GEOLOGY AND MINERAL RESOURCES OF WASCO COUNTY

Geology

Fifty million years is about as far back as the geologist can go in reading the history of Wasco County. In those times (the Eocene epoch) there was no Cascade Range. An arm of the ocean spread across western Oregon as far east as the present Cascade Range, and central Oregon was a low undulating land across which streams ran westward to the sea. Volcanoes were numerous and constantly showered pumice and ash on the land, or poured out sheets of lava, mainly the light-colored rhyolite. It is within these rhyolites that the Wasco County perlite, a glassy variety of rhyolite, occurs. Here, also, the so-called "thunder eggs" formed in the viscous lava.

These volcanic materials, plus sands and gravels deposited in lakes and stream beds, gradually built up during Eocene time over 3,000 feet of material which geologists have named the Clarno formation.

Life in Eocene time was quite different from today, and the climate was semi-tropical like that of Central America. Few fossil bones have been found in the Clarno formation, but fossil plant remains are abundantly preserved in the volcanic ash - plants such as avocadoes, figs, persimmons, and palms that grew in the low glades, and redwood forests of the higher regions.

At the close of the Eocene epoch, stresses in the earth's crust caused the Clarno beds in Wasco County to buckle up into northwest-trending mountain ranges which were later faulted and displaced. The streams which coursed down these mountain folds and fault escarpments eroded the rocks from the higher levels and deposited them in the lower levels until the country became a rolling plain on which occasional volcanic cones erupted.

This was the beginning of the Oligocene epoch, and it was during this time (some 40 million years ago) that the famous John Day beds, the most colorful and fossiliferous of central Oregon, were deposited. The John Day beds were mainly composed of ash that erupted from local volcanoes and accumulated in places as much as 2,000 feet in thickness on the folded and eroded Clarno formation.

The Cascade Range in Oligocene time was not high enough to act as a climatic barrier. So Wasco County's climate was still mild and humid, and vegetation was similar to that of the Eocene.

Fossil bones of many types of Oligocene animals, including giant pigs, small three-toed horses, and diminutive camels are found in the John Day beds.

Conditions which prevailed in Wasco County during the Oligocene epoch continued into early Miocene times. But in middle Miocene, 20 million years ago, volcanic activity reached such proportions that the whole of north-central Oregon and most of eastern Washington were blanketed by sheets of basaltic lava which welled out of many fissures and, in flow upon flow, attained a thickness of from 2,000 to 5,000 feet. It covered all of the Clarno and John Day formations of Wasco County and formed a seemingly endless and uninhabited plain of black lava which is now called the Columbia River basalt formation.

Late in Miocene times the Columbia River basalt and the older formations beneath it were folded into long northeast-trending folds. The cross-sections of some of these anticlines and synclines can be seen in the present day gorge walls of the Columbia River between Hood River and The Dalles.

Soil gradually formed on the Columbia River lava surface, and the climate, still warm and humid, again supported redwood forests and many types of animal life.

At the close of the Miocene, the entire Cascade Range was upwarped and tilted to such height that it became a climatic barrier between central and western Oregon. Wasco County was now cut off from the moist oceanic winds. Redwoods and climatically associated vegetation disappeared. Streams, such as the ancestral Columbia River, which had flowed sluggishly across the basalt plain, were rejuvenated by the uplift of the land and the resulting increase in their gradients caused them to begin to carve canyons in the Columbia River basalt. When these streams had eroded to the depth of the soft John Day beds beneath the lava, the hard protective armor of basalt was undermined and readily broke away from the cliffs, and thus the older formations were again exposed, as in the Mutton Mountains, which lie in the northeastern part of the Warm Springs Indian Reservation, and along the Antelope escarpment in the southeastern corner of Wasco County.

The Pliocene age which followed the Miocene, some 10 million years ago, was again a time of intense volcanism in Oregon. Great shield-like volcanoes formed along the eastern margin of the old Cascades, beginning as quiet effusions of olivine basalt and andesite, and later becoming explosive with many small cinder cones forming on the flanks of the larger volcanoes. In Wasco County, on the plains at the foot of this new Cascade Range, heterogeneous deposits were laid down in local depressions on top of the Columbia River basalt formation. This material, called The Dalles formation, is composed of sand and gravel, ash, pumice, mud flows, and lavas. Part of this deposit was derived directly from the volcanoes and part of it was reworked and carried by torrential streams which ran down the steep sides of the mountains and spread their loads out on the plains below.

Before the end of the Pliocene time, the Cascade volcanoes erupted great quantities of andesitic lava that flowed down over the foothills of the Cascades and covered part of The Dalles formation.

The cool dry climate of Pliocene time east of the Cascade Range barrier resulted in widespread grass lands on the plains where grased herds of animals such as antelopes, camels, and horses.

A general cooling-off of the climate of North America about a million years ago brought about the Ice Age of Pleistocene time. During this age, large volcanic cones, such as Mt. Hood and Mt. Jefferson, were constructed along the High Cascades. These composite cones were built partly by quiet eruptions of lava and partly by explosions of fragmental material.

Snow accumulated in depressions on these high volcanoes, and numerous glaciers moved radially down the flanks of the cones. The materials which the glaciers eroded were carried by the ice rivers down to lower levels and deposited, when the ice melted, as moraines and outwash gravels on the valley floors.

Since the close of the Ice Age and beginning of Recent time, about 20,000 years ago, volcanism has continued but at a diminishing rate. During the past few thousand years a number of small cinder cones have erupted in the Cascades and in central Oregon, some so recently as to have been witnessed by Indians before the coming of white man to Oregon.

Mineral Resources

Although the mineral industry of Wasco County is not extensive, it is responsible for the establishing of the most recent town in the State. Fittingly, the product produced by the workers of this new community is a newcomer to the nonmetallic field. The town is Frieda and it is located on

the Deschutes River approximately 9 miles south of Maupin at Frieda siding on the Oregon Trunk Railroad. The new product is a light-weight rock formed by the expansion, by heating, of a certain type of volcanic glass. The finished product is marketed under the name of Dantore. It is produced by the Dantore Division of Dant & Russell, Inc. Dantore is finding increasing use as a light-weight aggregate for plaster, concrete, and a multitude of other uses where light weight and insulating and acoustic properties are of value. A recent addition to the site at Frieda is a plant that uses Dantore in the manufacture of acoustical tile.

The raw material of Dantore is called perlite. This is the name given to certain types of glassy rocks with numerous concentric cracks whose broken-out fragments bear a fancied resemblance to pearls. Chemically, perlite is quite similar to rhyolite - a light-colored lava that contains free quartz. Perlite has a higher water content, however, and has cooled more rapidly so that its texture is glassy - i.e., obsidian-like.

In regard to the origin of the deposit at Frieda, J.E. Allen, formerly a geologist with the Oregon Department of Geology and Mineral Industries, states in the Department's Short Paper No. 16 that ". . . the presence of perlite masses within the bedded tuff, the apparent 'pillow structure' in the base of the perlite breccias, the repetition of water-laid tuffs below and above the perlite layers, and the degree of silicification and alteration of the breccias and portions of the perlites, suggest that the (volcanic) extrusions (to form the perlite) may have occurred beneath lakes of considerable depth; were, in fact, sub-lacustrine in nature. The extensive brecciation and silicification may have in part resulted from the interaction between the hot lava and the surrounding waters. The actual vent from which the

perlite came seems to be represented by the rhyolite plug just north of the mine portal, and the excessive thickness of the perlite at this point is due to the proximity of the vent.

"In the same area there are numerous thin rhyolite flows with composition similar to perlite, which cooled slowly enough to crystallize. If lakes were present at the time of their extrusion, they might have been cooled rapidly enough to form perlites."

A mineral product that receives little attention as such is sand and gravel. The U. S. Bureau of Mines estimated the value of Oregon's sand and gravel production in 1948 to be over 10½ million dollars. Wasco County had three consistent contributors to this total in The Dalles area. At the present time, road and building construction is at an all time high and it is anticipated that local sand and gravel deposits will play an important part in the future development of this county.

In the past, sandstone from a quarry in the southeastern section of The Dalles has been used for fireplaces, foundations, steps and trim. Although there is no production from this quarry at present, it is quite possible that it will be used at some time in the future. Technically, the material of this deposit is a tuffaceous sandstone as it contains some explosive volcanic debris. The sandstone beds accumulated as the result of stream deposition during late Miocene or early Pliocene time, about 10 to 15 million years ago.

A potential mineral product of Wasco County is volcanic tuff. Some materials of this type are well consolidated, have pleasing colors and varicolored patterns. Their use as a building and decorative stone is being investigated by the State Department of Geology and Mineral Industries. This Department has inspected a deposit in the southeastern part of the county

about 5 miles south of Pine Grove. The tuff of this deposit is gray and has wavy lines and bands of tan, the result of staining by iron oxides.

The present and future demands of industry for products utilizing nonmetallic minerals make it difficult to evaluate or predict the mineral wealth of any area. For instance, the mineral production of Oregon in 1938 according to the U. S. Bureau of Mines was about 7½ million dollars, of which 4¼ million dollars was the value of nonmetallic minerals. In 1948 the total mineral production was nearly 25 million dollars and nonmetallic production contributed over 24 million dollars. In 1940 Wasco County's major contribution to the State's mineral production was from sand and gravel. In 1950 Wasco County had one of the nation's largest perlite operations and the only plant in the West that was producing acoustical tile from perlite. Neither the nearly 600 percent increase in Oregon's mineral production nor the establishment of the perlite mine and plant at Frieda could have been predicted ten years ago. New developments in the mineral industry and the areas of the State that will benefit from them depend upon, among other things, research and a good knowledge of the geology of the State.