq. mi.; length, 322 mi.; falls 2,529 ft. (8 ft. per mi.); mean annual discharge, 808 second-feet; minimum, zero. Ice reaches thickness of 55 inches near headwaters. Budyumkan River: Drainage area, 575 sq. mi.; length, 52 mi.; falls 1,407 ft. (27 ft. per mi.); mean annual discharge, 53 second-feet; minimum, zero. Uryumkan River: Drainage area, 1,698 sq. mi.; length, 125 mi.; falls,1,797 ft. (14 ft. per mi.); mean annual discharge, 155 second-feet; minimum, zero. Ice reaches thickness of 55 inches. Urov River: Drainage area, 1,625 sq. mi.; length, 159 mi.; falls 1,761 ft. (11 ft. per mi.); mean annual flow, 111 second-feet; minimum, zero. Verkhnyaya Borzya River: Drainage area, 1,503 sq. mi.; length, 78 mi.; falls 1,069 ft. (14 ft. per mi.); mean annual flow, 21 second-feet; minimum, zero. Urulyungui River: Drainage area, 3,381 sq. mi.; length, 96 mi.; falls 469 ft. (5 ft. per mi.); mean annual flow, 39 second-feet; mean minimum flow, zero.	Dirt roads follow almost the entire valley of the Gazimur, Budyumkan, Uryumkan, Urov, and Verkhnyaya Borzya. The upper part of the Urulyungui Valley contains a short dirt road. Some stretches of these roads are no more than narrow trails. The valleys in the open steppe offer ease of movement and observation. The lower tributaries, being narrow, deep, thickly forested or in places swampy, are difficult to traverse, and observation is limited.	The streams are too small for navigation, even by small boats or rafts. They can usually be forded, except when in flood.

(continued)

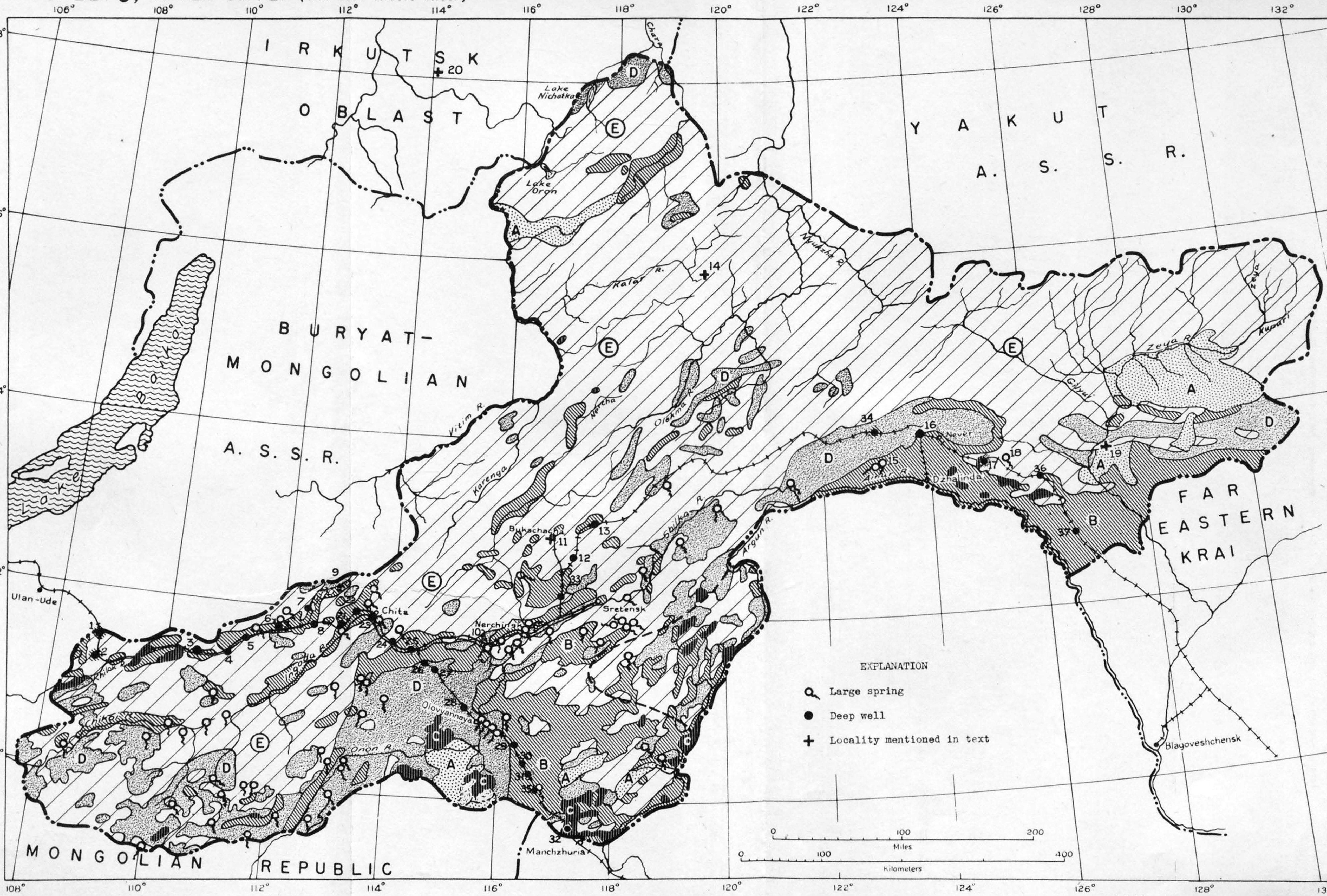
River	Valley Characteristics	River Characteristics	Ease of Movement[a/] Valley	Ease of Movement[a/] River
		AMUR DRAINAGE BASIN (continued)		
Shilka	A deep, narrow valley; has high, sheer hills on both sides. Chains of hills descend to the river banks on one side or the other, in places bordering the stream in overhanging cliffs. Floodplain is narrow. In a few places, the valley widens to a width of 1 or 2 miles. The lowermost 125 miles is especially narrow and gorge-like. The lower course is thickly wooded. The upper course is more or less open, particularly along the left side.	The stream is 1,000 to 1,300 feet wide and 6 to 8 feet deep, but rapids are numerous. The lower 250 miles has more than 100 rapids, shallower than 5 feet. Drainage area is 72,568 sq. mi.; length, 370 mi.; stream falls 659 ft. (1.8 ft. per mi.); the gradient changes considerably from place to place owing to the presence of rapids. At the mouth the mean annual discharge is 11,578 second-feet; mean minimum flow is 1,600 to 1,700 second-feet. Torrential showers cause floods in July and August. In dry periods the water is very low. In winter the water freezes top to bottom, except for pools along the bed in deeper parts of the channel. Near the upper end of the Shilka, the mean maximum ice thickness is 76 inches; in the lower course, it is 44 inches. The river is ice-free about 6 months, from early in May to the middle of November.	From the headwaters to Sretensk, a railroad follows the left bank and a dirt road, the right bank. Below Sretensk a trail, becoming a road after some distance, follows the left bank as far as the point where the gorge-like valley begins. This portion of the valley is difficult to cross because of its narrow, rocky character. A trail follows the left bank in the lower half of this stretch.	The river is navigable by steamboat, but rapids and periods of low water make navigation difficult and uncertain. Interruptions of traffic sometimes last 60 days. Possibly this river can be forded at rapids in low water.
Tributaries of the Shilka	The Chernaya, Nerchugan, and the upper parts of the Nercha and Kuenga Valleys are winding, narrow, deep and rocky valleys (as much as 1,750 feet deep), cut into a mountainous highland. The lower parts of the Nercha and Kuenga are incised into a treeless plateau. They are wider (up to 1.5 miles) and have floodplains of sand and gravel, covered with lakes, swamps, and meadows. Most of the valleys have terraces up to 70 feet above river level. Except for the lower Nercha and Kuenga, and the left bank of the Upper Nercha, these valleys are wooded. The uppermost part of the Ingoda Valley is a rocky gorge. From here to the mouth of the Chita, the valley is straight, wide, and flat-bottomed, between high ridges (about 1,500 ft.). The valley bottom is open grassland, wider on the left bank, and elevated above the stream. Near the mountain slopes, the valley becomes rolling and passes into foothills. Swampy places are numerous. The Chita Valley is similar. Its lower course is as much as 3 miles wide, swampy, with small lakes. Below the mouth of the Chita, the Ingoda Valley cuts through successive ridges, becomes narrow (less than ½ mile) and in places becomes a gorge with abrupt cliffs about 1,000 feet high. In some wide stretches terraces are distinct. The headwater area of the Ingoda is thickly forested. The straight, wide portion of the valley is open steppe. The lower part is more or less wooded as far as the open country at the Onon junction. The Onon River, in all but its lowest course, flows in a wide valley filled with alluvium, and covered in places by swamps and lakes. In the upper part it is a dissected hilly area. Most of the middle course is cut 150 to 200 feet into a flat plain. Near its mouth, the river has cut a deeper, narrow valley similar to that of the Shilka and Ingoda. The entire length of the valley is open grassland with only a few patches of pine woods.	The Chernaya, Nerchugan, and upper courses of the Nercha and Kuenga Rivers are swift mountain streams, which occupy most of the valley bottom and have boulders and sand and gravel islands in the channels. The lower Nercha and Kuenga flow less swiftly, but are mountain streams. In the upper valley, the Ingoda River is winding but flows mostly against the left bank. In the lower course its flow becomes swifter as the valley narrows between high cliffs, but in the few wide places the river forms several braided channels. The Onon River, in all but the lowest course, is a meandering stream, broken into braided, shifting channels with numerous islands and cut-off channels or oxbow lakes.	The Chernaya, Nerchugan, and upper Nercha and Kuenga Valleys are difficult for travel. Travel on horseback requires frequent crossing from side to side, and the streams probably cannot be forded during floods (frequent in July and August). The lower valley of the Nercha has wide, open fields and good carriage roads. The Trans-Siberian Railroad follows the lower course of the Kuenga, where the valley is easily passable. The Ingoda Valley is difficult for travel in the uppermost part. The rest has dirt roads, and the lower part is followed by the Trans-Siberian Railroad. The Onon Valley is easily passable, has dirt roads along its lower course, and a hard-surfaced road along the part of the upper course within the oblast.	The Onon and Ingoda are raftable for a large part of their length, but are too shallow for navigation by steamboats. The lower Ingoda is fordable at rapids in low water. The upper Ingoda and Onon have braided channels flowing on alluvial plains, and probably can be forded in places at low water, but cannot be forded during floods.
		LENA DRAINAGE BASIN (Lena River lies north of the Chita Oblast and drains into the Arctic Ocean)		
Chikoi	The headwaters begin in shallow, rounded and swampy basins. The upper north-flowing part of the valley (115 miles long) is a rocky gorge widening in places (½ to 1 mile), slopes covered with taiga forest. The middle section is straight, wide (2 to 3 miles or more), filled with alluvium, and bounded by high parallel ridges. Below Krasniy Chikoi the valley becomes winding, narrow, and has steep slopes. Its floor is treeless, but the mountain slopes are forested.	The upper course is a swift mountain stream. In the middle course, the stream flows slowly and forms a number of shifting channels with alluvial islands and bars between. The lower section is again constricted and is a more rapid mountain stream. Drainage area is 16,675 sq. mi.; length within the oblast is 280 miles; fall in this distance is 3,234 ft. (11.5 ft. per mi.). The mean annual discharge is 4,095 second-feet; mean minimum discharge, 670 second-feet. Where the Chikoi leaves the oblast the mean maximum ice thickness is 55 inches. The ice breaks up between the 18th of April and the 4th of May.	A trail follows the mountain valley of the upper course. A dirt road follows right bank of the river in the wide, flat, and swampy middle section. Below Krasniy Chikoi, where the valley is narrow, the road follows the upland and descends into the valley bottom only in a few places.	Navigation by steamboat is possible up to a short distance below Krasniy Chikoi, where the stream divides into braided channels in the wide middle stretch of the valley. Fording is probably prohibited by the soft bottom in most of the upper and middle course, and by deep water in the lower course.
Khilok	The valley head is a broad, low, swampy, and lake-covered saddle, below which the valley becomes deep, straight, wide, and flanked by parallel mountain ridges. The width ranges from ½ to 4.5 miles. The valley floor is covered with alluvium, and is swampy in places. The swamp and lake area at the headwaters is clear of forest, as is the lower third of the valley within the oblast. Between these areas the valley is forested but has irregular open patches, particularly on the right side.	The river consists of a number of braided, shifting channels with alluvial islands and bars between. The drainage area is 14,478 sq. mi.; length (including that outside the oblast) is 459 miles; stream falls 1,387 ft. in this distance (3 ft. per mi.); mean annual flow is 3,000 second-feet; minimum flow is 529 second-feet. Mean maximum ice thickness is 65 inches. Near Petrovsk the ice breaks up about the 15th of May. The river freezes between October 13th and November 21st.	The Trans-Siberian Railroad follows the right bank except in the lower course, where there is a dirt road, and in the headwater area, where there are no roads and movement is difficult, because of numerous lakes and swampy ground.	The river is not navigable because of its shallowness, bars, and shifting channels. Rafting is possible in the lower course. The river may be fordable in the lower course at rapids, during low water. The upper course has soft bottom.
Vitim[b/]	Above the mouth of the Muya River the valley is narrow, rocky, winding, and incised deeply into a mountainous plateau. Below the Muya, the valley widens, is floored with a hummocky, bouldery floodplain, which is swampy, between the hummocks. Valley walls are high. The main valley is thickly forested. Tributary valleys are also forested but have irregular patches of open country.	The Vitim is a mountain stream with a rocky channel containing boulders and gravel. Rapids numerous. Above the Muya River, the valley is about 300 to 650 feet wide. At the mouth of the Muya the river widens (½ to 1 mile), and forms several channels with large gravel islands between. At this point the current velocity is as much as 11 miles per hour. The braided channel continues as far down as the Paramski Porog, the largest rapids on the Vitim (1 mile long with drop of 28 feet). The stream narrows and remains narrow and shallow below the porog. Drainage area of the Vitim is 241,600 sq. mi.; length within the oblast is about 525 mi.; falls 1,375 ft. in this distance (2.5 ft. per mi.); mean annual discharge, 10,590 second-feet; minimum, 2,118 second-feet. Mean maximum ice thickness at mouth (outside of oblast) is 35 inches. At Bodaibo the river freezes between October 19th and November 1st, and the ice breaks up between May 8th and 26th. Drift ice lasts 5 to 13 days.	Pack trails follow stretches of the Vitim and a few of its tributaries. A trail follows the Kalar most of its length, leading to the gold mines in its headwaters. The trails in the Vitim Valley apparently lead from the rivers to isolated settlements in the interior where the streams are too small to be used as routes of travel in winter and too rocky to be used in summer.	Rafting is possible but extremely difficult. The Paramski Porog is a dangerous rapid. Vitim River is probably fordable at low water at places, especially at rapids.
Olekma[b/]	The upper course, above the Tungir River, is a narrow valley between steep hills, overgrown with pine forest. From the Tungir to the point where the Olekma leaves the oblast, the valley is somewhat wider. Stream terraces 50 to 65 feet high border the river along the entire valley. The valley is covered with thick taiga forest.	The Olekma drainage area is 93,257 sq. mi. Above the Tungir, the length is 230 miles; fall is 2,165 feet (9.5 ft. per mi.); mean annual discharge is 1,765 second-feet; minimum discharge, 494 second-feet. The channel is 250 to 660 feet wide, 2 to 20 feet deep, contains 29 rapids and is filled with coarse gravel. From the Tungir to the boundary of the oblast, the channel is wider (500 to 1,000 feet). The stream has bed of gravel and boulders, and numerous islands. Depth is 3 to 30 feet. There are 21 rapids in this section, in which the current velocity reaches 10 ft.-sec. From the Tungir to the Nyukzha, a distance of 186 miles, the river falls 459 ft. (2.5 ft. per mi.); has a mean annual discharge of 9,178 second-feet; minimum, 2,577 second-feet. From the mouth of the Nyukzha to Enyuka the river is 124 miles long; falls 590 feet (less than 5 ft. per mi.); has mean annual discharge of 19,768 second-feet; minimum, 5,648 second-feet. The mean maximum ice thickness at the mouth of the Olekma (outside of the Chita Oblast) is 59 inches. At this place the river freezes between October 30th and November 9th, and the ice breaks up between May 7th and 22nd.	Pack trails follow part of the valley. Travel is difficult because valley floor is narrow, swampy, and thickly forested.	Navigation is possible by steamboat almost to the junction with the Nyukzha, but is extremely difficult above Enyuka because of the many large rapids between these two points. River may be fordable at rapids during low water.
Tributaries of the Olekma	The Chara River (joins Olekma north of oblast boundary) heads in a wide, shallow, rounded basin with many swamps and lakes. Below the headwaters the valley is trough-shaped, having a rounded profile, and is deeply cut into the mountainous highland. The wide floodplain is hummocky with swamps between the hummocks. The entire valley is covered with taiga forest except for a few small open patches in the upper part. The Nyukzha and its tributaries have wide, gently sloping headwater valleys (½ to 2 miles wide). About 2 to 4 miles downstream the valleys contract sharply (to a width of 300 feet at the valley bottom). The middle course of the Nyukzha Valley is 6 to 9 miles wide with gently sloping walls and a wide floodplain, composed of fine gravel. The valley walls rise about 500 feet above the river, and are indented by as many as 6 terraces, the highest of which is 200 feet above river level. The floodplain is swampy in the wider stretches. The lower course of the Nyukzha Valley is less than 2 miles wide, flat-bottomed and has steep walls 500 to 1,150 feet high, indented by several small terraces, the lowest at 10 feet and the highest at 200 feet above river level. The Nyukzha Valley is completely covered with taiga forest. The Tungir Valley is a wide, elongate basin between mountain masses. Slopes are alternately steep and gentle. The tributary valleys which cut into the mountain masses are narrow, rarely wider than 700 to 1,000 feet. The valley slopes are terraced. The Tungir Valley is completely covered with taiga forest.	The Chara River has many rapids, and islands made up of fine cobbles and gravel. Large boulders are rare in the river bed. Depth at rapids in places is as low as 2 feet. Drainage area is 32,424 sq. mi. The entire length, including that outside the oblast, is 456 miles. The river falls 1,246 ft. in this distance (less than 3 ft./mi.); mean annual discharge, 10,590 second-feet; minimum, 2,824 second-feet. Nyukzha drainage area is 10,460 sq. mi.; length, 201 mi.; fall, 1,640 ft. (8 ft./mi.); mean annual discharge, 2,295 second-feet; minimum, 988 second-feet. The lower course of the river is swift-flowing, crooked and has many rapids. Gravel in the channel is coarse and bouldery, averaging 1 foot in diameter with individual boulders up to 3 feet in diameter. Width is 230 to 300 feet. The middle course of the river is wider (400 feet), slower-flowing, with fewer and smaller rapids, and many sharp bends. Channel is gravel. In the upper course, the stream occupies most of the valley bottom, and is a swift mountain stream. The Tungir drainage area is 32,424 sq. mi.; length, 172 mi.; fall 656 ft. (less than 4 ft./mi.); mean annual discharge, 1,412 second-feet; minimum, 424 second-feet. In winter the river freezes top to bottom in the upper course. It floods during July and August.	Horse and reindeer caravans are used for travel, which is difficult because the valleys are swampy or narrow. Few, if any trails.	Small boats can be used in the lower course of the Nyukzha. All tributaries can be forded at rapids, during normal flow.

a/ In winter all rivers, lakes, swamps, and all ground are deeply frozen and easily traversed.
b/ Tributaries of the Vitim and Olekma Rivers in the northernmost part of the oblast have been only poorly explored and may be incorrectly shown on the map.

Reliability rating: Class B.
Compiled by U. S. Geological Survey.

SHEET 5, WATER SUPPLY *(See also Rivers sheet)*

CHITA OBLAST



Reliability rating: Reconnaissance map
Compiled by U. S. Geological Survey

Introduction:--In Chita Oblast, because of the low winter temperature and the presence of a layer of permanently frozen ground beneath the surface, numerous problems, that are not common in more temperate climates, are encountered in securing water supplies. Most of the precipitation falls during the summer; springs and streams are numerous and afford ample supplies of water. However, in the winter all except the largest streams go dry or are frozen to the bottom and many of the springs cease to flow. In many parts of the region there are no permeable rocks which could furnish water to wells, and in many places where such rocks exist they are frozen to considerable depth and therefore impermeable. For these reasons the procurement of water supplies in the winter is extremely difficult and in some places it is necessary to haul water from distant points. During the construction of the Trans-Siberian Railroad it was expected that water supplies could be obtained from wells in the valley bottoms and from springs in the mountainous areas. Wells were partly successful in the western part of the oblast but almost uniformly unsuccessful in the eastern part. Springs were generally not practicable sources of water supply and in places spurs had to be built from the main line to the Amur River to obtain water for locomotives. Later, special tender-condenser engines were used which are capable of running 700 miles without addition of water.

Frozen ground[a/]:--Chita Oblast is near the southern margin of a large area in which the soil and rock is permanently frozen for a depth of a few feet to 100 feet or more. This is overlain by a layer of ground in which the lower part frequently remains unfrozen and the upper part, or "active layer", freezes in winter and thaws in summer. The upper boundary of the permanently frozen ground is more or less stationary from season to season and from year to year. In general, it is about 1.5 to 10 feet below the surface and in the southern part of the oblast it is as much as 26 feet. The lower boundary also is nearly stationary, but the thickness of the frozen ground varies from place to place. Usually it is thicker in river valleys and alluvium-filled basins. It is also thicker in the north and thins toward the south. Some frozen ground records of the oblast are given in the table of wells records. At locality 20, Uspenski mine, north of Chita Oblast, it is 165 feet thick. The greatest recorded thickness in the region, however, is at locality 11, Bukachacha, where it attains 330 feet. In the east at locality 19, Pikan, it is 165 feet thick. In places permanently frozen ground is lacking, and sometimes layers within frozen ground remain unfrozen. Such layers are called "taliks". Taliks are more numerous and larger in the south part of the oblast and on south-facing slopes

Surface water:--It is estimated that about 30% of the settlements of the Chita Oblast obtain their water supplies from streams or lakes. In general, the surface water is abundant and of good quality during the summer when most of the annual precipitation, which ranges from 10 to 17 inches, falls as torrential rains, but it is generally not a dependable source of perennial supply. As the precipitation decreases in the fall, the smaller streams cease to flow during October or November and the larger streams freeze over. By January all except the largest streams are frozen to the bottom and remain frozen until about the middle of April. During this period the water of the larger rivers stagnates and increases in mineralization but at some places is usable throughout the winter. As the winter advances and the flow of the rivers decreases the water freezes in layers, commonly separated by air spaces. Water from the surrounding ground or part of the remaining river water may flow between the layers or break through them to form springs on the ice. This water freezes as it emerges and forms mounds of ice, called "naledi", some of which attain considerable size.

Springs:--Springs are fairly common in the Chita Oblast. Some are perennial, others are temporary. In general, the temporary springs derive their water from the layer above the permanently frozen ground and most of them stop flowing when it freezes through. Others, in areas where that layer does not freeze to the bottom, flow during the winter because the frozen upper part provides an impermeable cover that creates artesian conditions, and stop flowing in the summer when the surface thaws and the artesian pressure is relieved.

Most of the perennial springs derive their water from water-bearing beds or fissured bedrock below the permanently frozen zone. The water finds its way to the surface through "taliks" in the permanently frozen ground. During freezing weather the water of the springs freezes as it pours out over the surface and forms mounds (naledi) which are a ready means of locating springs. Some large naledi persist throughout the summer. The critical time in determining whether springs are perennial is during February and March as that is the time when winter freezing of the soil reaches its maximum depth and the period when most springs cease flowing.

Perennial springs are in many places the locus of settlements and in the steppes of the south-central part of the oblast, west of the Argun River, springs form centers where roads meet and stock is herded. Some mineral springs supply water for spas, and small health resorts have been built around them. Some of these are also seasonal.

Wells:--Numerous wells have been dug or drilled in the Chita Oblast. Water has been found in stratified alluvial and basin deposits and also in fissures and cavities in massive limestone, granite and slate, above the permanently frozen ground, and in layers within and below it. Above the permanently frozen ground the water is generally not under artesian pressure and unless the permanently frozen ground is at a great depth or the well is sunk in a "talik" the water supply is likely to fail during the winter. Deep wells that draw their water from layers within or below the permanently frozen ground are likely to rise nearly to the surface. The largest yields are likely to be obtained from wells in the alluvial or basin deposits or in the limestone. Wells in the granite are generally of small yield and many yield no water.

Wells in the frozen ground are drilled with rotary rigs using heated or saline drilling fluid or with percussion rigs. They can be dug in the frozen ground if the ground is thawed by driven steam points or water points before digging begins. The ground is also sometimes thawed in this manner before drilling to make penetration easier. During drilling the wells must be cased through the active layer and the unfrozen layers (taliks) and when the well is completed, it must be cased through the frozen ground and also through the active layer as the pressures developed by alternate freezing and thawing would cause caving in an open hole. Through the permanently frozen ground the circulation of water in the well may be sufficient to thaw the ground and cause slumping.

Wells in the frozen ground should be of relatively large diameter as small wells are likely to freeze. Also the wells should be allowed to flow or be pumped steadily as cessation of movement is likely to allow the water to freeze. In "taliks" or in the active layer during summer these precautions are not necessary. Distribution pipes must be wrapped with insulating material and buried. Water must be kept circulating through them in the winter and is usually heated at the source to prevent freezing.

Pollution:--Springs, surface water, and shallow wells used by settlements generally have unsanitary surroundings. At some settlements, particularly along the south frontier, stock is watered at the same places from which the human supply is drawn. Epidemics of cholera, typhoid, and dysentery are common. In the Olekma gold region (locality 14 on the map) the streams used for water supply in the summer are swampy and cause dysentery.

In a large area in the drainage basin of the Argun River (outlined on the map by a dashed line) about 33 percent of the population in the settlements (98 settlements, 53,000 persons in 1927) are afflicted with Dr. Beck's disease, also called "Urov disease", after a river in the region. This disease has for a long time been ascribed to the spring water which supplies the populace. A study, made in 1927, showed nothing mineralogically unusual about the water except its radioactivity (33 mache units, 12.2 millimicro curies).

Ground Water

Area	Kind of Ground and Topography	Location	Springs: Discharge	Springs: Quality	Wells: Location and Yield	Wells: Quality	Potential Supplies	Equipment Needed
Not shown on map	Superficial deposits. Relatively thin, covering large part of most other areas. In most of the Chita Oblast the bedrock is covered by loose, unconsolidated sand, gravel, clay, and boulders, forming stream deposits on floodplains, terraces, and plateaus; lake deposits in basins and on plateaus; and coarse residual weathered materials on hills, slopes, and valley walls. These materials when unfrozen are highly permeable with the exception of clay, which makes up a minor portion.	Many throughout the oblast derive their water from surficial material. Many of the springs that issue on slopes or at the foot of slopes stop flowing in the winter. Some springs in floodplains and on river ice. Flow for shorter periods in north part, where permanently frozen ground is closer to surface, and depth of surface freezing greater.	Generally small, but springs issuing from river terraces at Chita and at locality 10 (Kazakova) supply part of water for these towns. Some springs on terraces and floodplains in the Amur-Zeya Region are perennial; the largest discharges are about 125 gallons per minute.	Water often polluted. Some from saline soils in lake basins is mineralized, particularly near central part of southern frontier.	Many shallow wells in settlements, particularly in valleys. Most go dry in winter. Some penetrate frozen ground and have permanent supply. Depths from a few feet to 130 feet, yields up to 100 gallons per minute. See records of several typical wells in following table.	Shallow water in basins and plains sometimes saline. Deeper water usually good, see analysis in following table. Many wells are polluted.	In the wide valleys in the western part of the oblast wells less than 130 feet deep probably will obtain moderate amounts of perennial artesian water within or beneath frozen alluvial deposits. Deeper wells in same area, will probably obtain larger supplies from rocks of area B which underlie the superficial deposits. In smaller valleys of the western part of the oblast and in all valleys in other parts of the oblast, wells in alluvial deposits may tap small perennial flows. In summer, dug wells less than 10 feet deep in any soil, probably will yield small quantities of water from the active layer, but the water is apt to be mineralized, particularly near lakes (high in chlorides, carbonates, and sulfates). In summer, surface water is abundant. Most springs in superficial deposits have flow only in summer.	Percussion rigs may be used for drilling in frozen ground, but rotary rigs, using heated or saline drilling fluid, may be more satisfactory. Casing is necessary, preferably of large diameter. Pipes for distributing water. All water except that from deep wells is apt to be polluted or highly mineralized and needs purification and treatment. Pumps necessary in most wells.
A	Superficial deposits of wide areal extent, similar to above, but thick and extensive.	On slopes at edges of terraces and plateau, and on floodplains. Most flow in summer, but some are perennial.	Information lacking.	Same as above.	In the east, ground-water supplies are probably small. Specific information is lacking.	Shallow ground-water supplies apt to be saline, especially in the south central area, but specific information is lacking.	Most springs and streams will afford water supplies only in summer. In the south central area, west of Argun River, deep wells may yield water of good quality from taliks. In the northern areas, the ground is probably frozen to great depths, so that water can be obtained only from summer-flowing springs.	Same as above.
B	Bedrock consists of stratified, flat or inclined, impervious rocks (shale, clay, and coal) and pervious rocks (sandstone, conglomerate, tuff, and breccia). Underlies unconsolidated materials in valleys of the north and west parts; underlies valleys and many of the ridges and slopes of the south central part; underlies low plateaus in the east part.	Few springs. Generally issue from valley walls, but some along fault zones or at formation contacts.	Information lacking.	Probably similar to well water.	Wells at many stations and towns on the west half of the oblast. Less frequent in the east half. Depths from 100 to 1,000 feet; yields up to 230 gallons per minute. See well records in following table. In the western half of the oblast most coal mines that penetrate below the frozen ground become flooded. One coal mine encountered a sustained flow of 156 gallons per minute at a depth of 100 feet.	Water generally good except when coming from coal beds. See typical analysis in following table.	The valleys of the western part are probably the most promising areas for obtaining ground-water supplies in the Chita Oblast. In these valleys, wells 100 feet deep or more should yield adequate supplies of potable water. Prospects for well supplies are less favorable in northern and eastern parts of oblast.	Percussion drills probably desirable. Rotary rigs (with heated or saline drilling fluid for penetrating frozen alluvium) also may be used. Casing necessary through alluvium in upper 100 feet of wells. Pumps necessary in most wells. Purification equipment not necessary for deep well water, but may be needed for treatment of spring water.
C	Trap rock (solidified lava flows) and associated volcanic ash. Forms flat surfaces on ridges, plains, plateaus, and wide valley floors. Most extensive in southern part of oblast.	Many perennial and seasonal springs; generally issue from crevices and margins of trap rock areas.	Information lacking.	Water generally contains free CO_2.	None known.		Many springs can be utilized. Wells drilled in trap rock may yield good supplies in places, but well sites must be selected on basis of field study. Ground may be frozen and deep wells generally will be more successful than shallow wells.	Purification equipment for spring water. Percussion rigs for drilled wells. Casing probably not necessary except for a few feet near surface. Pumps needed.
D	Moderately folded metamorphic rocks. Consist chiefly of massive fissured or cavernous limestone, and marble, but also includes slate, sandstone, quartzite, schist and other rocks. Underlie both mountain and valley slopes.	Many perennial and seasonal springs issue from fissures and solution channels in limestone and marble.	From 15 to 300 gallons per minute.	Moderately hard but otherwise good.	A number of wells in fissured slate and limestone, up to 500 feet deep; yield up to 100 gallons per minute. See well records in following table.	Water from slate and schist is usually good, see analysis in following table. Water from limestone is hard.	Adequate supplies may be obtained where camp sites are near springs. Deep wells drilled in fissured or cavernous limestone or fissured slate may yield good supplies.	Same as above.
E	Granite and metamorphic rock. Forms main mountain masses. Granite also occurs in patches too small to be shown on map, in other areas.	Many springs issue from fissures on slopes. At least 150 are known in south central part of area. Some used to supply spas.	Gonshinsky Spring (locality 18) supplies drinking and bathing water to a spa used every summer by several hundred persons. Ignashinsky Spring (locality 15) supplies a health resort of 20 houses.	Springs have been classified under two main types. Type 1 includes largest number of springs; temperature less than 39° F.; water alkaline, contains free CO_2; in places highly radioactive (as much as 200 mache units or 74 millimicro curies), high in bicarbonates, calcium, magnesium, sodium, iron and sulfate. See analysis in following table. Type 2: thermal springs distributed in north and northeast border regions, and in southwest corner. Temperature as high as 167° F. Water rich in sodium, free nitrogen gas; usually rich in sulfate, less commonly in bicarbonate; may also be high in calcium and iron and in places contain free CO_2. Radioactivity low.	A few wells. Yield is small. See well records on following table.	Information is lacking.	Springs will afford adequate supplies for small to medium sized units in many places. Drilled wells may afford small supplies, but suitable well sites are probably difficult to find, and results of drilling are unpredictable. Most likely places for springs and wells are along fault zones, at formation contacts and at contacts of granite and other rocks.	Same as B. Water may need treatment for high mineral content.

(Cont.)

Surface Water
(For greater detail on streams see Rivers Sheet)

River	Discharge	Freezing	Possible Use as Water Supply	Tributary Streams and Lakes
Amur. Largest stream in the oblast formed by junction of Argun and Shilka Rivers. Forms south boundary of eastern part of oblast. Drains east into Pacific Ocean.	In upper reaches mean annual discharge is 42,360 cu. ft./sec., minimum in winter is 5,825 cu. ft./sec. At east boundary of the oblast the mean annual discharge is 60,000 cu. ft./sec. and the minimum is 7,060 cu. ft./sec.	Ice appears in middle of October and breaks up in middle of April. Ice thickness varies from 48 to 62 inches.	Affords water supply throughout year. Used as source of supply by Blagoveshchensk (population between 50,000 and 100,000) and possibly some towns in the Chita Oblast.	Tributaries other than Zeya, Shilka and Argun have mean annual discharges of 2,000 cu. ft./sec. or less, and all freeze to the bottom in winter.
Zeya. A tributary of the Amur. Drains extreme eastern part of the oblast.	At its mouth at Blagoveshchensk in Far Eastern Krai (south of the oblast) mean annual discharge is 70,000 cu. ft./sec. and minimum discharge, in winter, is 780 cu. ft./sec. During summer floods the discharge approaches 1,000,000 cu. ft./sec.	Average number of ice-free days per year is 157. Ice thickness ranges from 47 to 54 inches. In upper reaches freezes to the bottom except in deep parts of the channel where stagnant pools remain.	Only lower end of river has enough water in winter to provide adequate supply. Upper reaches can supply water only in summer.	Mean annual discharges as much as 8,000 cu. ft./sec. All smaller streams freeze to bottom in winter, and larger streams freeze to bottom except near mouths. Minimum discharge, near mouth of largest river, Gilyui, is 160 cu. ft./sec. in winter.
Shilka. Left fork of the Amur. Drains most of southwestern part of the oblast.	At its mouth the mean annual discharge is 11,600 cu. ft./sec.; minimum, in winter, is 1,600 cu. ft./sec.	Freezes about the middle of November and ice breaks up in early part of May. Ice thickness 76 inches in upper reaches, 44 inches in lower. Flow is maintained beneath ice near mouth. In upper reaches river freezes to bottom except in deep pools.	Water in middle and upper reaches usable only in summer. The small amount of water remaining in winter becomes bad tasting and smelling. Sretensk and Nerchinsk use Shilka water in summer, ground water in winter.	Freeze through in winter, except for stagnant pools left in largest streams. Smallest streams go dry in fall. Town of Chita on the Ingoda and Olovyannaya on the Onon use river water for summer supply and ground water for winter supply. Lakes in steppe area along the Onon are saline and become dry or freeze in the winter.
Argun. Right fork of the Amur River. Marks central southern boundary of the oblast.	At its mouth mean annual discharge is 9,778 cu. ft./sec., minimum, in winter, is 880 cu. ft./sec.	Freezes in early November. Flow is maintained beneath ice near mouth. In upper reaches river freezes to bottom except in deep pools.	Usable only in summer.	Largest tributary has mean annual discharge of 808 cu. ft./sec. Smaller ones go dry in fall. All freeze to the bottom in winter along their entire length.
Chikoi. Flows westward to Lake Baikal.	At mouth, outside of the oblast, mean annual discharge is 4,095 cu. ft./sec., minimum is 670 cu. ft./sec.	Freezes to the bottom in the oblast. Ice thickness at mouth (outside of oblast) is 55 inches. Ice breaks up in early May.	Usable only in summer.	Tributaries small, freeze to bottom in winter.
Khilok. Flows westward to Lake Baikal.	At mouth, outside of the oblast, mean annual discharge is 3,000 cu. ft./sec., minimum is 530 cu. ft./sec.	Freezes from mid-October to mid-November. Ice breaks up about the middle of May. Ice thickness is 65 inches. Freezes to the bottom in winter.	Usable only in summer.	Tributaries small, freeze to the bottom in winter. Lakes at head have mineralized, unpotable water; and freeze through in winter.
Vitim. Forms northwestern boundary of the oblast. Tributary to Lena River which flows into the Arctic Ocean.	Where it leaves the oblast, mean annual discharge is 10,590 cu. ft./sec.; minimum, in winter, is 2,120 cu. ft./sec.	Freezes about the end of October, and ice breaks up in the middle of May. Ice thickness, 35 inches or more. Freezes to bottom in upper reaches.	In the lower part affords adequate supply throughout year. In upper reaches affords adequate supply only in summer.	Freeze to bottom in winter. Lake ice gets 68 to 78 inches thick. Largest lakes do not freeze to bottom and can possibly be used for water supply.
Olekma. Flows north. Tributary to the Lena River, north of the oblast.	Below the mouth of the Nyukzha mean annual discharge is 9,178 cu. ft./sec.; minimum, in winter, is 2,575 cu. ft./sec.	Freezes early in November and ice breaks up about the middle of May. Ice thickness, 59 inches or more. Freezes to bottom in upper reaches.	In the lower reaches affords water supply in winter as well as in summer.	Tributaries within the oblast have mean annual discharges as much as 2,000 cu. ft./sec. In winter all of the smaller streams freeze to the bottom, but the lower reaches of the larger tributaries could be used for water supply in winter. Lake ice gets 68 to 78 inches thick. Largest lakes do not freeze to bottom and can possibly be used for water supply.

Well Records b/

Location and Number	Area and Type of Material	Depth, in feet	Yield, in Gallons per Minute	Thickness of Permanently Frozen Ground, in Feet	Remarks
Taidut (5)	Superficial deposits	100	90	65 to 90	Water at base of superficial deposits.
Lake Ivan (9)	" "	100 to 130	80 to 110	—	A number of wells.
Chita Region (23)	Superficial deposits, river alluvium	154	Abundant	25	
Khizhe (Kuja) (1)	Area B	400	105	No frozen ground	
Petrovsk (2)	" "	330	Abundant	140	
Khushenga (4)	" "	450	45	95	
Mogzon (6)	" "	215	Abundant	175	At a depth of 13 feet well yielded 15 g.p.m. from talik in frozen superficial deposits.
Lake Irgen (7)	" "	300	360, when water level at 10 feet below surface		Six water horizons.
Sokhonda (8)	" "	230	35 to 45	160 to 175	Three flowing wells.
Kuka (21)	" "	185	130	60	
Chernovsk (22)	Area B, coal beds	255	115	70	Poor quality water.
"	Area B	820	35 to 50	75	Flowing.
Chita (23)	" "	450	Negligible	90	
Makkavevo (24)	" "	130	More than 180	75	Flowing.
Khadabulak (29)	" "	400	55	—	
Borzya (30)	" "	310	130	—	
Kharanor (35)	" "	1,070	1	175	
Matsievkaya (32)	" "	410	45	—	Poor quality water.
Ukurei (33)	" "	200	230	160	
Zilovo (13)	" "	140	90	130	
Urushcha (34)	" "	285	165	165	
Skovorodino (16)	" "	700	35	165	
Magdagachi (36)	" "	215	6	50	
Ushumun (37)	" "	400	40	35	
Karimskaya (25)	Area D, fissured slate	210	65	—	
Sedlovaya (26)	" "	210	60	—	
"	" "	500	100	—	
Buryat (27)	" "	290	85	120	
Bulak (28)	" "	700	15 to 25	—	
Soktui (31)	" "	70	25	15	
Toldan (17)	Area D, limestone	435	70	50	Hard water.
Bushulei (12)	Area E, granite	380	1+	230	
Zilovo (13)	" "	380	10	130	
Toldan (well 2) (17)	" "	190	5 (in winter sometimes up to 50)	175	

(Cont.)

Water Analyses
(in parts per million)

Sample	Ca	Mg	Mn	Cl	K	Na	SO_4	$2HCO_3$	Fe	Al_2O_3 Fe_2O_3	H_2SiO_3	SiO_2	Free CO_2	Total Hardness	Permanent Hardness
Taidut well (locality 5) in superficial deposits to depth of 13 feet.	11.0	2.5				17.22	3.53	45.68				20.0		63.36	7.67
Mogzon well (locality 6) in rocks of area B, 200 feet deep.	9.43			5.2			26.52			10.0				23.56	12.49
Khushenga well (locality 4) in rocks of area B, 450 feet deep.	49.74	9.71				27.08	6.59	71.82						128.7	36.77
Karimskaya well (locality 25) in slate of area D, 210 feet deep.	83.5	30.2		14.0		19.9	63.7	52.9		None				283.78	107.0
Gonshinsky spring (locality 18) one at the low temperature (type 1) springs from rocks of area E.	287	157	1.9	1.0	54	9.7	2.4	2053	9.7	Al-3.9	73		2992	2668	

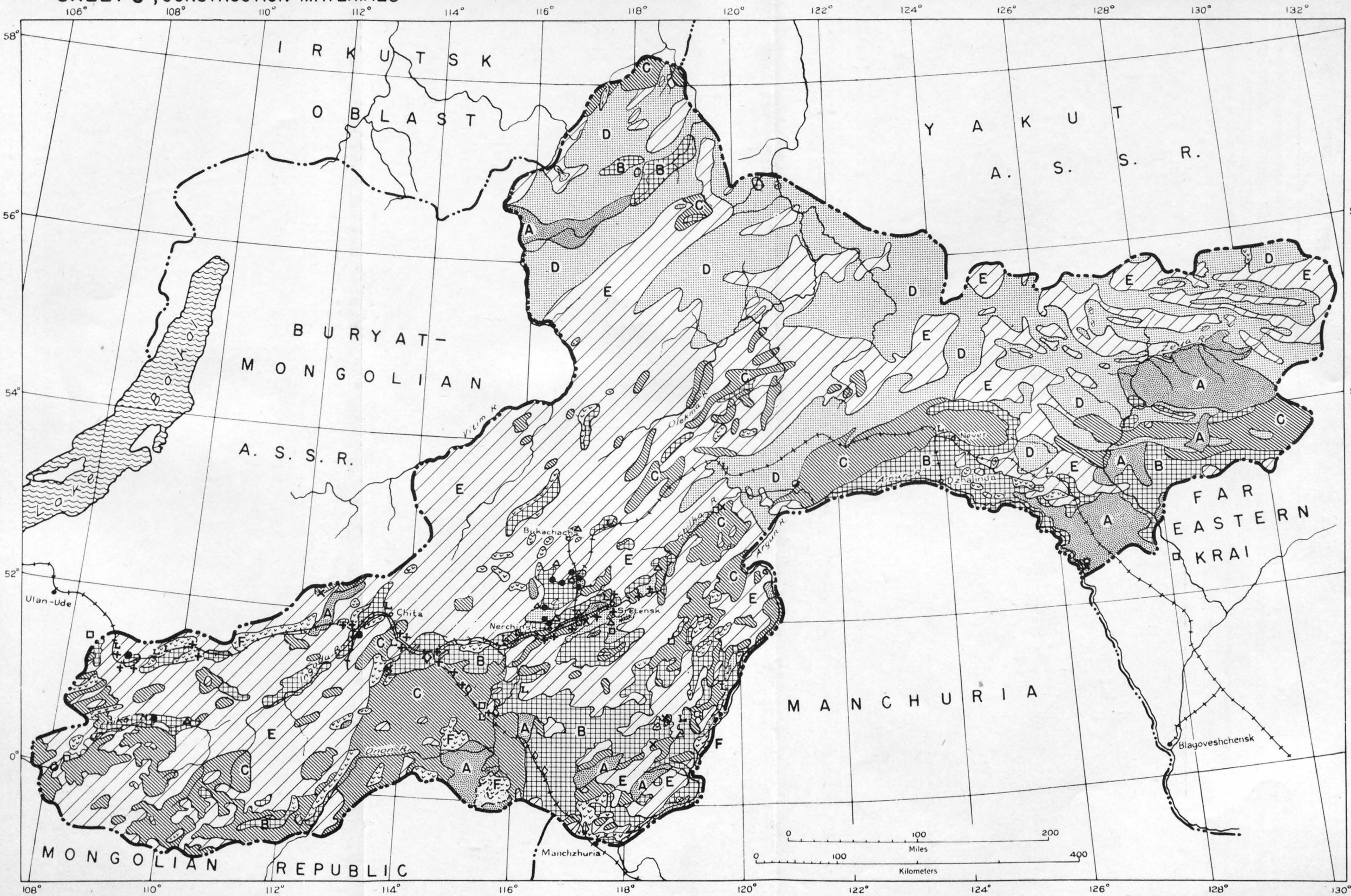
a/ For detailed discussion see special report, S.E.S. No. 62, Permafrost or permanently frozen ground and related engineering problems, March 1943.

b/ Data as of 1916, however in 1936 many of the same wells were being used, usually with diminished output.

Reliability rating: Class B.
Compiled by U. S. Geological Survey.

SHEET 6 , CONSTRUCTION MATERIALS

CHITA OBLAST



Reliability rating Reconnaissance map
Compiled by U. S. Geological Survey

Symbol	Kind of Material	Building Stone and Masonry	Riprap	Road Metal and Ballast	Lime, Mortar, and Cement	Concrete Aggregate	Brick
A	Unconsolidated and friable stream, lake, and other surficial deposits. Includes sand, clay, gravel, and some lignite. Not shown on map are alluvial deposits in the valleys of the major streams and small areas of lake deposits.	Not suitable.	Not suitable.	Sand and gravel abundant and suitable. In construction of Trans-Siberian Railroad alluvial material provided ballast.	No lime. Some of the clay may be suitable for cement manufacture. Best source of sand for mortar.	Sand and gravel are abundant and suitable for fine and coarse aggregate.	Brick clay, and some fire clay available.
B	Bedded rocks: Sandstone, conglomerate, shale, clay, and coal. Minor amounts of volcanic ash.	Some sandstone and conglomerate is hard enough to be used and is quarried.	Hard sandstone and conglomerate are usable.	Crushed sandstone and conglomerate suitable.	No lime. Some friable or weathered sandstone can be crushed to provide sand for mortar. Clay and shale suitable for portland cement manufacture. Volcanic ash may be suitable for puzzolan cement.	Some sandstone is friable or weathered and can be crushed to provide fine aggregate. Conglomerate can be crushed and used for coarse aggregate.	Brick and fire clay abundant. In most places is associated with coal, some with weathered shale and volcanic ash.
C	Stratified and metamorphic rock, some crystalline and foliated. Includes limestone, marble, slate, schist, sandstone, and quartzite.	Limestone and marble are suitable and widespread. Some sandstone and quartzite are suitable. Some slate is usable for roofing and flooring.	Good source.	Crushed stone suitable. Limestone excellent.	Main source of lime. Limestone and marble are burned for lime at numerous places. Limestone suitable for portland cement is not abundant because most deposits contain some magnesium. In places limestone may be suitable for natural cement. Scattered patches of residual clay in soil may be suitable for use in portland cement. No sand for mortar.	Crushed stone suitable for coarse aggregate. Some foliated rocks may be undesirable.	Scattered patches of residual clay suitable for brick.
D	Foliated rock and massive crystalline rock; mostly slate, schist, gneiss, and quartzite. Small amounts of marble.	Slate for roofing and flooring is abundant. Some gneiss, quartzite, and marble can be used for masonry.	Good source.	Many rocks suitable.	Marble is suitable for lime and possibly for portland cement, but is not abundant. Scattered patches of residual clay in soil probably suitable for use in portland cement. No sand for mortar, except in small soil patches.	Crushed stone suitable for coarse aggregate.	Scattered patches of residual clay probably suitable.
E	Massive crystalline rock, mostly granite. Found in some small areas not shown on map.	Main source. Widespread. Quarries along railroad provided stone for bridges and other structures during construction of railroad.	Main source. Almost all outcrops can be used. Was used in railroad construction.	Excellent source.	No lime. White, kaolin clay found in patches in soil and is suitable for use in portland cement. No sand for mortar, except for small patches in soil.	Crushed stone usable for coarse aggregate, excellent source.	Scattered patches of clay in soil usable for brick.
F	Volcanic rocks. Includes massive varieties and volcanic ash.	Trap rock has been used to some extent in railroad construction. Spongy trap rock makes good building stone which is light and a good insulator against cold. Volcanic ash may also be suitable for building stone.	Good source.	Volcanic rock excellent source.	No lime. Volcanic ash may be suitable for use in puzzolan cement.	Trap rock may be suitable for coarse aggregate but some may contain zeolites, or other minerals injurious to concrete.	Not suitable.

a/ Timber for construction is abundant in all parts of the oblast.

b/ Sand, gravel, and other unconsolidated materials are frozen hard in winter, and must be thawed before quarrying. At depths of 1.5 to 10 feet in much of the oblast, the ground is frozen in summer as well as winter.

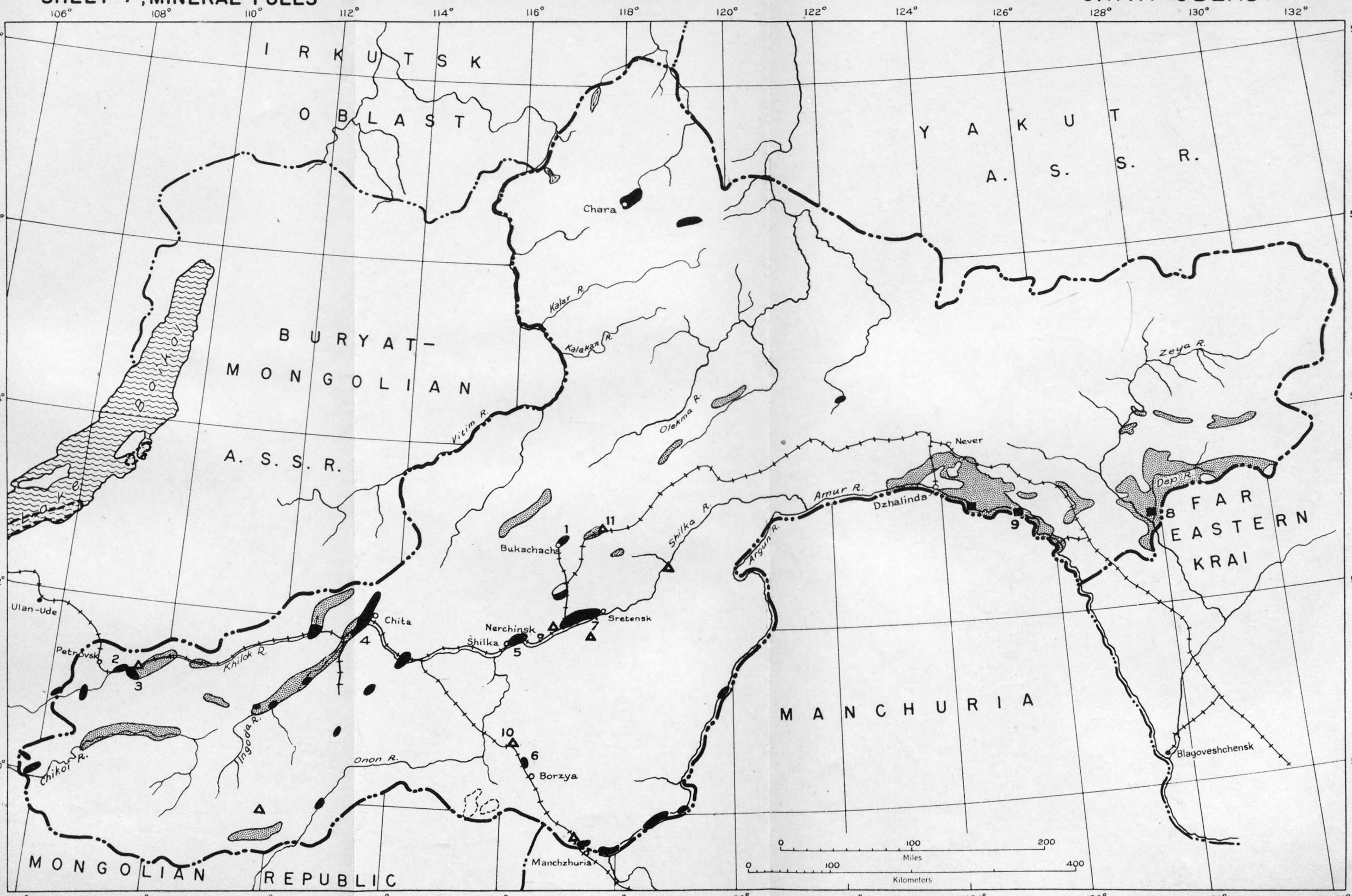
Legend (Data on quarries are in part taken from old sources and in most areas are incomplete).

- + Granite quarry
- □ Marble quarry
- × Limestone or marble quarry (for lime burning)
- ● Sandstone quarry
- ◕ Slate quarry
- △ Fire clay quarry
- ◇ Sand or sand and gravel pit
- L Lumber mill

Reliability rating: Class B.
Compiled by U. S. Geological Survey.

SHEET 7, MINERAL FUELS

CHITA OBLAST



Reliability rating: Reconnaissance map
Compiled by U. S. Geological Survey

COAL

Number	Mining Area	Quality [a/]	Production and Reserves [b/]	Accessibility	Mining Methods [c/]	Geology
1	Bukachacha	High-volatile bituminous coking coal.	1936 production 375,900 tons. Probable reserves 39,205,000 tons. Possible additional reserves 107,241,000 tons.	On broad-gage branch of Trans-Siberian Railroad, 43 miles (70 km.) long.	Drifts and surface workings. Depth of permanently frozen ground 330 feet (100 meters), below which the workings have not yet been extended.	In Jurassic rocks, 3,000 feet in thickness. Along the east edge of the mining area the beds dip west. Five workable beds.
2	Tarbagatai	Brown coal. Slacks on exposure.	Estimated reserves not more than 35,000,000 tons. (2 and 3: 1936 production 13,000 tons.)	On main line of Trans-Siberian Railroad.	Underground mines. Because ground is unfrozen timbering is used. Being in the Khilok River valley, the workings need to be constantly pumped.	In upper Jurassic coal-bearing deposits 1,475 feet in total thickness.
3	Khalyart	Brown coal. Slacks on exposure.	Estimated reserves 14,500,000 tons. (2 and 3: 1936 production 13,000 tons.)	Connected with Trans-Siberian Railroad by spur, about 7 miles (12 km.) long, which crosses the Khilok River over a wooden bridge.	Drift mines.	In upper Jurassic rocks.
4	Chernovsk	Brown coal. Slacks on exposure. Subject to spontaneous combustion which makes storing difficult.	1936 production 1,055,920 tons. Probable reserves 116,191,000 tons. Possible additional reserves 4,298,000 tons.	On spur, two miles long, of Trans-Siberian Railroad, 12 miles (20 km.) from Chita, the capitol of the province.	Open pit mines. Frozen ground makes work difficult and seasonal.	In Jurassic coal-bearing rocks more than 1,600 feet thick.
5	Arbagaro - Kholbon	Brown coal.	1922 monthly production was about 4,000 tons. Probable reserves 4,677,000 tons. Possible additional reserves 2,790,000 tons.	On Trans-Siberian Railroad, 11 miles (18 km.) from the town of Nerchinsk.	Underground mines. 126-foot shaft. The Kholbon workings have difficulty with mine water because close to the Shilka River.	In Jurassic coal-bearing rocks 1,000 feet thick.
6	Kharanor	Brown coal. Slacks badly on exposure.	1922 monthly production about 6,500 tons. Probable reserves 11,000,000 tons. Possible additional reserves 69,000,000.	One mile (two km.) east of Chita-Manchuria Railroad.	Shafts and open pits. Two shafts (1922). Surface stripping expected to be more profitable.	In Cretaceous rocks. Beds horizontal.
7	Delun	Brown coal.	Production not known. Probable reserves 602,000 tons. Probable additional reserves 13,209,000 tons.	On the Trans-Siberian Railroad 15 miles (25 km.) southwest of the town of Sretensk.	Mines are in permanently frozen ground.	In Jurassic rocks surrounded by gravel. Jurassic 2,300 feet thick. 4 workable coal beds.
8	Novo Yampol-Dep	High-volatile bituminous coking coal.	Dep River reserves estimated (in 1922) to be up to 480,000 tons.	Remote from railroad but on the Zeya River, a stream, navigable in summer.		In Jurassic rocks.
9	Tolbuzin	Bituminous coal. High ash content (29 to 32%) due to thin interbedded layers of shale.	Discovered in 1932. Developed since 1933. Production and reserves not known.	At left bank of Amur River (navigable in summer). Connected by dirt road with Trans-Siberian Railroad.	Drift mines.	In Jurassic rocks, cut by numerous igneous intrusions. Six workable seams with total thickness of 50 feet.

Coal Analyses

Localities	1. Bukachacha	2. Tarbagatai West part	2. Tarbagatai East part	3. Khalyart	4. Chernovsk	5. Arbagaro-Kholbon	7. Delun	8. Novo Yampol-Dep.	9. Tolbuzin
Volatile matter	38.78%	27.54%	38.43%	39.42%	36.77%	34.96%	29.22-35.18%	18.81-26.60%	17.00-23.00%
Ash	7.76	12.47	9.55	8.29	7.29	9.67	11.56-29.21	4.63-16.00	29.00-32.00
Moisture	4.73	11.80	5.55	11.49	15.68	13.41	5.25-13.12	0.38- 1.22	
Coke	59.0-79.0							60.04-70.39	
Carbon	78.69	76.02	75.12	69.36		71.36	63.35-75.56		
Hydrogen	6.59	4.91	5.38	5.06		4.85	3.76- 5.91		
Oxygen and Nitrogen	13.71	17.50	17.75	24.00		22.42	20.00 or less		
Sulfur	0.67	1.57	1.75	1.58	0.63	1.43	2.14- 5.84		
Heating value in calories	8292	7320-7850	6450-7415				5,761-7,169		
(B.t.u. in parentheses)	(14,872)	(13,176-14,130)	(11,610-13,347)				(10,370-12,904)		
Heating value air-dried in calories		5230-5955	4801-5755	5191	5,250 (?)				
(B.t.u. in parentheses)		(9,414-10,719)	(8,642-10,359)	(9344)	(9,450 ?)				
Bitumen	5.54								
Tar	14.31								

Oil Shale: Bituminous, combustible shale has been found in Lower Cretaceous rocks and in coal-bearing Jurassic rocks. These deposits have not been developed but are favorable for development. The oil shales are found in surface exposures at all localities shown on map except at locality 11 where oil shale was penetrated by borings at a depth below 25 feet.

Analyses at Locality 10
(Shale is in bed 30 to 40 inches thick)

	Dense shale	Fissile shale (in paper-thin sheets) Sample 1	Sample 2
Volatile matter (dry)	6.50%	5.8%	6.7%
Coke (dry)	1.95	2.2	1.7
Ash (dry)	91.57	92.02	91.56
Moisture	10.86	7.26	7.56

Analysis at Locality 11

Moisture (at 110° C.)	3.5%
Moisture (at super-heating)	27.10

Distillation in Fischer retort at 510° C:

Water	5.6%
Semi-coke	80.0
Tar	12.0
Gas and loss	2.4

Oil and Gas: None within Chita Oblast province. 1) Oil and gas seeps out along the shore of Lake Baikal, and the oil can be collected in barrels. Some test borings have been made, but results were unfavorable (1940). 2) An area along the Aldan River, several hundred miles north of the north boundary of the Chita Oblast has oil seeps, and test borings have proven favorable (1940). 3) The Cretaceous deposits containing oil shales in the central part of the oblast (the Eastern Transbaikal area) have been suggested as possible oil-bearing areas, but no drilling has been done.

Peat: Peat deposits are widespread in areas at swamps and lakes in the wide valley bottoms, and on some poorly drained uplands and slopes. The largest deposits are in the east, in the Amur-Zeya drainage area. Because coal is abundant in the same regions the peat deposits have not been used for fuel except possibly by a few individual households.

Numbers indicate producing coal fields, described above

- Areas containing workable coal.
- Coal basins whose boundaries are not known.
- Areas of coal-bearing sedimentary rocks, probably containing coal.

(The three above:) Of Jurassic, Cretaceous, or Tertiary age; all are brown coals except those on the Amur River, some of which are bituminous.

- Localities at which oil shale has been found.
- Area of oil and gas seeps on Lake Baikal.

a/ For analyses see table above.

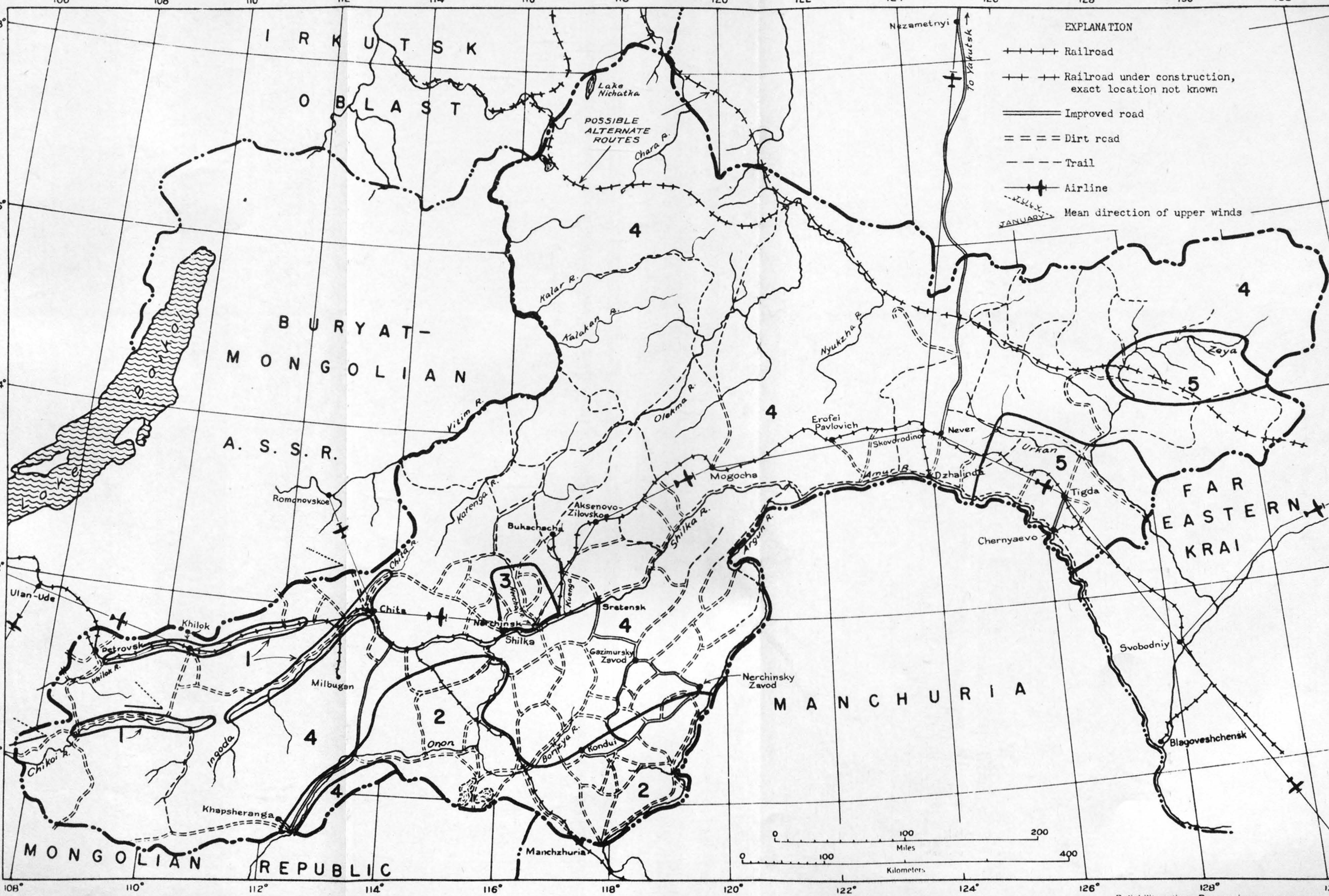
b/ In long tons.

c/ Date of information on extent of mining, 1937 except where otherwise stated.

Reliability rating: Class B.
Compiled by U. S. Geological Survey.

SHEET 8. SUITABILITY FOR TEMPORARY ROADS AND AIRFIELDS

CHITA OBLAST



Reliability rating Reconnaissance map
Compiled by U. S. Geological Survey

Introduction

Transportation routes for vehicles offer different problems in winter and summer. In winter (October to March) many of the frozen rivers may be used as roads (see Rivers sheet). At the same time the ground is frozen and all existing roads in valley bottoms are usable. Some regions are level enough and open enough to permit free movement of vehicles almost anywhere. Most of the region, including the minor stream valleys, is too thickly forested, however, to permit passage of vehicles without laborious clearing of the forest. Thus in winter the entire existing road system may be used and large streams may be used as roads; places far from large streams or from roads are inaccessible. These can be reached only by new road construction.

In spring the upper layers of the ground thaw and are wet and swampy so that travel over open country is impossible for vehicles, and many existing unimproved roads are unusable during spring and summer. At this time of year only improved roads can be used by vehicles.

Movement in the Chita Oblast is easiest east-west, following the main river valleys. The double-tracked, Trans-Siberian Railroad crosses the entire length of the area. There are no continuous improved roads in this direction, but in winter the rivers and stretches of unimproved roads could be used and probably would form a usable route of travel the entire length of the oblast.

Movement north or south involves crossing mountain ridges and there are no continuous natural routes in these directions. However, an improved highway, which connects Never with Yakutsk crosses the eastern part of the oblast, and the southern part of the oblast is served by many unimproved and improved roads, some of which cross the eastward-trending ridges and valleys.

Construction of temporary roads is difficult, because the deeper ground is permanently frozen, the surface is swampy in summer, many areas are densely forested, and in many places grades are steep. Most rivers can be crossed in summer only by bridges or ferries, as they are all subject to floods.

At present, overland travel in isolated regions is mostly by pack trains of reindeer or horses which follow river valleys or existing trails. Reindeer are preferred because forage for them is abundant. On roads, horse-drawn wheeled vehicles are commonly used the year around since snowfall is slight and much is cleared off by winds. Sleds or wagons are used on river ice.

Effect of permanently frozen ground on construction.

The most important factor influencing road and other construction in the Chita Oblast is permanently frozen ground. This is encountered a short distance below the surface (generally 1.5 to 10 feet; in southern part of oblast as much as 26 feet). Bedrock as well as loose, surficial materials are frozen. Permanently frozen ground, however, may not be present on many south-facing slopes. The ground above the permanently frozen ground, called the active layer, freezes in winter and thaws in summer.

The principal construction problems are to prevent heaving, or flow of ground and subsequent settling and to prevent flooding by water issuing from unfrozen layers in the ground. Ground water occurs above and below the permanently frozen ground and may also penetrate through layers or channels within it. The ground water is usually under pressure. This water comes to the surface as springs, may be tapped by excavations, or may break out if the overlying frozen ground is thinned by thawing. Warmed structures, unless insulated from the ground, will thaw the frozen ground and may cause ground water to break through to the surface, flooding the structure, or the ground around it. Some houses have been filled to the top with ice. Moving water tends to thaw frozen ground, and drainage ditches, such as those along roads may create springs which flood the area. In winter this water freezes as it emerges and roads may become covered with thick sheets of ice.

When thawed, unconsolidated surficial materials are apt to become saturated, or oversaturated with water because the permanently frozen ground does not permit downward circulation. Fine sand and silt tend to flow and become unstable when thawed, and to heave when frozen. To overcome such action, structures should be anchored into the permanently frozen ground by driving pilings through the active layer, and securing them at the lower end.

In road and airfield construction, fills are preferred to cuts, which should be avoided if possible. Clean sand and gravel make an excellent base or fill for roads or other construction. Drainage of the substructure should be provided for, and in most cases the thermal equilibrium of the ground should be disturbed as little as possible. Drainage ditches and borrow pits should be located as far from the road as is practicable. Clearing and destruction of the vegetation should be kept to a minimum.

Excavations in permanently frozen ground need no support, but if any unfrozen layer is encountered, or if the base of the frozen ground is reached, caving and flooding may result. Unconsolidated materials are as hard to excavate as rock when frozen, but may be melted by driven steam points or by circulating water. Owing to the resiliency of frozen ground, special explosives must be used (ammonal and ammonite), if the ground is excavated without thawing.

Construction in the Chita Oblast requires a careful preliminary survey of hydrologic and frozen ground conditions, and construction on oversaturated ground should be avoided. If the permanently frozen ground is over 10 feet in thickness, the existing thermal equilibrium in the ground should be maintained. If the thickness is less than 10 feet, the permanently frozen ground condition should be eliminated. For detailed discussion of the construction problems presented by permanently frozen ground, see the special report, **S.E.S. No. 62, Permafrost or permanently frozen ground, March, 1943.**

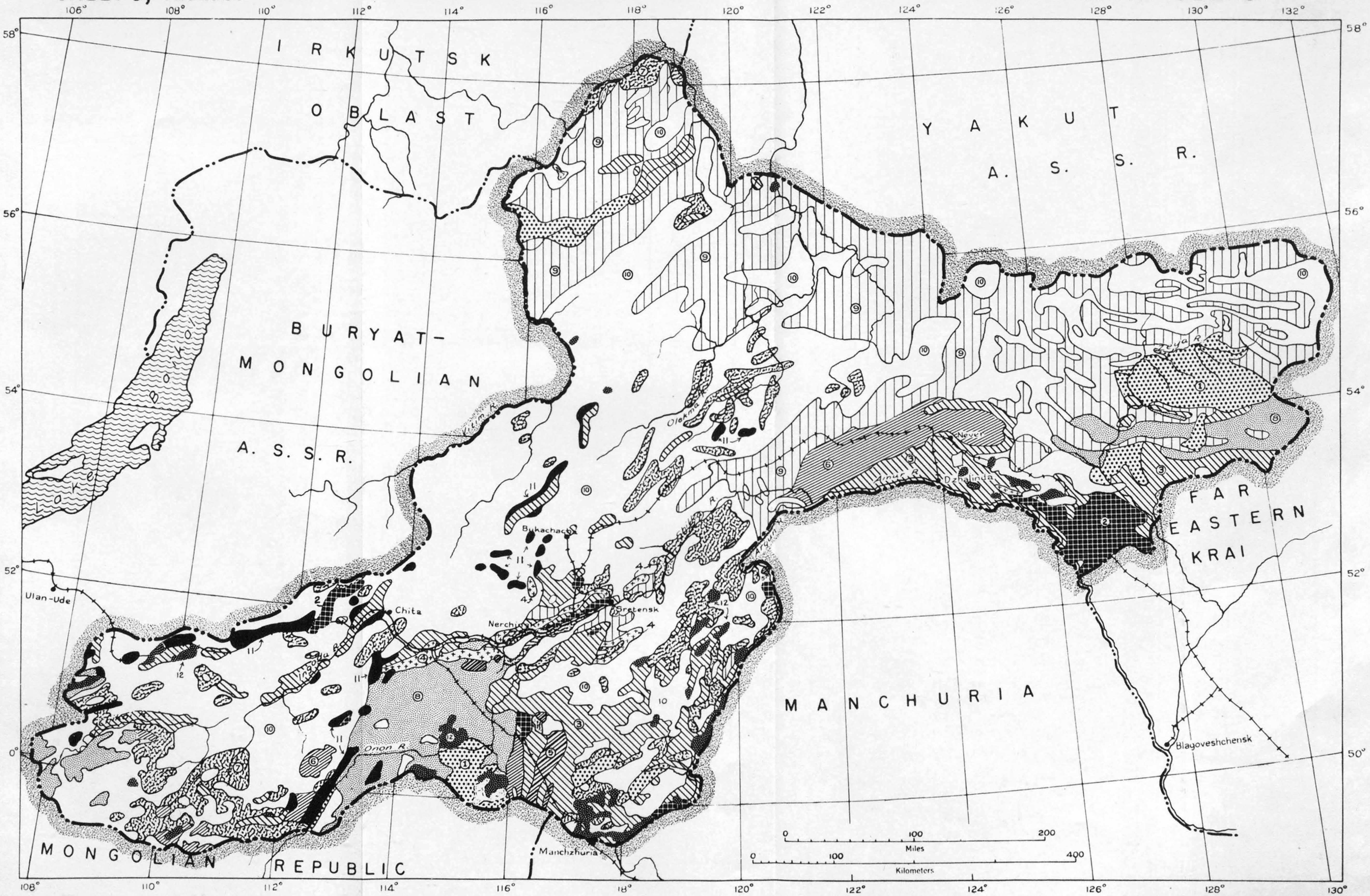
Frozen ground is a much poorer conductor of electricity than unfrozen ground. In the oblast, unfrozen surface materials have a resistance of about 50 ohms M^2/M, whereas the permanently frozen ground has an average resistance of 1,000 to 2,000 ohms.

Area	Topography	Kind of Ground and Improvements Needed	Suitability for Airfields	Construction Materials Available b/	Accessibility
1	Wide, flat river valleys between parallel ridges 1,000 to 2,000 feet above valley floors. Form best routes of travel in east or west direction in the western part of the oblast. Main streams are wide and must be crossed by bridges or ferries, except when frozen, but few river crossings are necessary. Most of small tributary streams require use of bridges or culverts because of summer torrents. Valley floors are wide and flat so that grades can be low, and alternate routes and detours are easily constructed. During winter the main streams are suitable for use as roads by heavy vehicles.	Soil and loose materials as much as 100 feet deep, thinnest near valley edges, where bedrock crops out in many places. Soil consists of sand, gravel and minor amounts of clay; possibly micaceous. In places ground is covered with swamps and peat, in others, dry meadow. In a few small areas dry sand forms the surface. Drainage is poor; most of surface soil probably unsuited for soil cement stabilization because of high organic content and moisture. Ground loose, and easily worked with graders in summer, but hard as rock when frozen and must be thawed. Wet ground requires high substructures and drainage ditches, but if ground is found to be permanently frozen side ditches should not be close to road and should be shallow. Ground should be disturbed as little as possible, to prevent change of thermal gradient. Deep borrow pits should be far from road. Width of valley permits detours but they must be drained or surfaced with corduroy. Little clearing necessary.	Prevailing lower winds are parallel to length of valleys. Runways in this direction can have unlimited extent. Runways in transverse direction can be built in few places because of limited width of flat ground, and high ridges, blocking approach. Best sites on terraces above rivers which are never flooded. Best possibilities for transverse runways are where the valleys widen at the mouths of large tributaries. Fields can be easily located where no clearing or grading other than that for drainage would be necessary. Coarse fill for sub-base, thick base course, and impervious top-dressing are necessary for all-weather use and to prevent frost heave. Thermal equilibrium of ground should be disturbed as little as possible during construction. Lakes at the head of the Khilok Valley, and smaller ones in other places, can be used for winter landing fields, when frozen (October to April).	Sand and gravel in valley bottoms suitable for most construction. Abundant stone and timber on valley walls. Granite quarries along railroad. Cement materials available in other parts of oblast. Oil and asphalt probably available in small quantities from oil seeps at Lake Baikal. Water is plentiful from streams during summer, but when rivers freeze water must be obtained from springs or wells. Winter-flowing springs not common. Wells at several railroad stations. Possibility of developing ground water supplies by wells 100 or more feet in depth is good.	Dirt roads follow all valleys, but are probably impassable during summer in many places. Trans-Siberian Railroad follows part of Ingoda and Khilok Valleys. Chita, and other large towns located along the railroad, mostly in valleys. Airfields or airports of some sort probably exist at Khilok and Chita.
2	Extensive, level plains, indented by shallow, ill-defined basins, which are dry or contain salt lakes. In places, mostly in the eastern part, isolated hills or small ridges interrupt the plains. Relief low. The few rivers are meandering and broken into numerous channels bordered by small swamps and lakes. The area forms easiest corridor of movement between Manchuria and the most settled part of the Chita Oblast.	Plains and basins covered by soil and loose material to depth of 250 feet or more. Consists of sand, clay, and gravel. In general, gravel content increases with depth. Soil in lake basins is more or less saline, and in places is highly so, but probably all but the most mineralized soils are suitable for soil cement stabilization. Ridges and hills are bare, hard rock, except on the lower slopes, which are covered with alluvium. Scraped roads are probably suitable in many places, but in places ground may be permanently frozen, so that drainage and special construction methods are required. Soil apt to be dry and dusty, and treatment with salt or oil probably desirable.	Airfields can be located in almost all parts of the area. Runways can be oriented in any direction, unless close to hills or ridges. No stabilization of subgrades necessary. Base course probably need not be thick but should be coarse and well-drained to prevent frost heave. Top-dressing should be impervious. The ground is probably suitable in many places for emergency landings or for temporary unimproved fields.	Sand and gravel abundant. Rock for road metal or building stone available in ridges and hills. Several granite and limestone quarries located along railroad at north edge of area. Materials for portland cement available in adjacent areas to the north. Salt for surfacing, in lake basins at south edge of area. Trees are sparse but timber is plentiful to the north and west. Water scarce during winter when rivers freeze. Scattered perennial springs probably supply the only winter source of water.	Area crossed by the Chita-Manchurian Railroad. Region thinly populated, except along the railroad. Several dirt roads on the plains.
3	Low plateau, surrounded by hills 500 to 800 feet high. Level in northeast part but gently rolling elsewhere. Dissected by narrow, steep-walled valleys up to 650 feet deep. Probably easiest route between the Shilka Valley and the headwaters of the Vitim River. Open country, low grades possible, except at river crossings. Steep plateau edges are ascended by tributary valleys in which grades are steep. Alternate routes and detours can be easily made on the plateau.	Depth of soil not known but probably is at least 10 feet. Consists of sand, gravel, and minor amounts of clay. Along the south edge the surface is gravel. Soil is dry and alkaline, probably suitable for soil cement stabilization. Probably little construction necessary in plateau surface. Scrapers, alone, probably could make road suitable for light traffic. Surfaced road could easily be made with graders borrowing suitable fill and road metal from ditches, but the ground may be permanently frozen, and construction methods should be appropriate. Blasting and difficult grading may be required where deep valleys must be crossed, or at plateau edges. Ground is dusty during strong winds.	Good location for airfields. No clearing and a minimum of grading necessary. Natural drainage, good. Addition of fill probably not necessary. Substructure should be coarse and well drained. Construction should take into account the probability that the ground is permanently frozen. Except in wet weather, emergency landings can be made in many places on the plateau.	Sand and gravel abundant in soil. Clay pits and quarries for granite, limestone, marble, and sandstone along railroad. Limestone and clay probably suitable for the manufacture of portland cement. Timber plentiful on surrounding slopes. Water in streams not available in winter. Several perennial springs in Shilka Valley. Wells drilled on plateau might encounter water at depths of about 100 feet, or more.	Trans-Siberian Railroad, which follows the Shilka Valley borders the area on the south. Spur line to Bukachacha a short distance east of area. Several dirt roads cross the area, connecting Shilka and Nerchinsk (in the Shilka Valley) and leading north from the railroad. An airfield or airport of some sort probably located at Nerchinsk.
4	Mountain masses and ridges trending generally northeast to east. Main valleys generally parallel the ridges and are narrow and steep-walled. Some of main streams, such as Vitim , Olekma, and Amur, can be used as roads during winter by heavy vehicles (see Rivers Sheet), but localities on minor streams or in interior can be reached only over trails or roads which can be constructed only with difficulty. Roads are most easily constructed in valleys but much rock excavation and many curves are necessary. Streams must be crossed in numerous places (most can be forded, except during floods). Mountain ridges in a few places can be crossed at water gaps, such as those along the Zeya, Ingoda, and Nercha, but these are narrow and have steep, rocky walls. In other places, ridges can be crossed at low saddles or passes at heads of valleys, generally covered with swamps and lakes. Some of these are low, but others require steep grades or even tunnels. Some plateau areas, as along the Olekma River are most easily traversed on the upland surfaces, but difficult grading required to cross deep valleys. Many places have little or no room for alternate routes or detours.	Highest parts of ridges and peaks are bare rock, but most parts of uplands and slopes are fractured and broken rock overlain by thin, bouldery, micaceous, clayey soil, rarely more than 1 or 2 feet thick. Soil mostly wet, and covered with dense forest. In places slopes have piles of broken rock. Low mountain saddles are usually wet and swampy, and soils may be peaty, particularly in the eastern part. Narrow valleys are filled with boulders or gravel. Wide portions have floodplains of gravel, sand, and in places thin peaty soil. Deepest soils are in the northern part, where loose materials reach 130 feet in thickness, and consist mainly of bouldery gravel. Most soils are unsuited for soil cement stabilization. Uplands and valleys forested in most places. Clearing necessary, and in most places is difficult. Rock cuts and embankments needed in many valley bottoms. Along large streams ordinary graders can be used but probably much fill is needed in places. Careful provision must be made for presence of deep permanently frozen ground. In mountain passes or saddles roads need coarse substructure, and good drainage.	Most of area unsatisfactory for airfields. Few places are level and unobstructed by topography. Some suitable areas in the uplands north of the Amur River, and along the Olekma River, but these need difficult clearing and are wet. Some wide parts of valleys in the southern part, and the U-shaped valleys of the extreme northern part may be suitable. These areas are small; runways could be located only along the valleys; high obstructing mountains on either side. Unless located on terraces, fields would be subject to flooding. All runways need high, well-drained substructure. The large lakes of the northern part, such as Lake Nichatka could be used for landings in winter.	Sand and gravel along large streams. Stone for building or for crushing available everywhere. Materials for portland cement available in southern part and along north edge. Timber abundant. Surface water supply available in summer, but scarce in winter because frozen. Best source of water is from perennial springs, many of which are known in southern part. Possibility of development of wells uncertain.	Southern part served by numerous roads and by the Trans-Siberian Railroad, except for the high mountainous area in the southwest. The northern part is inaccessible, crossed by a few trails, and almost uninhabited; however, the proposed Baikal-Amur Railroad which will cross the northern part of the oblast, may now be under construction. Probably airports or airfields of some sort at Aksenovo-Zilovskoe, Mogocha, and Skovorodino.
5	Level plains incised by valleys 300 to 800 feet deep, which are steep-walled and narrow. Main valleys have discontinuous wide stretches of floodplain. Headwaters of tributaries pass imperceptibly onto the uplands. Elsewhere the plains break off abruptly into the valleys. Roads with low grades can be built in many directions on the uplands. Valleys can best be reached or crossed by descending from the headwaters of tributaries. Many curves, some steep grades needed in valleys. Minor streams can be forded, except during floods. Alternate routes and detours can be easily constructed on the uplands. In winter, these need little preparation, but in summer require corduroy or addition of fill.	Plains covered by coarse sand and gravel, clayey in part and peaty; 7 to 12 feet in thickness. Soil unsuited for soil cement stabilization. Plains, heads of valleys and even most slopes are wet and swampy. Valley walls in narrow places are bare rock, but elsewhere are covered with bouldery soil. Wide floodplains are covered with sand and gravel, and have many swamps and lakes. Thin forest covers many valleys, and all of the plains, except for a wide stretch in the middle of the southwest plain (along Trans-Siberian Railroad). When unfrozen the ground can be easily worked with ordinary graders. On uplands wet ground requires addition of fill, and high, well-drained substructure. Some clearing necessary, but little grading except that necessary to provide drainage. Valleys are wet, require high substructure, and even the large ones need rock excavation where rock walls approach the river edge. Roads in valleys will be subject to flooding in July and August.	Upland plains suitable for airfields. No topographic obstructions except at outer edges, which are bounded by high ridges. Runways can be oriented in any direction. Grades can be low, but high, well-drained sub-base and subgrade are necessary. Clearing necessary, except along Trans-Siberian Railroad.	Sand and gravel available on plains. Stone for construction abundant in valley walls and in ridges adjacent to plains. Materials for portland cement available at southern edge of southwest area (near Amur River). Timber plentiful. Surface water available from streams in summer but only from Amur and lower Zeya in winter; remaining streams freeze completely. Several springs flow throughout the year. Possiblity of development of ground water supply uncertain.	Southern area crossed by Trans-Siberian Railroad, and several roads. Northern area is reached only by the Zeya River (navigation in summer, vehicle travel over ice in winter), and by a few poor trails. The area is to be crossed by the proposed Baikal-Amur Railroad which may now be under construction. Airfield or airport of some sort may be located at Tigda.

a/ Includes some data on other construction problems.

b/ Granite, limestone, trap rock, and sandstone are available in parts of each area. For distribution of these materials and for distribution of some of quarries, see Construction Materials Sheet. For details of Water Supply see Water Supply Sheet.

Reliability rating: Class C.
Compiled by U. S. Geological Survey.



Reliability rating: Reconnaissance map
Compiled by U. S. Geological Survey

Stratified Rocks

1 — Recent and Pleistocene: Lacustrine clayey sand and gravel in ancient or existing lake basins; alluvial sand, gravel, boulders, and minor amounts of clay in stream valleys, on terraces, plains, and plateaus; glacial moraines in valleys of the Vitim-Olekma divide at the north end of the oblast; residual weathered material containing boulders and clay; and rocky talus slopes. Only thick deposits of wide areal extent are shown on the map.

2 — Tertiary: Continental deposits consisting of unconsolidated fine cross-bedded sand, gravel (quartz and chalcedony), and smaller amounts of clay and brown coal.

3 — Cretaceous (?) and Jurassic: Mostly undifferentiated continental deposits consisting of sandstone, arkose, conglomerate, shale with plant remains, and coal. Also contains Lower Cretaceous (?) fissile, bituminous shale with brackish water and marine fossils; some Jurassic shale and sandstone with marine fossils and Jurassic sandstone and conglomerate with interbedded tuff, porphyry, and basalt. The whole Jurassic and Cretaceous (?) section is intruded by granite and felsite porphyry, is cut by quartz veins, and is in part altered by contact metamorphism, particularly in the Amur River region.

4 — Triassic: Fine- to coarse-grained compact sandstone, arkosic in part; black, micaceous, laminated shale; some conglomerate containing pebbles of rounded quartz, crystalline rock, and sandstone. Along intrusive contacts the sandstone is metamorphosed to quartzite and the shale is changed to black hornstone. Crystalline limestone is sparsely distributed, being confined to areas near the intrusives. Upper Triassic beds contain marine fossils.

5 — Permian: Mostly marine, partly continental; consists of graywacke, sandstone, shale, conglomerate, small amounts of felsite and associated tuff. The Permian is separated from the rest of the Paleozoic by an angular unconformity and is much less metamorphosed, being more like the Mesozoic.

6 — Carboniferous to Ordovician sedimentary rocks: Consists of sedimentary rocks whose age and relationships are known. Have been affected by metamorphism in varying degree. Not as strongly metamorphosed as undifferentiated Paleozoic.
- Carboniferous: Marly limestone, black shale, arkosic sandstone.
- Devonian: Limestone, smaller amounts of sandstone, and in lower part black shale.
- Silurian: Fossiliferous, argillaceous limestone with smaller amounts of sandstone.
- Ordovician: Fossiliferous sandstone.

7 — Undifferentiated Cambrian and Proterozoic: Phyllite, schist, hornstone, limestone and dolomite (in many places altered to marble); smaller amounts of sandstone, quartzite, arkose, graywacke, conglomerate.

8 — Undifferentiated Paleozoic metamorphic rocks: Includes rocks ranging in age from Cambrian to Carboniferous which have not as yet been differentiated or are too highly metamorphosed to be differentiated. Contains slate, schist, phyllite, hornstone, limestone, marble, amphibolite, sandstone, arkose, and quartzite. Generally more highly metamorphosed than Mesozoic. Associated granites are gneissoid.

9 — Pre-Cambrian:
- Proterozoic: Graywacke, schist, slate, phyllite, quartzite, and crystalline limestone.
- Archeozoic: Schist, gneiss, and granite-gneiss.

Igneous Rocks

10 — Intrusive Rocks: Mostly granite, granodiorite, quartz diorite, and syenite; some diorite, gabbro, norite, diabase, pyroxenite, peridotite, dunite, and serpentine. Post-Jurassic, late Paleozoic, Proterozoic, and Archean in age.

11 — Jurassic extrusive rocks: Basalt, porphyrite, tuff (includes some interbedded sedimentary rocks).

12 — Cenozoic: Basalt, andesite, tuff.

Structure

The north part of the Chita Oblast is an exposed basement complex, a portion of the "ancient shield" of Siberia, and has not been inundated by seas since Middle Cambrian time. The rocks of the shield were strongly metamorphosed and folded during the pre-Cambrian and early Paleozoic (Caledonian) orogenies into arcuate belts that strike ENE. and NE. At a later time the folded rocks were broken by normal faulting into horsts and grabens striking generally parallel to the folding but with some cross faults that strike northwest. In Mesozoic and Tertiary time continental sedimentary and volcanic rocks filled the grabens and covered portions of the ancient uplands.

The area south of the shield remained a geosyncline until early Carboniferous time when its rocks were metamorphosed and strongly folded by the Variscan orogeny. This orogeny was followed in the Mesozoic by continental deposition, volcanism, and in places marine deposition, and then by renewed folding and normal faulting which lasted from late Jurassic to late Cretaceous and possibly into the Tertiary. The strike of the folds is northeast. South of Chita highly folded and metamorphosed Paleozoic rocks were thrust from the southeast many miles over less strongly folded and metamorphosed Mesozoic rocks. In the eastern part of the area, thrust sheets are not found but the Mesozoic rocks are more severely metamorphosed.

Post-Jurassic normal faulting was widespread in the areas of granite as well as in the folded sedimentary rocks.

Igneous activity

Extensive bodies of granitic rock were intruded in the pre-Cambrian, during the Caledonian orogeny (early Paleozoic) and during the Variscan orogeny (late Paleozoic). Intrusives of post-Jurassic age constitute most of the igneous rocks found in the southern part of the area, and may also be extensive in the northern part.

Volcanic activity occurred in the Jurassic, possibly in the Cretaceous, and throughout Cenozoic time. Several extinct volcanoes have been found along the Vitim River and in the Amur River region.

Geomorphology

The Chita Oblast is a high mountainous region made up of parallel ridges and valleys controlled by the geologic structure. The tops of the ridges are flat or rounded, and have concordant summit elevations, representing an ancient peneplain. Scattered monadnocks rise above the general level. At least two younger cycles of erosion are represented by lower dissected plateau surfaces, best developed along the Olekma River. Some of the large valleys are grabens and are wide, flat, and poorly drained. Many are filled with old lake deposits, which the present streams have incised leaving elevated terraces. Some valleys cut across the ridges and are generally deep and narrow, and may contain the remnants of narrow stream terraces.

Pleistocene glaciation was limited to the mountains of the northernmost corner of the Oblast. The sharp alpine forms, U-shaped valleys, moraine lake basins, and tarns of this area contrast greatly with the rounded, flattened uplands of the rest of the oblast.

The only large level areas are (1) in the south central part, southeast of Chita; (2) between the Zeya and Amur Rivers, and (3) near the head of the Zeya. The first, a northern extension of the steppes of Mongolia, is a wide, rolling or hummocky plain covered with detritus. It contains many saline lakes and dried lake basins, and has scattered areas of rocky hills and ridges with alluvial fans at their base. The two level areas on the Zeya River are low, flat, marshy plateaus covered by alluvial and lake deposits representing stream valleys and basins of interior drainage of an earlier erosion cycle, into which the present stream valleys are incised.

At the west-central boundary along the upper Vitim River, a small part of the extensive Vitim Plateau is included within the Chita Oblast. This plateau is partially formed of basalt flows.

Mineralization

The strong mineralization of the Oblast was caused by extensive and recurrent igneous activity. The richest ores are associated with younger intrusives, as well as with early Paleozoic and Carboniferous intrusives. Most metallic ores other than gold are restricted to eastern Transbaikalia (area southeast of Chita) where the intrusives are Jurassic or later in age. Gold occurs mainly outside of this area associated with older granites.

The ores consist of: pegmatite and pneumatolytic quartz gangue with tungsten, molybdenum, tin, and mica; hypothermal quartz gangue and quartz tourmaline gangue with gold; polymetallic gold-bearing ore; pneumatolytic fluorite ore; quartz gangue with cassiterite and galena; porphyry bodies in volcanic necks with pyrite and gold; mesothermal ores and metasomatic necks and stocks with silver-lead-zinc ore, some with copper, others with antimony or cinnabar; and placer deposits with gold, wolframite, and cassiterite.

Ground Water

Ground water escapes as springs from fissures in crystalline rock. The springs are mostly concentrated along fault zones, intrusive contacts, and unconformities. The water is usually mineralized and sometimes thermal, explainable by association with the igneous activity and mineralization of the region. Numerous fissure springs are fed by water contained in solution cavities and fissures in Paleozoic limestones. The stratified Mesozoic and Cenozoic deposits in the valleys (particularly in the grabens) form artesian basins. The permanently frozen ground acts as an impervious layer forming artesian aquifers even in unconsolidated, coarse-grained sediments. Due to winter freezing, shallow ground water and springs with shallow ground-water source can be utilized only during the warm months.

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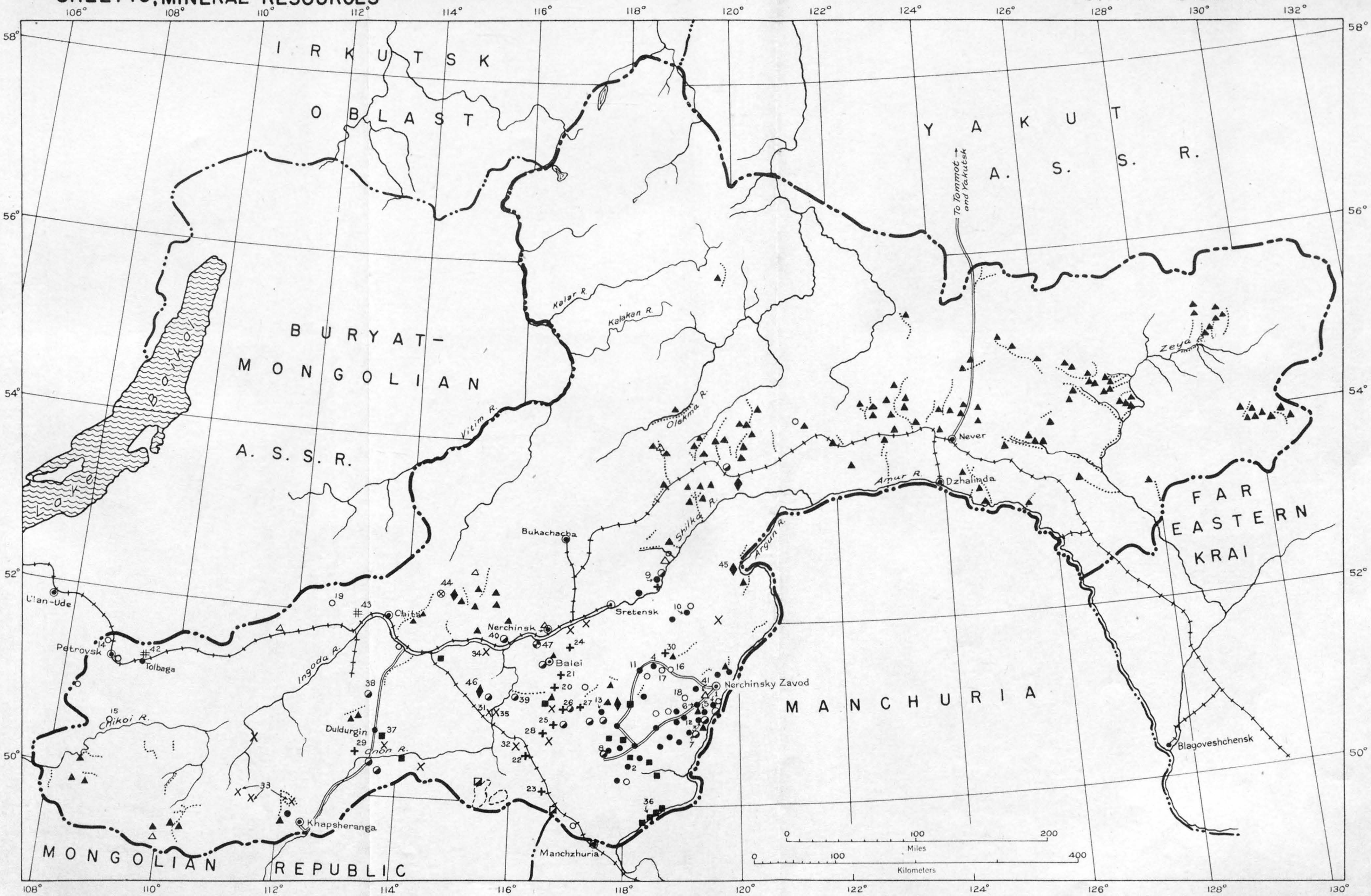
SHEET 10, MINERAL RESOURCES

CHITA OBLAST



Reliability rating Reconnaissance map

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Numbered localities on map are described below. Localities shown on map but not numbered are small, undeveloped, or poorly prospected.

● LEAD, ZINC, AND SILVER (INCLUDING SOME ARSENIC AND ANTIMONY)

Most of these mines are in the Nerchinsk region. Transportation facilities are poor and concentration plants are lacking (1938). The mining districts are interconnected by dirt and surfaced roads but they are distant from the railroad, which is reached only over dirt roads. A railroad through the region is reported to be under construction. Principal ore minerals are galena, sphalerite, and arsenopyrite.

Reserves of high-grade ore estimated to be 3,000,000 tons in 1938. Production has been sporadic and many if not most of the mines were idle after the revolution.

In the years preceding 1933 the mines were resurveyed with the object of reopening some of them. At present many mines may be producing but data are not available. The figures for production and reserves are taken from a report published in 1933.

Locality Number	Mining district or mine	Total past production and grade of ore[b] (See above)	Grade of reserves and estimated reserves of metal[b]	Depth to which working has progressed	Ore body
MAJOR IMPORTANCE					
1	Nerchinsky Zavod District				
	Karpovsko-Glubokinsky mine	5,407 tons of ore. 9.5% Pb, 24.5 ounces per ton Ag.	8.5% Zn, 5.0% Pb. Possible reserves: 3,200 tons Zn, 2,400 tons Pb.		Tubular vein in limestone.
	Vozdvizhensky mine	111,245 tons of ore. 11% Pb, 14 ounces per ton Ag.	10.0% Zn, 5.0% Pb. Probable reserves: 4,000 tons Zn, 3,000 tons Pb. Possible additional reserves: 20,000 tons Zn, 15,000 tons Pb.	260 feet	Irregular tubular pockets in limestone at contact with porphyry dike.
	Blagodatsky mine	119,200 tons of ore. 10.25% Pb, 15.2 per ton Ag.	8.0% Zn, 6.0% Pb. Possible reserves: 56,000 tons Zn, 42,000 tons Pb.	540 feet	Connected tubular veins and pockets in limestone.
	Ekaterino-Blagodatsky mine	17,846 tons of ore. 13% Pb, 15 ounces per ton Ag.	18.5% Zn, 4.5% Pb. Probable reserves: 9,200 tons Zn, 2,200 tons Pb. Possible additional reserves: 30,500 tons Zn, 7,400 tons Pb.	260 feet	Tubular veins and pockets in limestone.
	Staro-Zerentuisky mine	18,055 tons of ore.	5.0% Zn, 4.0% Pb. Possible reserves: 5,000 tons Zn, 4,000 tons Pb.	260 feet	Tubular veins and pockets in limestone.
	Trekhsvyatitelsky mine	40,000 tons of ore. 18% Pb, 24.5 ounces per ton Ag.	8.0% Zn, 6.0% Pb. Probable reserves: 16,000 tons Zn, 12,000 tons Pb. Possible additional reserves: 32,000 tons Zn, 24,000 tons Pb.	180 feet	Tubular veins and pockets in limestone.
	Sredne-Novo-Zerentuisky mine	86,500 tons of ore. 10-11% Pb, 14 ounces per ton Ag.	8.0% Zn, 6.0% Pb. Probable reserves: 8,000 tons Zn, 6,000 tons Pb. Possible additional reserves: 16,000 tons Zn, 12,000 tons Pb.	245 feet	Pockets and short veins in limestone.
	Maltsevsko-Kilginsky mine	60,762 tons of ore. 11% Pb, 9% Zn.	6.2% Zn, 2.3% Pb. Probable reserves: 5,400 tons Zn, 2,000 tons Pb. Possible additional reserves: 7,100 tons Zn, 2,700 tons Pb.	195 feet	Tubular veins and pockets in limestone.
	Timofeyevsky mine	5,569 tons of ore.	8.0% Zn, 6.0% Pb. Possible reserves: 1,600 tons Zn, 1,200 tons Pb.	145 feet	Tubular veins and pockets in limestone.
	General Savinsky mine	3,000 tons of ore.	10.0% Zn, 8.0% Pb. Possible reserves: 1,000 tons Zn, 800 tons Pb.	130 feet	Tubular veins and pockets in limestone.
2	Klichkinskaya District				
	Savinsky 5th mine	66,416 tons of ore.	3.3% Zn, 3.0% Pb. Known reserves: 45,200 tons Zn, 27,400 tons Pb. Probable additional reserves: 27,800 tons Zn, 21,500 tons Pb. Possible additional reserves: 27,700 tons Zn, 8,400 tons Pb.	245 feet	Ore in fissure veins.
	Pochekuevsky mine (potentially a large producer)	36,119 tons of ore.	Oxidized zone: 4.0% Zn, 4.5% Pb. Possible reserves: 7,800 tons Zn, 8,700 tons Pb. Unoxidized zone: 18.0% Zn, 4.5% Pb. Probable reserves: 19,600 tons Zn, 6,900 tons Pb. Possible additional reserves: 122,600 tons Zn, 43,000 tons Pb.	330 feet	Fissure veins in shale and limestone.
	Klichkinskaya mine	73,000 tons of ore.	9.0% Zn, 17.0% Pb. Probable reserves: 1,300 tons Zn, 2,500 tons Pb. Possible additional reserves: 3,500 tons Zn, 6,700 tons Pb.	260 feet	Fissure veins.
3	Kadainskaya District				
	Kadainsky mine	160,000 tons of ore.	15.0% Zn, 6.7% Pb, some antimony. Known reserves: 85,000 tons Zn, 37,000 tons Pb. Probable additional reserves: 22,000 tons Zn, 4,000 tons Pb. Possible additional reserves: 28,000 tons Zn, 17,000 tons Pb.	245 feet	Steeply dipping fissure vein and replacement body in dolomite.
	Vtoro-Bukatuevsky mine	16,000 tons of ore. 15% Pb, 12.6 ounces per ton Ag.	9.0% Zn, 5.0% Pb. Possible reserves: 4,500 tons Zn, 3,000 tons Pb.	215 feet	Probably similar to above.
SECONDARY IMPORTANCE					
4	Taininsky mine	29,123 tons of ore. 15% Pb, 12.6 ounces per ton Ag.	10.0% Zn, 5.0% Pb. Probable reserves: 4,000 tons Zn, 2,000 tons Pb. Possible additional reserves: 16,000 tons Zn, 8,000 tons Pb.	195 feet	Replacement bodies controlled by fissure in limestone.
5	Mikhailovsky mine	106,326 tons of ore. 9% Pb, 11.5 ounces per ton Ag.	6.1% Zn, 6.0% Pb. Probable reserves: 12,300 tons Zn, 10,900 tons Pb. Possible additional reserves: 9,400 tons Zn, 8,700 tons Pb.	330 feet	Tubular vein in limestone.
6	Smirnovsky mine	7,000 tons of ore since 1927. 20% Pb, 24.5 ounces per ton Ag.	15.0% Zn, 10.0% Pb. Possible reserves: 2,200 tons Zn, 1,500 tons Pb.	100 feet	Irregular pockets.
7	Pokrovskaya District				
	Pokrovsko-Pre-Argunsky mine	17,677 tons of ore. 6.25% Pb, 9.6 ounces per ton Ag.	7.0% Zn, 4.0% Pb, 0.31-0.35% antimony in main vein. Probable reserves: 7,000 tons Zn, 4,000 tons Pb. Possible additional reserves: 7,000 tons Zn, 4,000 tons Pb.	130 feet	Fissure veins.
	Zorgolsky mine	1,500 tons of ore. 14% Pb, 17.5 ounces per ton Ag.	6.0% Zn, 4.0% Pb. Possible reserves: 600 tons Zn, 400 tons Pb.	65 feet	Vein.
8	Algachinsky mine	25,000 tons of ore. 17.5% Pb, 33.6 ounces per ton Ag.	3.0% Zn, 9.0% Pb, 0.29% antimony. Probable reserves: 500 tons Zn, 1,400 tons Pb. Possible additional reserves: 2,500 tons Zn, 6,800 tons Pb.	260 feet	Fissure vein in sandstone and porphyry.
9	Shilka District				
	Ekaterininsky mine	174,389 tons of ore. 3.75% Pb, 7.2 ounces per ton Ag.	3.0% Zn, 2.0% Pb. Possible reserves: 30,000 tons Zn, 20,000 tons Pb.		Irregular pockets and tubular veins in limestone.
	Shilkinsky mine	17,481 tons of ore.			Irregular pockets and tubular veins in limestone.
	Pavlovsky mine	20,742 tons of ore.			Irregular pockets and tubular veins in limestone.
MINOR IMPORTANCE					
10	Kultuminskaya District				
	Preobrazhensky mine	43,900 tons of ore. 15% Pb, 15.7 ounces per ton Ag.	9.0% Zn, 7.0% Pb. Possible reserves: 4,500 tons Zn, 3,500 tons Pb.	440 feet	Tubular vein in limestone.
11	Ildikansky mine	100,973 tons of ore.	8.0% Zn, 6.0% Pb. Possible reserves: 1,600 tons Zn, 1,200 tons Pb.	460 feet	Ore bodies controlled by fissure in limestone.
12	Yavlenskaya District	12,695 tons of ore. 7.9% Pb, 15.7 ounces per ton Ag.	3.0% Zn, 2.0% Pb. Possible reserves: 6,000 tons Zn, 4,000 tons Pb.	130 feet	Irregular ore bodies and veins in various types of rock.
13	Akatuevsky mine	63,402 tons of ore. 2% Zn, 2% Pb. 10.5 ounces per ton Ag.	3.0% Zn, 2.0% Pb, some antimony. Known reserves: 1,800 Zn, 1,200 Pb. Probable additional reserves: 6,000 tons Zn, 1,400 tons Pb. Possible additional reserves: 12,000 tons Zn, 8,000 tons Pb.	165 feet	Fissure vein in limestone.

(Cont.)

O IRON DEPOSITS

From about 1929-31 the western part of Chita Oblast was explored by magnetometer; as a result many new areas of iron ore were found and old ones were delimited. Most deposits have been only prospected and are undeveloped (1932).

Locality number	Name of deposit	Grade of ore	Reserves	Occurrence	Remarks
14	Baleginsky	47.75% Fe, 0.19% S, 0.04% P.	Probable reserves of ore: 3,139,000 tons; possible additional reserves of ore: 308,000 tons. 1,000,000 tons of the reserves can be worked by stripping.	Magnetite. In contact metamorphic zone of limestone and granite.	Worked since 1789. Ore smelted at Petrovsk, 15 miles away to which mine is connected by railroad spur. According to 1940 data the Petrovsk works were recently reconstructed and two open-hearth furnaces and a gas generating plant were installed. It was also reported that these works and the Komsomolsk works (on the lower Amur River outside of Chita Oblast) had a combined annual steel production of 1,500,000 tons. Most of this production was from the Petrovsk works.
15	Korotkovsky		Worked for brief period in 1899, at which time reserves were estimated at 100,000 tons.	Magnetite associated with copper minerals. Contact metamorphic deposit.	Connected with Trans-Siberian Railroad by 100 miles of dirt road.
16	Yakovlevsky		Magnetometer estimate: 4,000,000 tons of ore above depth of 330 feet.	Magnetite and hematite.	Discovered in 1930. In Nerchinsky Zavod zinc and lead district. Connected with other lead-zinc districts by system of dirt and surfaced roads.
17	Bistrinsky	45-60% Fe.	Magnetometer estimate: 14,000,000 tons of ore above depth of 300 feet.	Magnetite, specular hematite, pyrite, and chalcopyrite.	Chalcopyrite used as copper ore. In Nerchinsky Zavod zinc-lead district.
18	Zheleznie Kryazh	60% Fe, 0.1% As, 0.08% S, 0.05-0.06% P.	112,000,000 tons of ore above depth of 600 feet.	Largest contact metamorphic deposit in region. Magnetite, some pyrite, arsenopyrite, and pyrrhotite.	In Nerchinsky Zavod district.
19	Beklemishevsky	39.7% Fe, 0.89% P, 0.06% S.	Small deposit.	Sedimentary siderite ore.	On dirt road 25 miles from Trans-Siberian Railroad.

+ TUNGSTEN DEPOSITS

At one time Chita Oblast was the only tungsten-producing region in the U.S.S.R. According to 1938 data, the Bukuka and Belukha deposits have the largest reserves in the U.S.S.R., but production is small. These are probably the only mines worked in the district since the revolution. Bismuth has been a by-product at most mines.

Locality number	Name of deposit	Production and grade of ore	Estimated reserves	Occurrence and Mining Methods	Accessibility	Bismuth production at tungsten mines
20	Bukuka	In 1917 produced 43.29 tons of 70% WO_3 concentrate. 1919: 2.24 tons of 70% WO_3 concentrate. 1926-27: 5.18 tons of wolframite concentrate and 5.48 tons of mixed wolframite-scheelite concentrate. Average 0.3% wolframite in quartz. In 1938, small production. Ore averages 0.3% wolframite.	2,098 tons of tungsten (1933).	Wolframite-bearing quartz veins in granite.	Connected with Trans-Siberian Railroad by dirt road 44 miles long, passable for motor vehicles.	1918 production: 0.1 ton Bi_2S_3 concentrate with 75% Bi. 1919 production: 0.9 ton with 10-50% Bi.
21	Belukha	In 1917 produced 22.02 tons of 70% WO_3 concentrate. 1919: 1.46 tons of 70% WO_3 concentrate. Last half 1926: 2,523 tons of ore containing 0.9% WO_3. Small production in 1938.	1,776 tons of tungsten (1933).	Wolframite-bearing quartz veins. Concentrating plant at mine.	On dirt road between Bukaka mine and Trans-Siberian Railroad, about 30 miles away.	
22	Sherlovaya Gora	In 1916 produced 7.61 tons of 70% WO_3 concentrate. 1917: 4.86 tons of 70% WO_3 concentrate. Average WO_3 in ore - 0.5%.	Tens of thousands tons of ore. Nearby placer reserves estimated in 1933 at 900 tons (65% WO_3).	Lode and placer deposits.	Connected with Chita-Manchuria Railroad by dirt road 9 miles long.	Ore is basobismuthite and native bismuth with arsenopyrite. Reserves less than 1,000 tons. In 1917 0.3 ton of concentrate was produced with average bismuth content 50%.
23	Kharanor	1911-1915: produced 10.81 tons of 70% WO_3 concentrate. 1916: 4.52 tons of 70% WO_3 concentrate. 1917: 9.83 tons of 70% WO_3 concentrate. Average WO_3 in ore 0.6%.	Probable reserves of tungsten 85 tons.	Wolframite and scheelite ore. Open pit mining.	5 miles by dirt road from Chita-Manchuria Railroad.	0.42% native bismuth in biotite granite with arsenopyrite.
24	Kazakov	In 1917 produced 0.82 ton of 70% WO_3 concentrate.	No data.	Scheelite in quartz-calcite veins. Large placer deposit.	22 miles by dirt road from station on Trans-Siberian Railroad.	Small amount in placer deposit.
25 26	Malosoktui, Bolshesoktui	In 1916 produced 5.20 tons of 70% WO_3 concentrate. 1917: 19.40 tons of 70% WO_3 concentrate. 0.5-0.8% WO_3 in ore.	Actual reserves of tungsten 22 tons.	Wolframite-bearing quartz veins in granite, and placer deposits.	20 miles by dirt road from station on Chita-Manchuria Railroad.	
27	Oldanda	In 1917 produced 1.0 ton of 70% WO_3 concentrate. 0.5-0.8% WO_3 in ore.		Wolframite vein.		
28	Antan	Production not known. 0.05-0.1% WO_3 in ore.	2,500-3,000 tons.	Placer deposit.		
29	Duldurgin	In 1917 produced 0.17 ton 70% WO_3 concentrate.		Wolframite vein.	Near town of Duldurgin which is on road between Onon River and Trans-Siberian Railroad.	
30	Ushmunski Golets	In 1917-18 produced 0.33 ton 70% WO_3 concentrate.		Wolframite-bearing quartz veins in schist.		

× TIN DEPOSITS

According to 1938 data this region was the only well prospected tin district in U.S.S.R. Some deposits were worked in early part of 19th century; then practically no work was done until about 1932 when the area was thoroughly prospected. The following is taken from a report published in 1933.

Locality number	Name of region or deposit	Production	Grade of ore	Reserves and size of deposit	Occurrence	Accessibility
31	Ononsky Lode	Apparently no production since 1852.	Average: 0.6% Sn.	1927 data. Known reserves: 114.10 tons Sn; probable additional reserves: 163.40 tons Sn; possible additional reserves: 293.50 tons Sn.	Cassiterite-bearing quartz veins in metamorphosed sandy shale, containing coal seams.	2 miles from station on Chita-Manchuria Railroad.
	Placer		Average: 0.02-0.03% Sn.	About 25 tons Sn, in gravels 33-46 feet thick.	Cassiterite placer deposit.	
32	Sherlovaya Gora		0.026-0.076% Sn.	1,825 tons cassiterite, in gravels 5-15 feet thick.	Placer deposit.	7 miles from station on Chita-Manchuria Railroad.
33	Khapcheranginsky (Exact location not known)	Reported to produce 65% of U.S.S.R. tin (1940). This production would probably amount to more than 4,500 tons.	3.12% Sn.	Tentative estimate: 7,000 to 10,000 tons of tin.	Cassiterite-bearing quartz-ochre vein in slate and chlorite schist.	Connected with Trans-Siberian Railroad by surfaced road 200 miles long.
34	Zavitinsky Lode		0.50% Sn. Tin content 1-4 tons for each 23 feet of depth.		Cassiterite-bearing pegmatite dikes.	6 miles from station on Trans-Siberian Railroad.
	Placer		0.02-0.03% Sn.	1.5 miles long, 65-200 feet wide, 1.5-4 feet thick.	Cassiterite placer deposit.	
35	Malo-Kulindinsky	Apparently no production since 1820.	0.1-0.7% Sn.	No data.	Cassiterite in muscovite granite dikes.	5 miles from Chita-Manchuria Railroad.
6	Smirnovsky (see lead-zinc-silver locality 6).		Three tested samples have following tin content: (1) 2.41-2.54%; (2) 9.97-10.0%; (3) 7.94%.	Tentative estimate: 500-1,000 tons of 1-2% Sn ore to depth of 150-200 feet.	Polymetallic deposit worked for lead, zinc, and silver, as well as tin.	15 miles SW. of Nerchinsky Zavod. Not easily accessible.

(Cont.)

■ FLUORITE DEPOSITS

36 **Soyuzplavik** (1938 data): Largest productive Russian deposits. Principal source of fluorspar for artificial cryolite used in aluminum plants of U.S.S.R. Several hundred thousand tons of reserves. Vein deposits. Connected with Chita-Manchuria Railroad by dirt road 50 miles long along the Argun River.

Two main mines: Abagaitui: In 1927 produced 839.6 tons ore; delivered 1,368.3 tons unsorted ore to railroad (including ore from previous production); had 78.3 tons unsorted ore left on hand.

Kalangui: No production in 1927; delivered 165.0 tons unsorted ore to railroad station (from previous production); had 229.8 tons of unsorted and 810.9 tons of sorted ore left on hand.

37 **Duldurgin** (1925 data): Actual reserves 1,870 tons; possible additional reserves 11,475 tons above depth of 105 feet. 1916 production: 65 tons. Probably not producing at present. On hard surfaced road between the Onon River and the Trans-Siberian Railroad.

◒ ANTIMONY DEPOSITS

Apparently no production as late as 1938. The deposits below are described in a report dated 1928. They are accessible by dirt roads. Several antimony deposits are associated with lead-zinc-silver deposits (see descriptions of localities 3, 7, 8, 13.

38 **Darasun**: Ore is in quartz veins (more than 10 inches thick) at contact of felsite porphyry with coal-bearing shale. 66.64% stibnite in ore. (47.60% Sb, 19.04% S). Prospected in 1915; 3 veins discovered, 15 tons of ore removed.

39 **Ust-Ulyatui**: Ore is in the central portion of quartz veins cutting Lower Jurassic conglomerate. Stibnite grains are up to 1/2 inch in size, with a concentration of 30 to 50%. Area entirely undeveloped.

40 **Ust-Onon**: Four quartz veins containing up to 25% stibnite. Veins 5 to 10 inches thick.

△ MERCURY DEPOSITS

Apparently no production as late as 1938.

41 **Ildikansky**: Veins less than 2 1/2 inches wide containing dolomite breccia cemented by cinnabar. In places veins contain solid cinnabar. Veins cut granite and dolomite. Near hard surfaced road.

Mine: Pokrovskaya lead-zinc-district, see (locality 7): Cinnabar found in lower levels of a lead-zinc mine. Ore contains 0.08% Hg.

Placer deposits: Cinnabar found in many placer deposits, mostly gold placers. Richest contain 0.40% Hg S.

♯ MICA DEPOSITS (1937 data)

42 **Tolbaga**: Muscovite in pegmatite dikes. 0.5-1.8% muscovite. 160 tons of possible reserves. 15 tons mica produced in 1933; 17.5 tons in 1934. On the Trans-Siberian Railroad, 0.3 miles from town of Tolbaga.

43 **Kamensko-Chernovsk**: Muscovite in pegmatite dikes. 10,800 tons of reserves. 19 miles from Chita. About 10 miles by dirt road from Trans-Siberian Railroad.

⊗ MOLYBDENUM DEPOSITS

Apparently none producing as late as 1938.

44 **Gutai** (1927 data): Possible reserves 16.3 tons. 3.8 tons of 85-87% MoS_2 concentrate were produced during prospecting work. In pegmatite dike.

◆ COPPER DEPOSITS (1933 data)

Apparently no production as late as 1938.

45 **Malaya Kudecha**: Vein of chalcopyrite, bornite, and, in oxidized zone, malachite. Average copper content of ore 3-6%, increased to 15% by sorting. About 10 miles from a port on Argun River.

46 **Voskhodsky**: Chalcopyrite ore. 1% Cu, less than 1% As, 3.5-7 ounces (100-200 grams) per ton Ag. 200,000 tons ore reserves. About 15 miles from Chita-Manchuria Railroad.

◕ MONAZITE DEPOSITS (1926 data)

47 **Borshchovochnie**: In biotite granite and gneiss and (with gold) in placer deposits along streams of the Borshchovochnie ridge. 1 ton produced in 1926. Reserves of monazite at least several tens of thousands of tons. Between 5 and 10 miles from the Trans-Siberian Railroad across the Shilka River. No road.

GOLD DEPOSITS

▲ Gold mine .... Placer deposit

The province is one of the main gold-bearing regions of the U.S.S.R. Gold deposits have been known and worked since 1777 and the better or more accessible locations have been worked out. The location of mines and placer deposits shown on the map are based on 1937 data. The largest gold deposit now worked (1940) is the Balei deposit near Nerchinsk. In the fiscal year 1926-27 the Transbaikal (i.e., the region west of the Argun River) produced 3,261.6 lbs. (1,482.55 kilograms) of lode and placer gold. In the same period 649.35 lbs. (295.16 kilograms) of gold were produced in the Zeya-Aldan region (this includes the Zeya district of the Chita Oblast and also the Aldan River district which lies north of and outside of the Chita Oblast, both containing large deposits of gold).

ARSENIC DEPOSITS

Most of the arsenic is obtained as a by-product in the smelting of lead-zinc ores. The ore mineral is arsenopyrite. Many of the polymetallic mines (in the Nerchinsk region) contain large reserves of arsenic. Possible reserves exceed 80,000 tons. Ore contains from 1 to 18% As. Apparently no arsenic was being produced as late as 1934.

SALT DEPOSITS

Salt is available in saline lake basins on the south-central frontier.

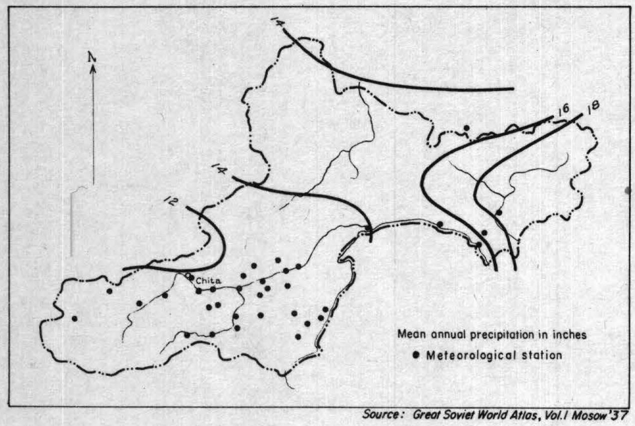
a/ For distribution of coal deposits see Mineral Fuels sheet.

b/ Tonnage figures throughout this sheet represent long tons.

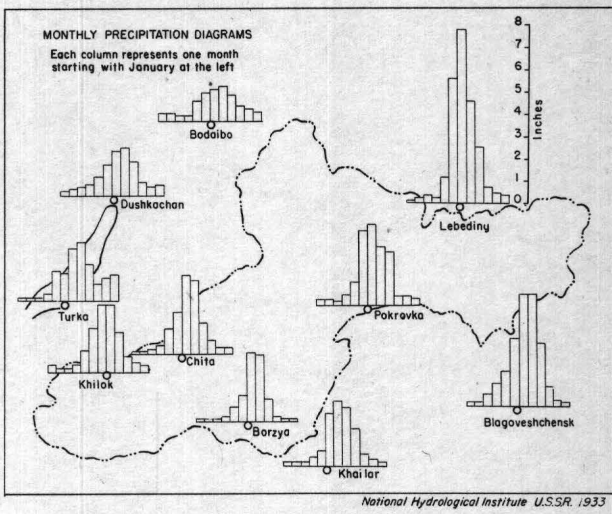
Reliability rating: Class B
Compiled by U. S. Geological Survey.

SHEET 11, CLIMATE

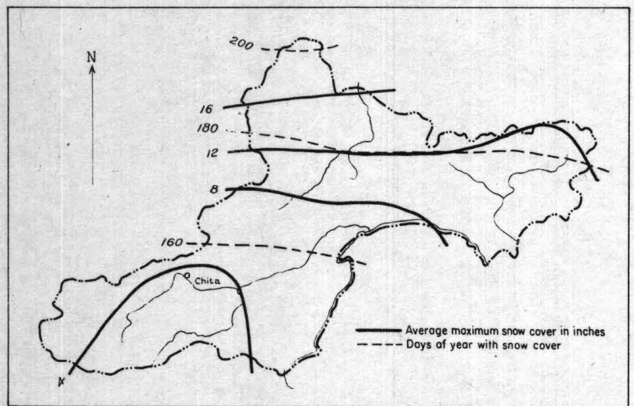
CHITA OBLAST



Source: Great Soviet World Atlas, Vol.I Mosow '37



National Hydrological Institute U.S.S.R. 1933



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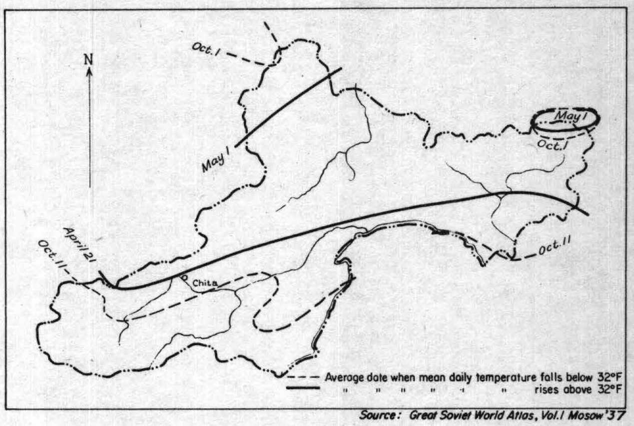

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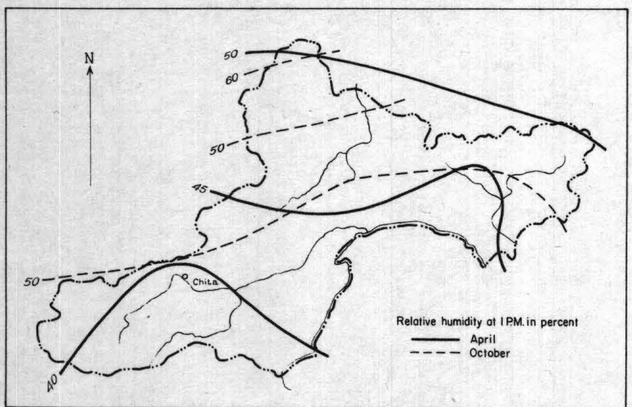

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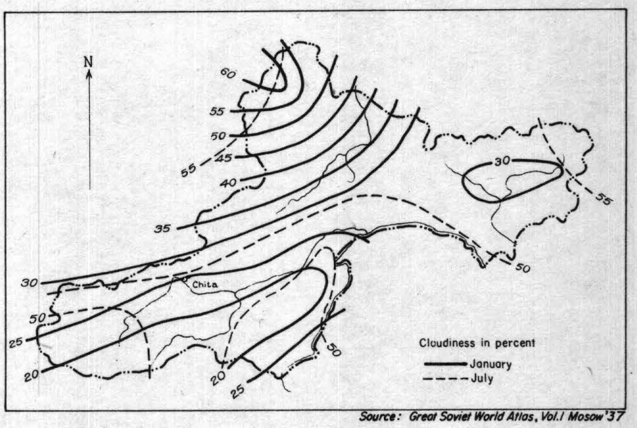
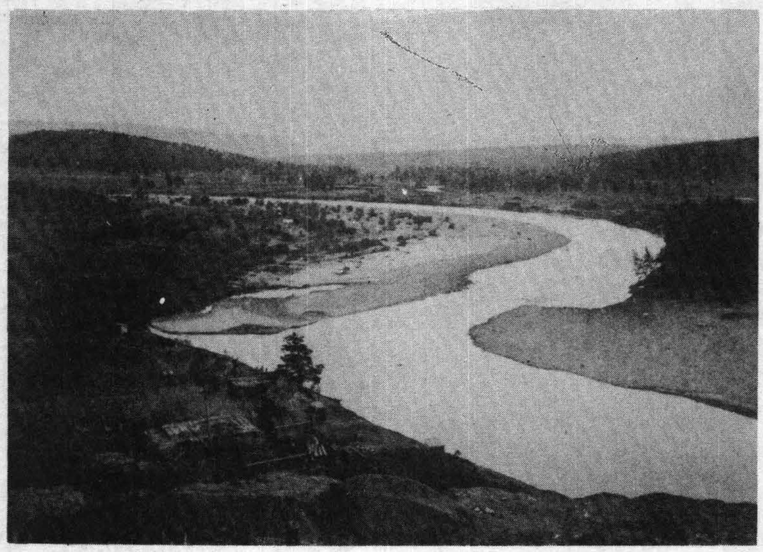


Source: Great Soviet World Atlas, Vol.I Mosow '37

Compiled by U. S. Geological Survey

SHEET 12, VIEWS CHITA OBLAST



Khilok River from Trans-Siberian Railroad. Typical of open, flat valleys of areas 1 and 4 (Terrain Appreciation Sheet). Slopes are forested but valley floor is mostly meadow.

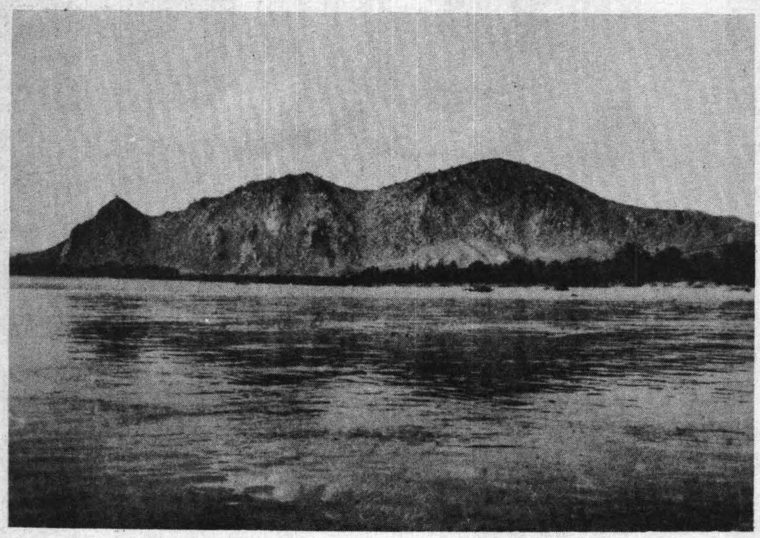
(V. A. Obruchev, Explorations geologiques et minieres le long du chemin de fer de Siberie, vol. 22, 1914.)

SHEET 13, VIEWS CHITA OBLAST

Khilok River Valley. Typical of wide, flat, alluvium-filled valleys in western part of Chita Oblast. Long mountain ridge in background. Some of these valleys are more than 7 miles wide and in most places are open and easily passable. (Areas 1 and 4, Terrain Appreciation Sheet.)

(V. A. Obruchev, Explorations geologiques et minieres le long du chemin de fer de Siberie, vol. 22, 1914.)

SHEET 14, VIEWS CHITA OBLAST



Lower course of Chikoi River. Typical of wide rivers in narrow parts of valleys in areas 1 and 4 (Terrain Appreciation Sheet).

(V. A. Obruchev, Explorations geologiques et minieres le long du chemin de fer de Siberie, vol. 22, 1914.)

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41

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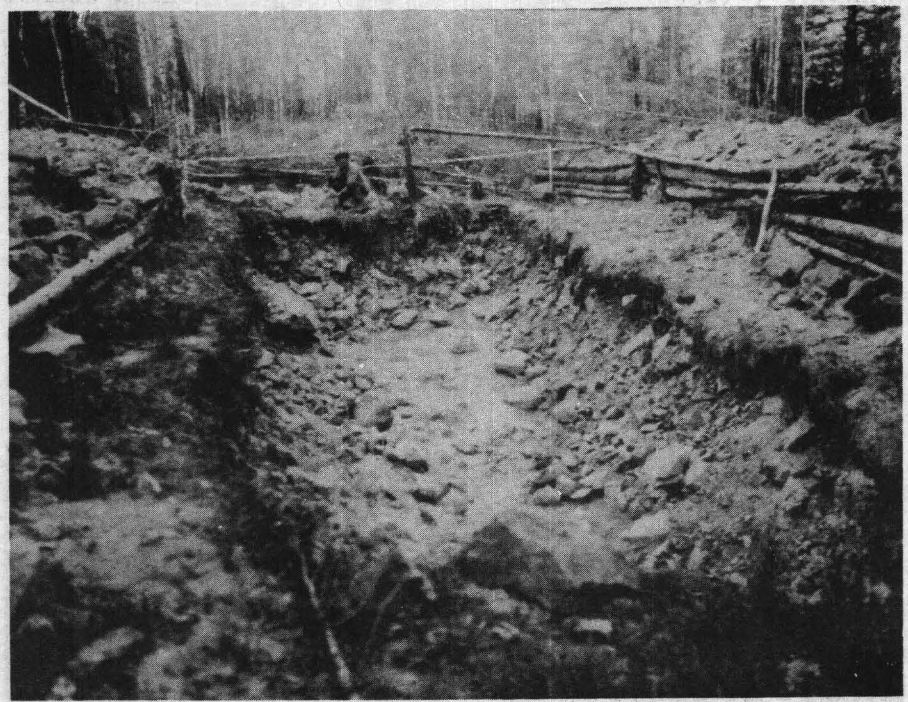
Part of city of Chita. Trans-Siberian Railroad and Chita River in foreground. Mountain ridge behind city is typical of the long ridges in the southern part of the oblast, which have steep, forested slopes and rounded, or flat tops. (Aziatskaya Rassiya).

SHEET 16, VIEWS CHITA OBLAST



Cut exposing bouldery soil on a hillside in the northern part of area 5 (Terrain Appreciation Sheet). Typical of thin, stony soil on slopes in many parts of the oblast.

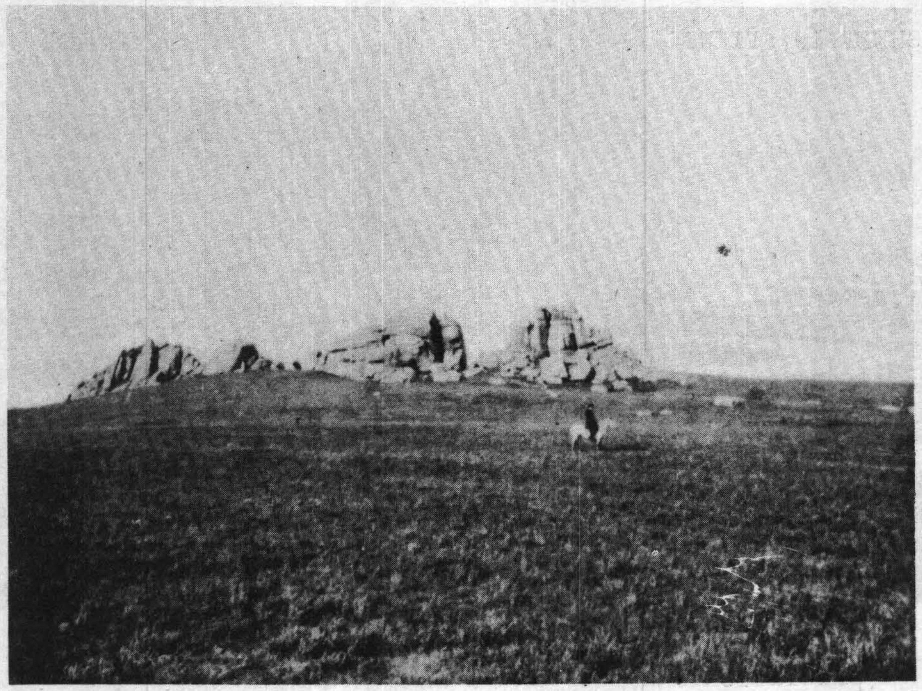
(P. P. Sushchinsky, Trav. Mus. Geol. et Mineral, Petrograd, 1915.)

SHEET 17, VIEWS CHITA OBLAST

View in open steppe region of Southeast Transbaikal, typical of areas 5 and 6 (Terrain Appreciation Sheet). Low hills in background. This region has much dry ground, few barriers to movement.

(P. P. Sushchinsky, Trav. Mus. Geol. et Mineral., Petrograd, 1915.)

SHEET 18, VIEWS CHITA OBLAST



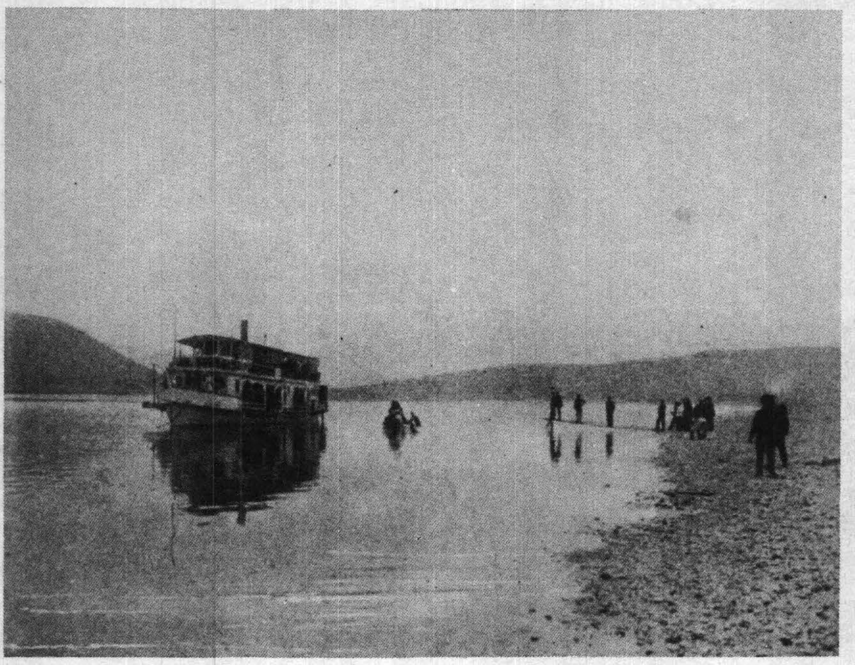
Open, dry steppe of area 5 (Terrain Appreciation Sheet). Northward continuation of steppes of Mongolia. The plain has many rocky knobs rising above it.

(P. P. Sushchinsky, Trav. Mus. Geol. et Mineral., Petrograd, 1915.)

SHEET 19, VIEWS CHITA OBLAST

Floodplain of Argun River in area 5 (Terrain Appreciation Sheet). Shows wide meanders on swampy floodplain, and numerous cut-off channels or oxbow lakes. (Vidal de la Blache, Geographie Universelle, Vol. 5, Paris, 1932.)

SHEET 20, VIEWS CHITA OBLAST



Amur River during low water. Shows steep valley walls in distance and bouldery stream bed in foreground.

(W. Gerrare, Greater Russia, New York, 1904.)

SHEET 21, VIEWS CHITA OBLAST

U-shaped valley, steep mountain slopes, bouldery valley floor, typical of area 12 (Terrain Appreciation Sheet.)

(L. G. Kotelnikov, Akademia Nauk, USSR, 1935.)

SHEET 22, VIEWS

CHITA OBLAST

Lake Nichatka, in northern part of area 12 (Terrain Appreciation Sheet). Pine - larch taiga in foreground.

(L. G. Kotelnikov, Akedemia Nauk, USSR, 1935.)