UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

PUMICE DEPOSITS IN THE ALASKA PENINSULA - COOK INLET REGION, ALASKA

by
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1951

52-103

This report is preliminary and has not been edited or reviewed for conformity with U. S. Geological Survey standards and nomenclature.

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ABSTRACT

Three principal areas of pumice deposition have been found in the Alaska Peninsula-Cook Inlet region: Katmai National Monument, Augustine Island, and the Veniaminof-Aniakchak area.

Vast quantities of pumice were deposited in Katmai National Monument resulting from the eruption of Mt. Katmai and related volcanic action in 1912. The principal deposits in the coastal areas of the Monument occur in the valley of the Katmai River and in the Amalik Bay-Kukak Bay area.

Several areas of pumice deposition have been found on the south and west sides of Augustine Island, located 200 miles southwest of Anchorage. Mining was carried on by the Alaska Katmalite Corporation during the period 1946-1949, but no production has taken place since that time.

Pumice deposits found in the Aniakchak-Veniaminof area have probably been derived from three principal sources: Aniakchak Crater, Mt. Veniaminof and Purple Crater. The limited data available indicate the deposits of chief interest occur in the valley of the Aniakchak River and in areas adjacent to Chignik Bay.

INTRODUCTION

The use of pumice as lightweight concrete aggregate is a relatively recent innovation in the Alaskan construction industry. At the present time it is employed as a cement admixture in building blocks and in other forms of concrete. It is quite probable that pumice and other volcanic materials will eventually find use in such products as acoustic plaster, silica abrasives and pozzuolana 1/.

1/ Siliceous materials used as cement admixtures in concrete for the purpose of reducing heat of hydration, inhibiting alkali-aggregate reaction and increasing resistance to sulfate waters.

As the demand for pumice increases it is likely that artifical substitutes having similar physical characteristics will be developed. Preliminary exploration and testing of a shale deposit for the manufacture of an artificial lightweight aggregate--haydite--is presently being undertaken by an Anchorage company. (Eckhart, report in preparation)

The occurrence of pumice in the Alaska Peninsula-Cook Inlet region has been known for many years, but owing to the fairly recent development of a demand for the material, specific information pertaining to particular deposits is rather incomplete. The work undertaken by the U. S. Geological Survey in the area under consideration prior to 1950 consisted primarily of reconnaissance surveys. As pumice was of no economic value in Alaska at the time these studies were conducted, occurrences of the material were generally not differentiated from other categories of volcanic ejecta either on geologic maps or in reports. Present knowledge of the geology of such pumice deposits therefore, is based largely upon general observations made incidental to the study of the broader aspects of the regional geology.

Much of the information obtained by the earlier surveys has been published in bulletins of the Geological Survey which are now out of print and are available only in libraries. Additional data have been gathered recently by members of the Geological Survey, some in connection with pumice investigations, others incidental to oil investigations in the region. Mining problems pertaining to the more important deposits have been examined by the Alaska Territorial Department of Mines. The purpose of this report is to bring together in readily available form the existing information available to the Geological Survey which pertains to pumice deposits in the Alaska Peninsula-Cook Inlet region.

GEOGRAPHY

Several geographic limitations must generally be dealt with in the consideration of the commercial possibilities of pumice deposits in the Alaska Peninsula-Cook Inlet region: 1) The deposit must be located within a reasonable distance of the market, which at present is Anchorage; 2) the deposit must be reasonably accessible to transportation facilities; and 3) adequate shelter must be available for loading facilities due to the nagivation hazards presented by the high tides and severe storms characteristic of this area of the Pacific. Because of these limitations the area referred to in this report as the Alaska Peninsula-Cook Inlet region is restricted to Kodiak and Augustine Islands and that portion of the Alaska Peninsula lying between the Pacific coast and the crest of the Aleutian Range (see pl. 1).

In the southwestern part of the area the Aleutian Range rises abruptly from the coastline; to the north the axis of the Range diverges from the coast and a narrow, rolling piedmont lies between the mountains and the shore. Access to many parts of the coastal area is very difficult owing to swampy terrain, dense brush, swift glacial-fed streams and scarcity of safe harbors.

Roads are practically non-existent in the region and airplanes are the chief means of year around transportation. During the navigation season general cargo boats and barges operate in Cook Inlet and Shelikof Strait principally from the ports of Kodiak, Seldovia and Anchorage.

Except for the Anchorage and Kodiak regions, population in the Alaska Peninsula-Cook Inlet region is sparse. The total number of permanent inhabitants of the several villages along the coast probably does not exceed 500.

GENERAL GEOLOGY

Volcanism is the dominant feature of the geology of the Alaska Peninsula -Cook Inlet area. Thirty volcanoes have been identified to date in the area under discussion, of which eleven are believed to have been active in historic time (Coats, 1950, p. 38). The volcanoes in this area represent only a portion of the festoon of volcanic peaks situated along an arc which extends from Mt. Spurr (fig. 1) in a southwesterly direction through the Aleutian Chain.

The volcanic rocks exhibit a wide range of chemical composition with those of intermediate and basic composition predominating. The more acidic varieties are usually found as lava flows which are relatively restricted in extent, or as unconsolidated deposits of ash and pumice.

In general the present volcanoes have been built upon a basement of strata of Paleozoic and Mesozoic age. Rocks of Paleozoic age crop out over limited areas primarily in the vicinity of Kamishak Bay. Strata of Mesozoic age crop out along the eastern slopes of the Aleutian Range from Tuxedni Bay to Stepovak Bay.

During the Mesozoic era extensive areas of the northeastern part of the Alaska Peninsula-Cook Inlet region were intruded by granitic bodies of batholithic proportions.

PUMICE DEPOSITS

Terminology pertaining to pyroclastic rocks varies quite widely and has undoubtedly led to considerable confusion. Many of the descriptions of pumice deposits given below have been taken from a wide variety of reports written over a period of 53 years so it is likely that rock names or classifications used in the papers do not in each instance have precisely the same meaning. Rather than attempt to interpret each author's usage a list of the most frequently used terms is presented below with a definition which is thought to have been most generally accepted during the period in question. The definitions have been taken from the report of the Committee on Sedimentation of the National Research Council (Wentworth and Williams, 1932, pp. 19-53) and from the Dictionary of Geologic Terms (Rice, 1950).

Ash.- Uncemented pyroclastic debris consisting of fragments mostly under 4 mm. in diameter.

Cinders.- Vesicular, pumiceous or scoriaceous ejecta of the same range in size as lapilli.

Lapilli.- Fragments of juvenile lava (liquid or plastic when ejected) or fragments broken from the vent wall or from bedrock. Fragment size ranges in general from 4 to 32 mm. in diameter.

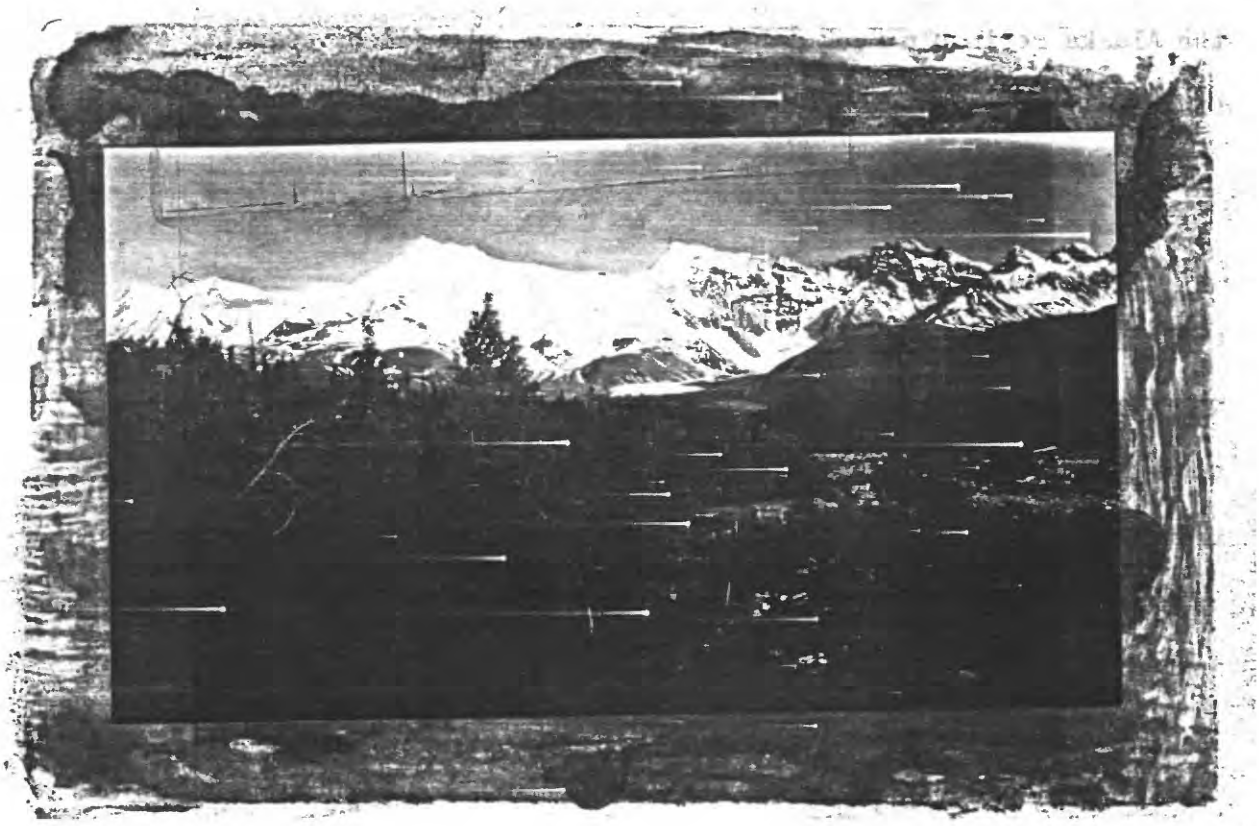

Figure 1. View of Mt. Spurr from the southeast.

Pumice.- A general term applied to ejecta of acid and intermediate magmas, which are so extremely vesiculated as to resemble froth.

Scoria.- An irregular, rough, clinker-like fragment of lava, thrown out in an explosive eruption or formed by the breaking up of the first cooled crust of a lava flow. Usually basic in composition.

The known pumice deposits in the Alaska Peninsula-Cook Inlet region are associated with volcanoes which have erupted violently, ie, Mt. Katmai, Mt. Augustine, Aniakchak and Mt. Veniaminof (see pl. 1). The limited data now available indicate that pumice occurs in potential commercial quantities in three general areas listed below in the order of their importance:

1. Katmai National Monument
2. Augustine Island
3. The Veniaminof-Aniakchak area

Katmai National Monument and vicinity

At the present time mining is not permitted within the limits of Katmai National Monument. However, a bill (H. R. 4794) introduced July 13, 1951, by E. L. Bartlett, Alaskan Delegate to Congress would authorize the Secretary of the Interior for a period of 15 years "... to permit the removal of deposits of siliceous volcanic ash, commonly known as pumicite, from such areas as he may designate along the shores of Shelikof Strait in Katmai National Monument, Alaska." In view of these circumstances the economic geologic problems relating to the pumice deposits in the Monument are included in the following discussion.

Pumice deposits in Katmai National Monument have not been studied in detail by the Geological Survey. The geology of the western portion of the monument was mapped by Smith (1923) in connection with oil investigations but no quantitative data relating to the pumice in that area is given. The information discussed below which pertains to deposits in the valley of the Katmai River is from a report by Fenner (1950). Descriptions of the material in the Amalik Bay-Kukak Bay area are from a report by the Territorial Department of Mines (Roehm, 1947).

Vast amounts of pyroclastic materials were ejected from Mt. Katmai, Novarupta Volcano and fissures in the Valley of the Ten Thousand Smokes (see pl. 2) during the violent eruptions in 1912 (Fenner, 1920, 1923, 1950; Griggs, 1922; Martin, 1913). Much of the material flowed or fell upon the area immediately surrounding the loci of ejection but a great volume of the finer material was carried by the wind for many miles to the southeast. The ashfall on central Kodiak Island, 100 or more miles to the southeast of the area of eruption, slightly exceeded an average of one foot in thickness.

Due to the relatively low density of much of the ejecta, large quantities of the material have been eroded by wind and water subsequent to their original deposition. In many instances the pumice and ash have been re-deposited at some distance from their initial source. The localities of subsequent reconcentration have been governed to a large degree by wind direction and by the orientation of the drainage with respect to the areas of original deposition. These facts should serve to delineate to some extent those areas which might be favorable for examination for possible accumulations of pumice or ash.

The extensive pumice deposits in the Valley of the Ten Thousand Smokes are relatively inaccessible to Cook Inlet. That locality has therefore been excluded from consideration in this paper.

Valley of the Katmai River

Some insight into the nature of the material originating from volcanic centers in the Monument can be gained from the descriptions of Fenner (1950, pp. 614-627) who has made detailed studies of the Katmai ashfall. Two cross-sections of the ashfall in the valley of the Katmai River showed total thicknesses of about 12 and 15 feet respectively. In general the material ranges in size from fine ash to pumice fragments four inches in diameter. Colors from pure white to black were noted and several layers contain banded pumice. The association of lapilli of basic lava and sedimentary rocks with the ash and pumice are common. Detailed descriptions of the cross-sections are given in Table 1.

The combined chemical composition of "average" pieces of pumice from the various layers of section 1 is as follows: (Fenner, 1950, p. 616).

	Combined analyses
SiO_2	69.14
Al_2O_3	14.34
Fe_2O_3	4.41
FeO	
MgO	1.68
CaO	3.88
Na_2O	3.95
K_2O	2.12
TiO_2	0.48
	100.00

Exploitation of the deposits in the valley of the Katmai River or its tributaries would presumably require the use of Katmai Bay for loading; this harbor is exposed, rocky and partly foul (U. S. Coastal Pilot, 1947, p. 272) so that navigational difficulties would undoubtedly be encountered.

Table 1

Description of cross-sections of Katmai ashfall in the Katmai River valley.

Section No. 1	Section No. 2
A-175 18 in.; pure white layer; coarse, but fine at top; many lapilli.	A. 48 in.; pure white; coarse, fine at top, many lapilli.
A-176 3½ in.; terra-cotta layer; coarse at bottom to fine at top; mostly white pumice coated buff.	B. 1½ in.; white pumice coated buff; coarse.
A-177 11 in.; coarse; buff, together with white, gray, red, striped, and nearly black pumice.	C. 16 in.; light-gray or buff as a whole, but contains white, brown, gray, and striped; coarse, but finer at top.
A-178 2 in.; very like A-177 but many pieces stained bright yellow; medium fine.	D. 5 in.; yellow or orange but color is a stain; brown, gray and white pumice.
A-179 9 in.; buff; coarse, finer at top.	E. 8 to 9 in.; light-brown. F. 2½ in.; yellow. G. 4 in.; brown. H. 2½ in.; yellow. These four are not very different from D; color a stain.
A-180 50 in.; gray, but some white and terra-cotta pieces; very coarse but finer at top.	I. 48 in.; very coarse; uniform gray except some variegated. K. 18 in.; fine gray; much like I but size of pumice is less.
A-181 in.; light-gray in general, but white pumice prevails; coarse at bottom, sand at top.	L. 21 in.; coarse gray; similar to I and K but size is greater; fine at top.
A-182 8 mm.; sand.	M. ½ in.; fine.
A-183 10 mm.; grit.	N. 2 in.; coarse.
A-184 6 mm.; fine sand.	O. ½ in.; fine, some lumps.
A-185 30 mm.; grit.	P. 5 in.; coarse, fine at top.
A-186 28 mm.; sand.	Q. 3 in.; fine.
A-187 35 mm.; red-brown to purple sand.	R. 1½ in.; lavender gray.

Geographic Harbor

Pumice has been found at two localities adjacent to Geographic Harbor, an embayment located at the northwest head of Amalik Bay (see fig. 2). On the southwest shore of the harbor an abundance of the material has accumulated at high tide level. Benches, which rise abruptly from the shoreline to an elevation of 30 to 50 feet, are also covered with pumice. The thickness averages about three feet on the bench tops and increases gradually as the bench gives way inland to steeper slopes. The pumice is very light gray to slightly brownish and is relatively free of non-vesicular impurities.

Another accumulation of pumice has formed in a long, glaciated valley northwest of Geographic Harbor. The rolling valley floor has been blanketed with ejecta, the thicker portions being found on the lee sides of small hills and in topographic depressions. The pumice is light gray in color and contains a small percentage of non-vesicular material (Rochm, 1947).

Geographic Harbor is an excellent anchorage (U. S. Coastal Pilot, 1947, p. 272) and the bench adjacent to the shoreline provides good natural loading facilities.

The only pumice production reported in the Alaska Peninsula-Cook Inlet region since 1949, was from the operation of Stock and Grove at Geographic Harbor (Report of the Commissioner of Mines from the biennium ended December 31, 1950, p. 17). The site has not been visited by Survey personnel and no additional information on the operation is available.

Takli Island

Takli Island, located at the mouth of Amalik Bay, was blanketed by pumice ejected by the Katmai eruptions. Subsequent to that time the material has been re-concentrated in topographic depressions by the wind. The largest deposits are found on the east and northeast slopes of the hills and in those valleys oriented in a north-south direction. The deposits on the lee hillsides are said to vary in thickness from 6 feet near the base to a thin veneer at the top. Accumulations in the bottoms of the valleys, while quite variable, probably do not exceed 6 feet. The percentage of non-vesicular glass in the Takli Island deposits appears to be quite high and would probably necessitate some means of benefication.

Roehm (1947, p. 7) states that there are many small bays and lagoons along the coastline of Takli Island, although no anchorage for Takli Island is listed in the U. S. Coastal Pilot (1947, p. 272).

Kinak Bay

Two localities of pumice deposition have been found in the area adjacent to Hidden Harbor, located at the head of Kinak Bay. One of the sites is in a low pass extending northeastward from the harbor. The small rolling hills and benches within the pass are mantled with light gray pumice. The other area lies northwest of the harbor, where wind action has concentrated pumice along the mountain slopes from their bases to elevations of 500 feet. Roehm (1947, p. 4) states that the deposits exceed 10 feet in thickness at lower elevations. The pumice in both areas appears to be quite similar and contains approximately 3 to 5 percent non-vesicular material.

Hidden Harbor is well protected but shallow. The pumice bottom constitutes poor holding ground.

Figure 2. View of the Amalik Bay-Kukak Bay area from the west.

At the northeast head of Kinak Bay pumice deposits up to four feet thick have accumulated in depressions in a wide valley extending in a northeast direction from the shore. The material contains numerous layers of cinders and is probably unsuitable for lightweight aggregate.

Kukak Bay

Pumice in considerable quantity has been deposited in the area at the head of Kukak Bay. A mantle of pumice covers the rolling topography of the large valley which extends westward from the head of the bay toward the Aleutian Range. Although the deposits in the valley have not been examined at close range, the areas of greater accumulation are reported to be in the hills and mountain slopes on the north side of the valley, about 2 miles inland from the head of the bay.

Streams entering the head of Kukak Bay have discharged considerable amounts of pumice which have subsequently been washed back onto the beach at high tide level. Roehm (1947, p. 10) describes one such deposit which is one-half mile long and 60 to 70 feet wide. It is 3 feet thick at one locality. The deposit consists almost entirely of high grade pumice with an average fragment size of one-fourth inch.

The Coastal Pilot (1947, p. 271) states that Kukak Bay provides an excellent harbor.

Kamishak River area

During the course of a geographic investigation of the Kamishak area, Thompson (1949. p. 463) observed that the flood plain alluvium of the Kamishak River consists of "reworked Katmai ash". No details are given as to the thickness or continuity of the deposits.

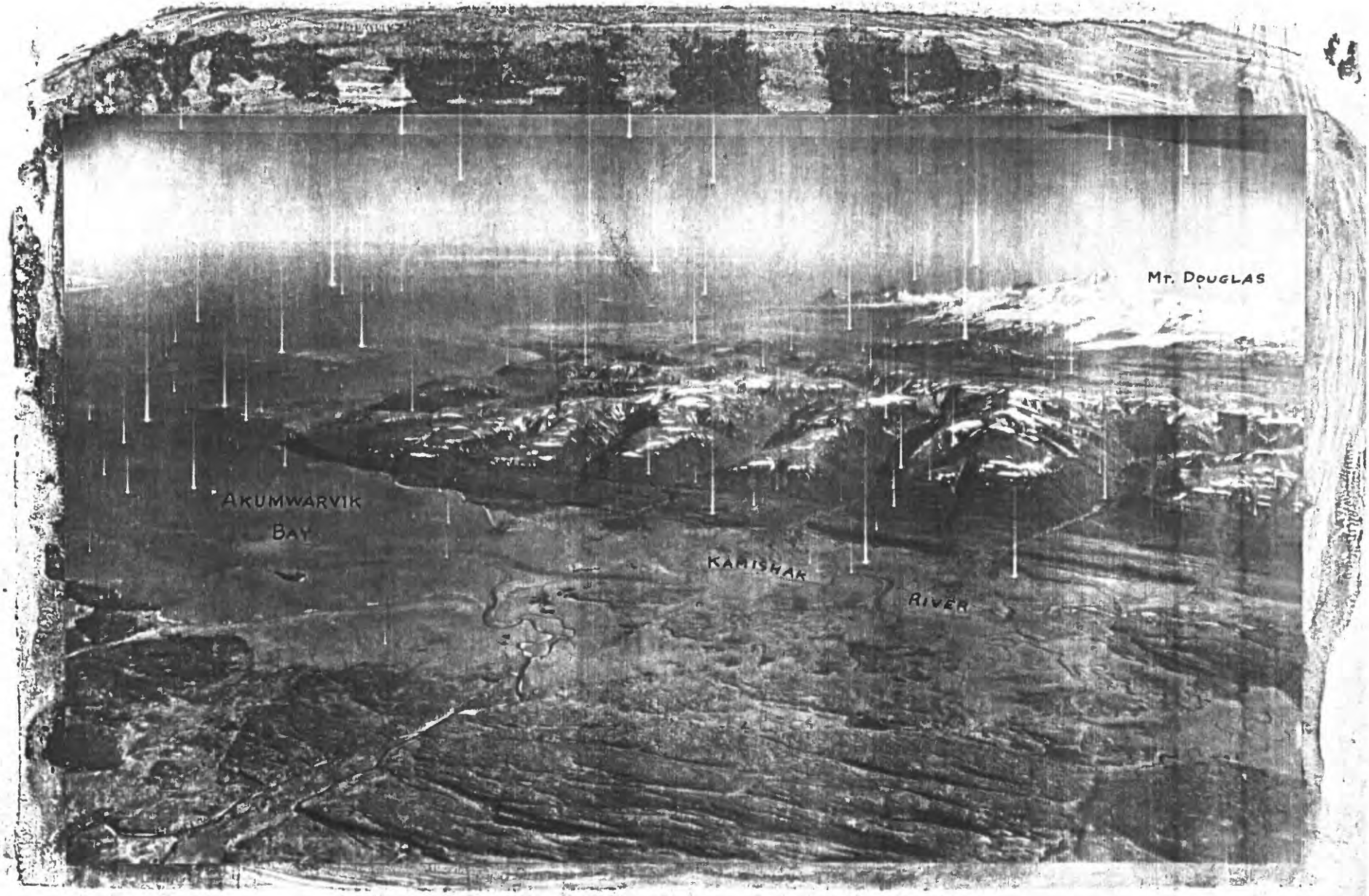

Figure 3. View of the Kamishak River area from the west.

An investigation of the Kamishak River and adjacent areas was planned by the Geological Survey in 1950 but the seaward approaches to the area were found to be unnavigable for all practical purposes. The southern shores of Kamishak Bay are bordered by reefs, and extensive offshore areas are bared at low tides, including that region at the mouth of the Douglas River. Akumwarvik Bay (see fig. 3), into which the Kamishak River flows, is filled with sand and is dry at low tide (U. S. Coastal Pilot, 1947, p. 166). It would appear that any deposits in this area probably would be considered inaccessible for exploitation.

A reconnaissance flight over the coastal area between the Douglas River and Bruin Bay was made in 1950, in an effort to ascertain whether obvious deposits of pumice existed along the coastal area in question. None of the exposed strata suggested such deposition although it is quite probable that only extensive, well-exposed deposits would be discernible from the air.

Augustine Island

Augustine Island is located in the western part of Cook Inlet about 200 miles southwest of Anchorage (see pl. 1). The island comprises a volcanic cone, Mt. Augustine, which has a diameter of seven miles at its base and rises to an elevation of 3,970 feet (see pl. 3). The upper portions of the mountain are barren but the lower parts are covered by grass, brush and a few spruce trees.

The volcanic cone is composed largely of fragmental materials with subordinate amounts of trachytic and andesitic lavas (Becker, 1898, p. 23). A large portion of the island has not been explored and data relating to deposits of pumice are confined chiefly to the material on the south and west sides of the island which has been described by Dahners (1947).

There are numerous relatively thin (up to 3 feet) deposits of pumice occupying shallow depressions in the lower parts of the island, apparently representing the remnants of a blanket deposition of ejecta. Insufficient development work has been done to determine their individual extent. Much of the material in these deposits is non-pumiceous volcanic glass which would have to be considered as an impurity insofar as a lightweight aggregate is concerned. Some means of beneficiation would probably be required to remove or substantially reduce the non-pumiceous material.

A deposit of considerably higher purity is located at an elevation of 1,250 feet, about five miles from the shallow, rocky lagoon which is used as a loading harbor (see figs. 4 and 5). At this site (see fig. 6) pumice apparently has been concentrated by the action of intermittent streams draining the upper reaches of the cone. The material is about 10 feet thick and is exposed along a gully for 300 feet. Although the lateral margins of the deposit are not exposed, Dahners estimates the deposit to have a maximum width of 50 feet.

The deposit appears to be composed largely of rounded fragments of pumice with little or no impurities.

During the period 1946-1949, the Augustine Island deposits were worked by the Alaska Katmalite Corporation. In the earlier development stages several of the relatively thin deposits found at the lower elevations were excavated and then subsequently abandoned in the search for higher grade material. In 1949 the deposit located 5 miles east of the loading harbor was being excavated. The pumice was bulldozed over a loading ramp and trucked down the side of the mountain to the harbor where it was dumped directly on barges for transport to Anchorage. The mine operated only during the summer months. No production has taken place since 1949.

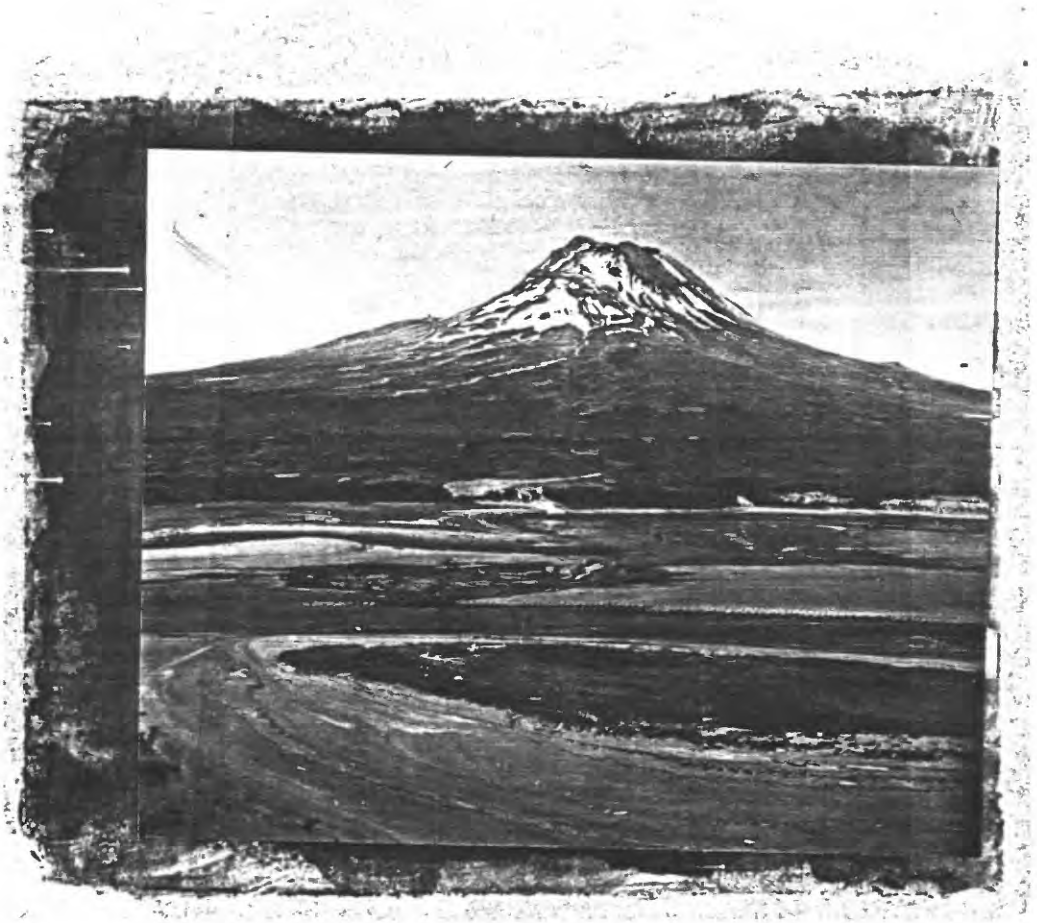

Figure 4. View of Augustine Island from the west, showing harbor and dock.

Figure 5. View of Augustine Island from the southwest, showing the location (a) of recent pumice workings and access road.

Figure 6. Recent pumice workings at Augustine Island.

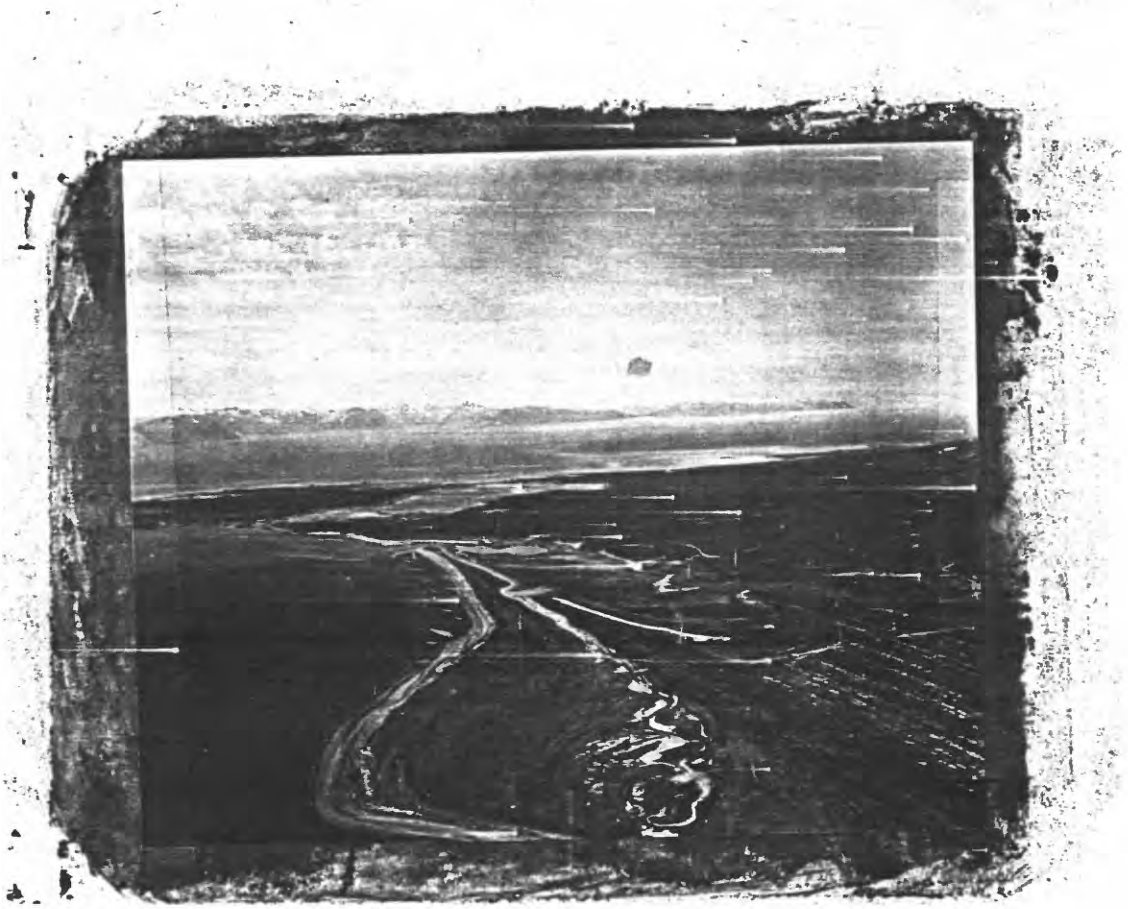

Figure 7. View of the lagoons at Augustine Island from the south.

Harbor conditions at Augustine Island are relatively poor. Only limited shelter is provided by two shallow, rocky lagoons on the west and south sides of the island (see fig. 7). Both are extremely hazardous to navigation even for shallow draft vessels (U. S. Coastal Pilot, p. 167). In addition, boulders are strewn profusely along the greater portion of the shoreline and a reef skirts the north end of the island.

The Veniaminof-Aniakchak area

The Veniaminof-Aniakchak area includes in general that portion of the Alaska Peninsula region situated between Mt. Veniaminof and Aniakchak Crater. The center of the area is located about 500 miles southwest of Anchorage (see pl. 4). This distance probably eliminates the area as far as commercial production is concerned, for the time being at least, but the amount of ejecta deposited here seems sufficient to warrant recording the status of our present knowledge of the geologic conditions.

Deposits of pyroclastic material occuring in this area have been derived from three principal sources: Mt. Veniaminof, Purple Crater and Aniakchak Crater.

Mt. Veniaminof appears to be composed chiefly of pumice, scoria and interbedded lava flows. Extensive alluvial flats north of the peak are probably composed largely of detritus eroded from this cone. A few restricted deposits of alluvium have been found in the valleys tributary to Chignik Lagoon and may possibly contain pumice but no specific references to pumice in these areas have been recorded.

Only the north and east sides of Mt. Veniaminof have been explored and consequently there is no information available on the coastal area south of the mountain which might contain pumice or other detritus eroded from the cone.

Data relating to Purple Crater are likewise very generalized and little is known as to the distribution of ejecta which may have been derived from it, although Knappen (1926, p. 204) states that it is one of the sources of fragmental material found in this area.

Aniakchak Volcano is composed of pyroclastic material, lava flows and lapilli of sedimentary rocks derived from bedrock. A great quantity of material ejected in Recent time blankets the adjacent lowlands and has been reported deposited as far south as Hook Head (see pl. 4). The ejecta is composed chiefly of ash, lapilli, and pumice. Streams draining Aniakchak Crater are continually transporting ash and pumice to the sea. All of the valleys for many miles around are filled with deposits of the ejecta but apparently the thicker deposits occur in the valleys of the streams draining the north and east sides of the crater. Smith and Baker (1922, p. 189) state that the valley of the Aniakchak River has been completely filled by ash and cinders. Some of the material transported by this river has formed bars in Aniakchak Bay but much of it has been thrown back on the beaches to form a series of deposits at high tide level.

Atwood (1911, p. 75) found two deposits of pumice during reconnaissance surveys in the Veniaminof-Aniakchak area. One forms a small knoll in the valley of Bear Creek about one mile from its mouth at Chignik Bay. The quantity of pumice is described as "considerable" and fragments up to six inches in diameter were noted. The other deposit was found about two miles from the head of Hook Bay on the mountain southwest of the harbor. The pumice is said to be associated with vast quantities of fragmental material of which the mountains are composed.

With the exception of Chignik Bay none of the shoreline identations in the Veniaminof-Aniakchak area offer completely satisfactory protection from the weather, although most of the larger bays are suitable under certain wind conditions. In general, the area between the coastline and the foothills is low and swampy, so that much of the material immediately adjacent to the volcanic centers probably could not be considered accessible for all practical purposes unless the larger streams draining these areas should be found to be navigable.

Other areas

Thin patches and beds of volcanic ash occur in many localities in the Alaska Peninsula-Cook Inlet region. In places the ash has accumulated in considerable quantity and may be of some economic importance should a demand for material of ash size develop or should the material prove to possess pozzuolanic properties.

Capps (1935, pp. 87-88) describes a 6-foot ash bed located on the southeast side of Straight Creek, a tributary which drains the east flank of Mt. Spurr. The ash is overlain by 12 to 18 inches of vegetable material and soil which in turn supports a heavy growth of spruce.

Kodiak Island received a heavy ashfall resulting from the Katmai eruptions of 1912. Drifts of ash which appear to be about 10 feet in thickness were photographed by Martin in 1912 (1913) although the average thickness of the ashfall was little more than one foot in the central part of the island. Some of the thicker drifts, if preserved from erosion, might be of local economic value.

Recent petroleum investigations have been made by the Geological Survey in the Chinitna Bay-Tuxedni Bay area. In connection with these surveys, the south, east and north flanks of Mt. Iliamna and the adjacent lowlands were visited. No pumice or appreciable quantities of volcanic ash were noted during the course of this work.

The reported occurrence of two pumice deposits in the vicinity of Bruin Bay was investigated in 1950, but only a few scattered fragments were found at high tide level on the beach.

During the 1951 field season an aerial reconnaissance was made along the west coast of Cook Inlet between its headwaters and Iliamna Bay to determine whether any obvious deposits of pumice existed in this area. Five miles inland from Harriet Point (due east of Mt. Redoubt) an outcrop suggestive of pumice was observed. Subsequent to the flight, Survey geologists working in the vicinity (Grantz, personal communication, 1951) reported finding no pumice in the alluvium of streams whose headwaters drain the area in question. Trappers living in the vicinity of Harriet Point also reported seeing no pumice in the area adjacent to Mt. Redoubt.

CONCLUSIONS

From the information now available it appears that the pumice deposits in the Amalik Bay-Kukak Bay area of Katmai National Monument offer certain geologic and, perhaps of greater importance, geographic advantages over the Augustine Island and the Veniaminof-Aniakchak areas. The quantity of material present is probably substantially greater than elsewhere and the quality appears to be suitable for commercial use. The accessibility of the pumice deposits to navigable, sheltered harbors is a most desirable feature not known elsewhere in the region.

Our present knowledge of the extent of pumice deposition on Augustine Island is quite sketchy. Although numerous pits have been excavated in the lower parts of the southwest side of Augustine Island, it is doubtful that any systematic scheme of prospecting has been carried out. It is also probable that the more remote parts of the island, both in elevation and distance from the lagoon, have not been adequately examined. If additional substantial deposits should be found however, the successful exploitation may well hinge upon whether or not the lagoon can be made safe for navigation.

The Veniaminof-Aniakchak area is approximately 500 miles from Anchorage; unless there is an unusual demand for pumice this distance probably would have to be considered prohibitive. However, if the examination of deposits in this area should prove desirable in the future, several localities would warrant investigation. These would include the deposits on Bear Creek and the Aniakchak River and near Hook Head. In each instance limited shelter would probably be available for loading facilities at the adjacent coastline. Examination of the beach deposits in the vicinity of the mouth of the Aniakchak River would also be worthwhile.

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Duplicating Section, Department of the Interior, Washington 25, D. C. 11844

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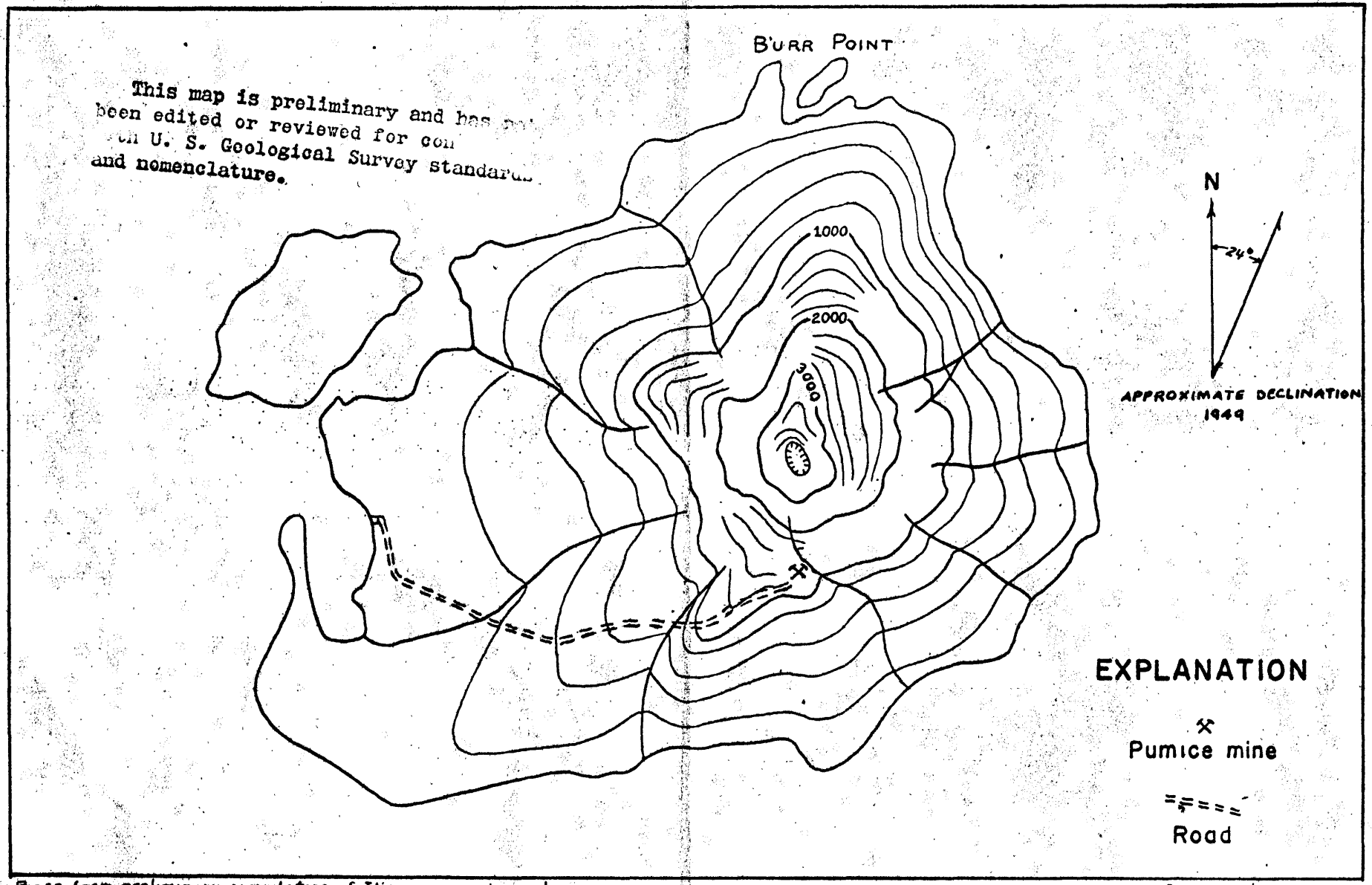
PLATE 3



This map is preliminary and has not been edited or reviewed for conformity with U. S. Geological Survey standards and nomenclature.

Base from preliminary compilation of Iliamna quadrangle

R.M. Moxham, 1951

MAP OF AUGUSTINE ISLAND

1 0 1 2 3 4 Miles

C.I. 200 Ft.

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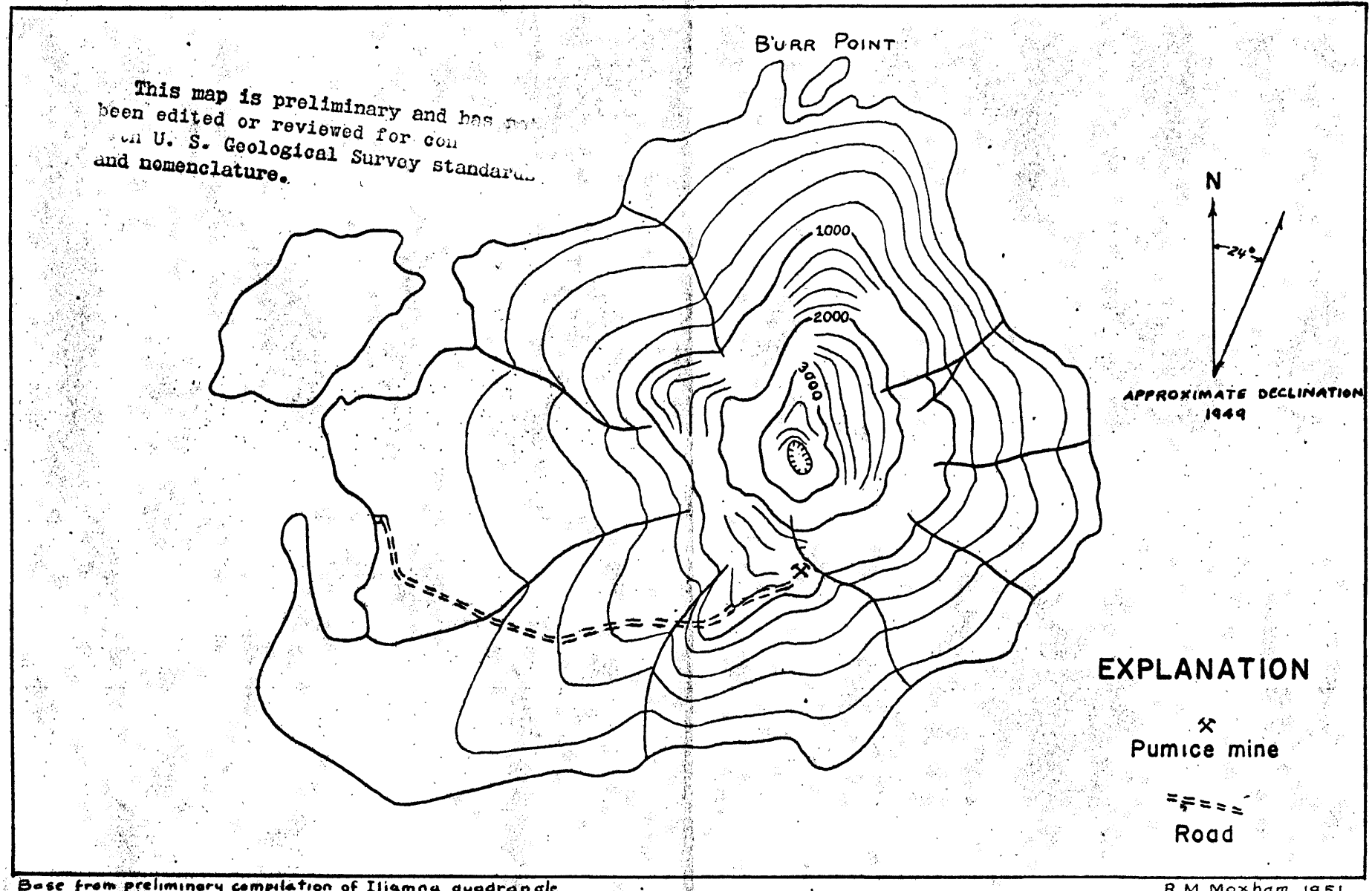

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MAP OF AUGUSTINE ISLAND

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