GLADNEY & ADAMS

GEOLOGY OF THE GLADNEY AND ADAMS SAND AND GRAVEL PLANT, KLAMATH FALLS *

Klamath County

Location: T. 36 S., R. 7½E., sec. 32 on the southwest side of Howard Bay, upper Klamath Lake. Twenty-one miles north and west of Klamath Falls on the Lake-o-the Woods Forest Service road.

General: The source of the material of this deposit is the mountains to the southwest. The peaks of Mt. Harriman, Mt. Carmine, Aspen Butte, and Greylock Mountain at one time were most likely parts of a single volcanic cone of the shield or Icelandic type. At the time of its maximum size this cone must have been approximately 11 miles long by 7 miles wide and risen above the plateau at least 2500 feet. Little Aspen Butte, High Knob, and Crater Mountain are probably parasitic cones of this shield which apparently, by the degree of dissection on their flanks, were not active until the parent cone had undergone considerable erosion.

The deposit was formed by streams depositing their load along the outer margin of this mountain. The distance which the streams could carry their load was restricted by the shore of Howard Bay. Consequently all the material derived from the mountain by erosion (except the most minute particles and that which went into solution) was concentrated between the lake shore and the steeper slopes - a distance of three to four miles. That the amount deposited is considerable is shown by the test pits of the gravel plant, a well, and the gravel mantle around the base of the present mountains. Test pits were dug on 300 ft. centers throughout the area leased by this company. They were all dug to a depth of 24 feet and all bottomed in gravel. A well just beyond the southern border of the leased area is reported to have been drilled to 90 feet and was still in

* See note at end of report.

gravel. A reconnaissance along the road 3 miles to the north, 2½ miles to the south, and up the trail for 3 miles to the southwest (to an elevation of 4500 feet) showed rounded gravel blanketing the area.

<u>Petrology</u>: The materials of the deposit range in size from clay particles to boulders. The clay and silt, of which there is little, are separated by washing. Of the remainder, separation by the plant has shown that approximately ____% is sand size, ____% is pebble size, and ____% is of boulder size. The sand has some mineral grains and is generally quite angular. The pebble to boulder sizes usually show rounding from sub-rounded to sub-angular. From the distance the material has been carried one would expect very little rounding, but even on the upper slopes of the mountains the freshly weathered material shows a tendency towards rounded edges. It is believed that the inherent characteristics of the rock are such as to invite rounding. Logs of the test pits were not available and as the water level was within a few feet of the surface no sections were observed. It was reported, however, that soil never occurred lower than three feet from the surface and that all sizes of material were encountered, intermixed, at all depths, i.e. there was little evidence of sorting. The one exception to this was a large lense of sand found at a depth of 15' in one of the pits. This lack of sorting within the deposit indicates little reworking of the material by wave action. Flat subrounded pebbles are frequent and were probably developed from platy lava. The largest boulder seen was nearly 2' in diameter. Usually the boulders of this size are quite vesicular and probably are basaltic in composition. According to Williams the culminating flows of many volcanoes of this region were quite gaseous and were mainly basalt. So these larger boulders probably represent erosion very near the summit. The fact that vesicular rocks are a very minor portion of the deposit lends strength to this belief.

A petrographic report on the aggregate made by the State Department of Geology and Mineral Industries laboratory in Portland, Dr. W. D. Lowry, petrographer, is as follows:

Notes on aggregate from sec. 32, T. 36 S., R. 7½E., near Klamath Falls, Oregon. Samples collected by Hollis M. Dole, April 1947. Examined by W. D. Lowry, April 1947.

Sample HG-75 (P-5887) - sand fraction

Minerals and rock particles identified:

1.	Opal (sponge spicule) - - -	uncommon
2.	Hypersthene, 0.5± mm - - -	common
3.	Plagioclase, probably basic andesine or acid labradorite -	common
4.	Volcanic glass, brown, n slightly > 1.53 -	fairly common
5.	Augite - - -	" "
6.	Basic lava grains - - - -	common

a. Matrix has intersertal texture with plagioclase laths and pyroxene (augite)? prisms.

b. The smaller grains, for the most part, crush easily. The larger grains have a higher percentage of strong grains. Whether this is the result of their greater dimensions primarily is not known.

Remarks: This sand appears to have a relatively high percentage of structurally weak grains. The mineral grains are strong.

Sample HG-76 (P-5888) - consisted of 8 pebbles - 1 angular, 6 subangular, and 1 subrounded.

Composition: Gray basic andesites, mainly porphyritic but included one dense and one slightly vesicular andesite. Plagioclase (n > 1.55) is present as phenocrysts in all but the dense rock and hypersthene occurs as phenocrysts in several of them.

Remarks: All except the angular pebble were hard to break with a hammer.

Sample HG-77 (P-5889) - consisted of 19 rock fragments

Composition: All are gray basic andesites. Two are gray highly vesicular porphyritic (plagioclase phenocrysts) basic andesites. Seven are gray vesicular porphyritic basic andesites. Of them, two have phenocrysts of hypersthene and all have plagioclase ($n > 1.55$) phenocrysts. Three are dense gray basic andesites with an intersertal texture characterized by plagioclase laths and pyroxene prisms. The remaining seven are gray porphyritic basic andesites characterized by plagioclase phenocrysts. Several of them have, in addition, hypersthene phenocrysts.

Remarks: The nonvesicular varieties are fairly strong. Apparently the weakness of the highly vesicular varieties accounts for their absence in the smaller sizes.

Sample HG-78 (P-5890) - sand fraction

Minerals and rocks identified:

1. Hypersthene, $0.6 \leq$ mm - - - common
2. Plagioclase ($n > / < 1.55$), $0.55 \leq$ mm - - - common
3. Basic lava fragments - - - common
   a. Porphyritic with intersertal texture.
   b. Plagioclase, $n > 1.55$.

Remarks: The smaller grains of basic lava crush rather easily for the most part. The mineral grains are sound.

Comments on aggregate in general:

This aggregate because of its high percentage of basic andesite components should be used with a low-alkali cement. The sand fraction is likely to be the cause of weakness if test blocks of concrete made with it do not meet specifications. It would appear that the coarser fractions such as represented by samples HG-76 and HG-77 would be satisfactory. Whether or not the coarser fragments can be crushed to form a satisfactory fine aggregate is problematic. The intersertal texture of these basic andesites casts serious doubt on this possibility.

Origin: At the present time a negligible amount of material is being carried off the mountain. Undoubtedly the bulk of the deposit was laid down during the Pleistocene period. Glacial action has gouged deeply into the sides of the cone, carving its once smooth slopes into a series of peaks and valleys. There is topographic evidence of at least seven glacial cirques. On the south and east sides of Mt. Mazama Williams (1, pg. 125) states that "some (glaciers) must have . . . . . . ended at elevations as low as 4500 feet." On this cone it is unlikely that the glaciers extended this low. At no place do the topographic maps show evidence of U shaped valleys below 5600 feet. Nevertheless glaciers were undoubtedly large enough and endured over long enough periods to excavate ample material to keep their streams filled to capacity. And, during periods of recession when the streams became torrents any excess material that might have piled up would be available for washing down the slopes. From the cirques to the shores of Howard Bay is approximately 6 miles with a difference in elevation of around 2300 feet. In the first 2½ miles from the cirques the drop is approximately 1400 feet. So it is obvious there was sufficient gradient, water, and available material to form a gravel deposit of large size at the shores of the lake.

According to Williams (1, pg. 17) the plateau on which the volcanoes in this area rest is composed chiefly of olivine basalt and olivine-bearing basic andesites. He assigns a Pliocene age to these rocks. By comparing this volcanoe to Mount Bailey and Mount Thielsen (similar volcanoes of approximately the same size and elevation) it is evident that it lies somewhere between the two in the amount of dissection. Williams (1, pg. 19) says "probably the main activity (of Mt. Bailey and Thielsen) ceased early in the Pleistocene period, while Mt. Mazama was still in its infancy." On these correlations then it would probably be correct to say that the bulk of the rock of this deposit was derived from a Plio-Pleistocene shield volcanoe resting on Pliocene lavas -- both of the High Cascade (2, pg. 243) series.

Upper Klamath Lake occupies a portion of the Klamath Graben. Moore (3, pg. 40) in speaking of the faulting in the Klamath region says: "...The faulting was... later than the development of the main part of the Cascade Range and probably no older than uppermost Pliocene, and the extreme freshness of some of the scarps, particularly those near Algoma, would indicate a Pleistocene or even Recent age." It is not unlikely to believe, then, that subsidence of Howard Bay was taking place at the same time that filling was going on. This, along with the protected position of the bay from strong winds, might account for the lack of beach ridges or other shore features being observed.

Report by H. M. Dole, June (?) 1947.

__Note__: This report was written as the result of a request inspection by Mr. Adams. This firm was to furnish all data on ownership, flow-sheet of plant, give map of area, costs, etc. Repeated letters and phone calls from Grants Pass met with promises but no information. As Dole was transferred to Portland before being able to revisit Klamath Falls he was unable to complete this report. Therefore, it is being filed under "confidential" and "geologic reconnaissance".

THERE IS NOTHING OF A CONFIDENTIAL NATURE CONTAINED IN THIS PARTIAL UNCOMPLETED REPORT.

__Bibliography__:

1. Williams, Howel, The geology of Crater Lake National Park, Oregon: Carnegie Institution of Wash. Publ. 540, Wash., D. C., 1942.
2. Callaghan, Eugene, Some features of the volcanic sequence in the Cascade Range in Oregon: Am. Geophys. Union Trans., 14th Ann. Meeting, 1933.
3. Moore, Bernard N., Nonmetallic mineral resources of eastern Oregon: U. S. Geol. Survey Bull. 875, 1937, Washington 25, D. C.