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COVER PHOTO

Chevron folds in Roseburg Formation exposed in roadcut on east bank of Umpqua River immediately east of Woodruff Mountain in southwestern Oregon (see article beginning next page). These folds may be associated with a branch of the Bonanza fault. Photo courtesy Ewart Baldwin.

Micropaleontological data from five oil and gas wells released

The Oregon Department of Geology and Mineral Industries (DOGAMI) has released micropaleontological data on samples from five oil and gas test holes drilled along the west side of the Willamette Valley as Open-File Report 0-80-1, *Micropaleontological Study of Five Wells, Western Willamette Valley, Oregon.* The work was performed by Daniel R. McKeel, Consulting Micropaleontologist, under contract to DOGAMI.

The five wells selected for micropaleontological study, located between Forest Grove to the north and Albany to the south, are Texaco Cooper Mountain 1, Reichhold Merrill 1, Reichhold Finn 1, Reserve Bruer 1, and Humble Miller 1. Geologic ages (foraminiferal stages) have been assigned by McKeel to rock units penetrated in the wells. Paleoenvironments are also indicated. Results of the micropaleontological work will be useful for future geologic investigations of the area and western Oregon.

Copies of Open-File Report 0-80-1 may be purchased for $2.00. Address orders to the Oregon Department of Geology and Mineral Industries, 1069 State Office Building, Portland, OR 97201. Payment must accompany orders of less than $20.00. □

CONTENTS

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Deposition and deformation of the Eocene Umpqua Group, Sutherlin area, southwestern Oregon

by R.K. Perttu, Bear Creek Mining Company, Spokane, Washington 99213, and
G.T. Benson, Earth Sciences Department, Portland State University, Portland, Oregon 97207

ABSTRACT

The lower to middle Eocene Umpqua Group, 5,000-10,000 m (16,500-33,000 ft) thick, exposed north of Roseburg, Oregon, consists of basal tholeiitic basalt overlain by a thick turbidite sequence and succeeding interbedded siltstone, sandstone, and conglomerate, all involved in northeast-trending folds with local, intensely deformed zones. In contrast, the middle Eocene Tyee Formation, mainly thick-bedded sandstone, of the Coast Range to the west and the upper Eocene and younger andesitic volcanic rocks of the Cascade Range to the east are only slightly deformed around generally north-trending axes. Lithology and current directions suggest contemporaneity of deposition and development of the Umpqua Group structures in the Roseburg-Sutherlin area. Here the Umpqua Group represents the slope development of an accreting continental margin followed by shelf deposits of the Tyee Formation.

INTRODUCTION

Marine sedimentary and basaltic volcanic rocks of the lower to middle Eocene Roseburg and Lookingglass Formations crop out in a broad, north-trending belt north of Roseburg, Oregon (Figure 1). This belt is bounded on the west and north by the slightly younger middle Eocene Flournoy and Tyee Formations which form most of the southern Oregon Coast Range, on the east by upper Eocene and younger andesitic volcanic and associated rocks of the western Cascade Range, and on the south by pre-Tertiary rocks of the northern Klamath Mountains. Structures in the Roseburg Formation are large, northeast-trending, faulted folds that parallel the pre-Tertiary grain in the northernmost Klamath Mountains. These Roseburg Formation structures are quite different from the open, north-trending flexures in the slightly younger Eocene formations of the Coast and Cascade Ranges. Sedimentary structures and facies distribution suggest that deformation of the Umpqua Group was necessarily almost contemporaneous with its deposition, and the two processes must have been interrelated. Furthermore, the changes in lithology and structural trends from the Roseburg Formation to younger units suggest a transition from an active continental slope to a more stable shelf environment.

STRATIGRAPHY

The pre-Tertiary units of the Klamath Mountains crop out south of the Sutherlin area and may partially underlie it. These Klamath Mountains units include Jurassic and Cretaceous graywacke, conglomerate, mudstone, and volcanic rocks, which are generally sheared and/or metamorphosed, with local pods of chert and blueschist and bodies of serpentinite (Ramp, 1972), all with a strong, northeast-trending structural grain. Successively younger units in the Sutherlin area are the Roseburg, Lookingglass, and Flournoy Formations (Umpqua Group); the Tyee Formation; and the volcanogenic rocks of the Western Cascade suite.

Umpqua Group

The Umpqua Formation was defined by Diller (1898) as a thick Eocene sequence consisting predominantly of thin-bedded alternating sandstone and shale overlying and interfingering with volcanic rocks. Baldwin (1965, 1974, 1975) subdivided the Umpqua into the Roseburg, Lookingglass, and Flournoy Formations, permitting elevation of the Umpqua to group status (Thoms, 1975). Baldwin (1974) included the volcanic rocks in the Roseburg Formation but distinguished them on his map; Thoms (1975) referred them to the "Siletz River Formation." We have chosen to call these volcanic rocks Roseburg basalt, following Baldwin.

Roseburg basalt: Basaltic volcanic rocks, mainly pillow lavas and zeolitized breccia with an aggregate thickness of up to 2,000 m (6,600 ft) or more, form the basal unit of the Umpqua Group in the Roseburg area (Baldwin, 1974). The volcanic rocks interfinger with and are overlain by Umpqua Group sedimentary rocks (including units younger than the Roseburg Formation) in cores of structural highs as far north as Drain (Figure 2). The Roseburg basalt is tholeiitic, similar to the lower part of the Siletz River Volcanics of early to middle Eocene age in the northern Oregon Coast Range (Snavely and others, 1968). The basalt is not everywhere present at the base of the Umpqua Group (Figure 1).

Roseburg Formation: The lower sedimentary unit of the Umpqua Group, the Roseburg Formation, includes sandstone, siltstone, mudstone, and minor conglomerate. In the Sutherlin area, the Roseburg sedimentary section is at least 2,500 m (8,000 ft) thick and consists predominantly of rhythmically alternating graywacke and mudstone beds. Most of the sandstone beds were deposited by turbidity currents. Graded bedding is common, with some beds containing more than one grading unit, and scour structures and bioturbation are evident. Conglomerate occurs mainly near the Roseburg basalt, which was the primary source of the clasts. In general, the ratio of sandstone to siltstone in the Roseburg Formation decreases northward, away from the presumed source area.

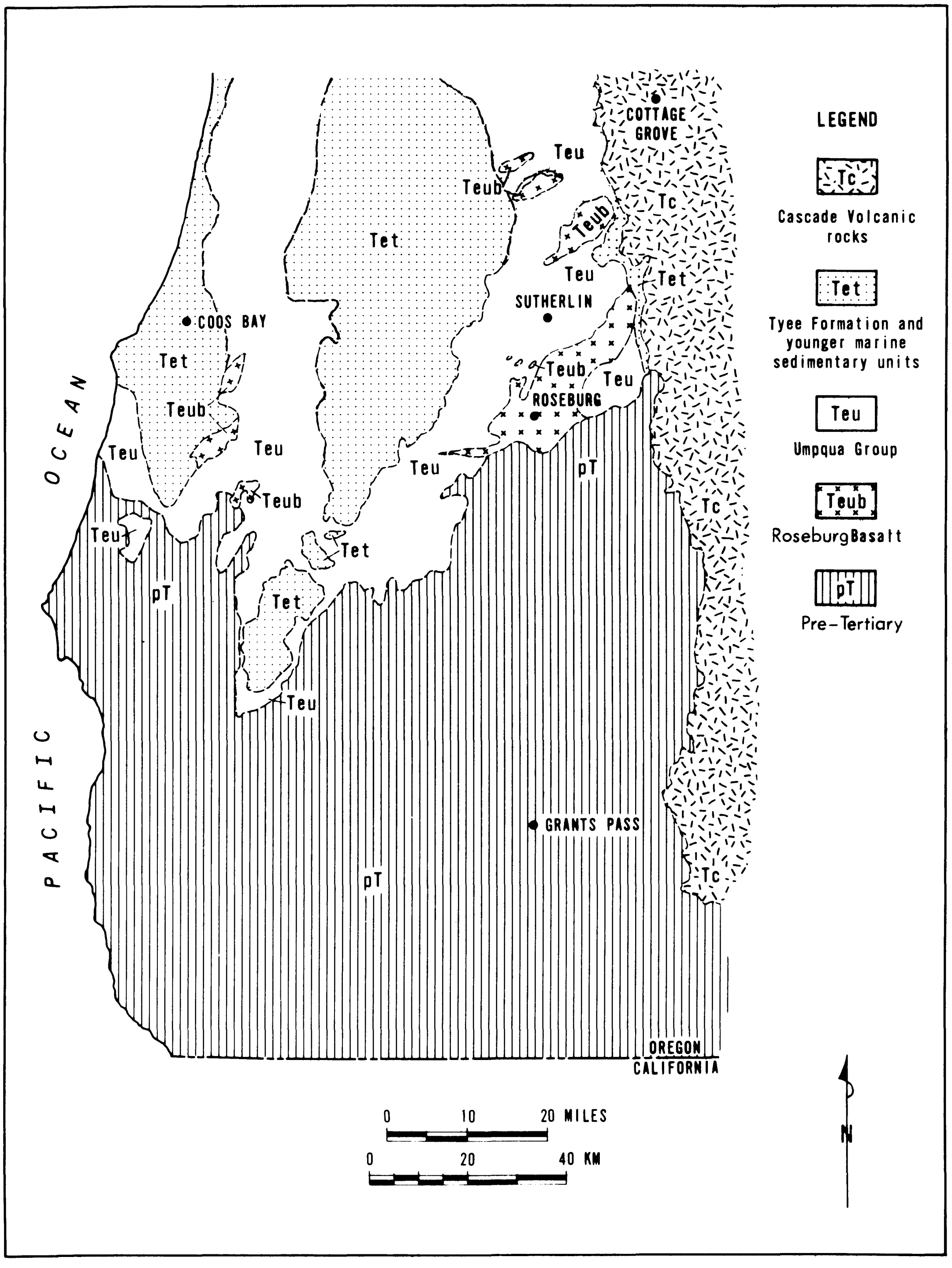


Figure 1. Regional geologic map of southwestern Oregon showing Umpqua Group and adjacent major rock units (modified from Wells and Peck, 1961, and Baldwin, 1976).

Lookingglass Formation: In its type area, southwest of Roseburg, Baldwin (1974) has subdivided the Lookingglass Formation into three members: basal conglomerate and sandstone, middle siltstone and sandstone, and upper sandstone and conglomerate. Further south, where the Lookingglass oversteps the pre-Tertiary, the middle unit becomes coarser; locally, it pinches out and interfingers with the upper and lower members. To the north, the Lookingglass, like the Roseburg, becomes finer grained, and the basal Lookingglass conglomerate is only locally present, as at Woodruff Mountain (Figure 2).

Clasts in the Lookingglass conglomerate include a variety of plutonic and metamorphic rock types apparently derived from Klamath Mountains terranes, in contrast to the predominant basalt pebbles in the Roseburg

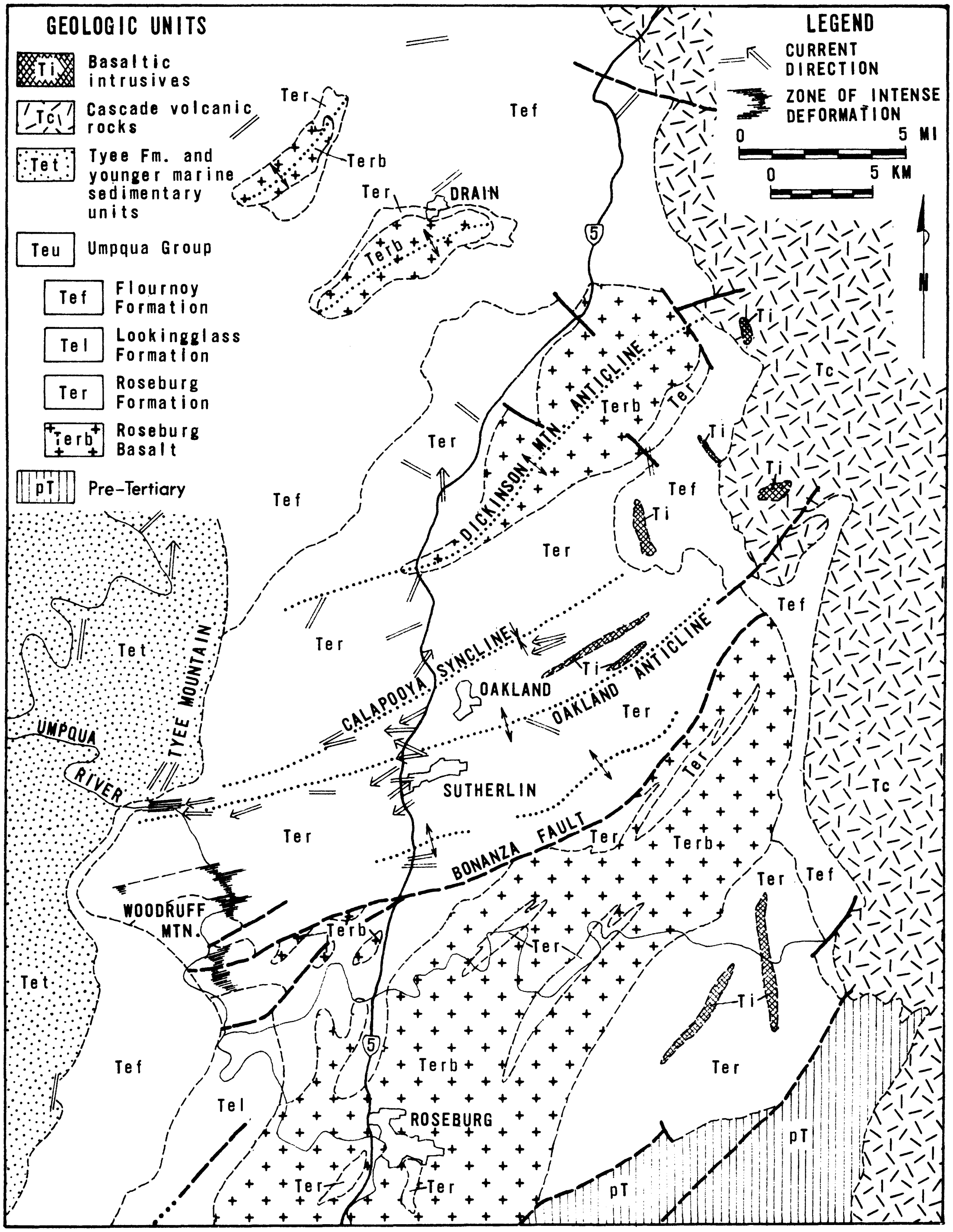


Figure 2. Regional geologic map of the Sutherlin area, Oregon (modified from Ramp, 1972, and Baldwin, 1974).

conglomerate. Lookingglass sandstone beds are generally not graded and, especially to the south, are characterized by fossil assemblages (Baldwin, 1975) suggestive of a shallower depositional environment. The Lookingglass conglomerate at Woodruff Mountain may represent a channel filling on the continental shelf or upper slope.

As a rule, lithology is more consistent in the Lookingglass Formation than it is in the Roseburg Formation; deformation is less intense, with decreasing deformation upward in the formation, and dips are gentler. A regional difference in attitudes has been shown by Girard (1962). Local steep dips in the lower part of the Lookingglass Formation probably mark the dying phases of the Roseburg-style deformation.

Flournoy Formation: West of Roseburg, the Flournoy Formation is about 900 m (3,000 ft) thick and includes a lower unit composed of sandstone and lesser siltstone and an upper unit composed of alternating beds of sandstone and siltstone (Baldwin, 1974). To the south, the Flournoy sandstone becomes coarser grained, thicker, and lithologically very similar to the overlying Tyee Formation. To the north, the Flournoy Formation is finer grained, which is consistent with the regional facies patterns in the Umpqua Group.

Tyee Formation

Resistant sandstone beds of the Tyee Formation form ridges of the southern Oregon Coast Range. In its southern facies (Lovell, 1969), the Tyee Formation is up to 1,500 m (5,000 ft) thick and consists principally of thick-bedded sandstone with lesser siltstone and pebble conglomerate. The sandstone is typically medium- to coarse-grained, micaceous, lithic to feldspathic graywacke. Cross-bedding and channeling, plant remains, and coal lenses are common. To the north, bedding becomes thinner and rhythmic, the ratio of sand to silt decreases (Baldwin, 1975), and fossils are not found (Thoms, 1975). This transition suggests a change from delta to shelf and perhaps marginal basin facies.

Dips in the Tyee Formation are gentle. In particular, the beds exposed in the long Tyee escarpment west of Sutherlin do not reflect either the northeasterly trends or the degree of deformation found in the underlying Roseburg and Lookingglass Formations (Figure 2).

Volcanic units of the Western Cascade Range

Late Eocene and younger volcanic and volcaniclastic rocks of the western Cascade Range overlie Tyee, Umpqua, and pre-Tertiary units east of Sutherlin and Roseburg (Figures 1 and 2). The predominantly andesitic Cascade rocks generally dip gently eastward into a pile thousands of meters thick.

A few sills and dikes of basaltic composition cut the Eocene rocks east of Sutherlin and Roseburg (Figure 2). These intrusions may be as old as late Eocene or as young as Miocene.

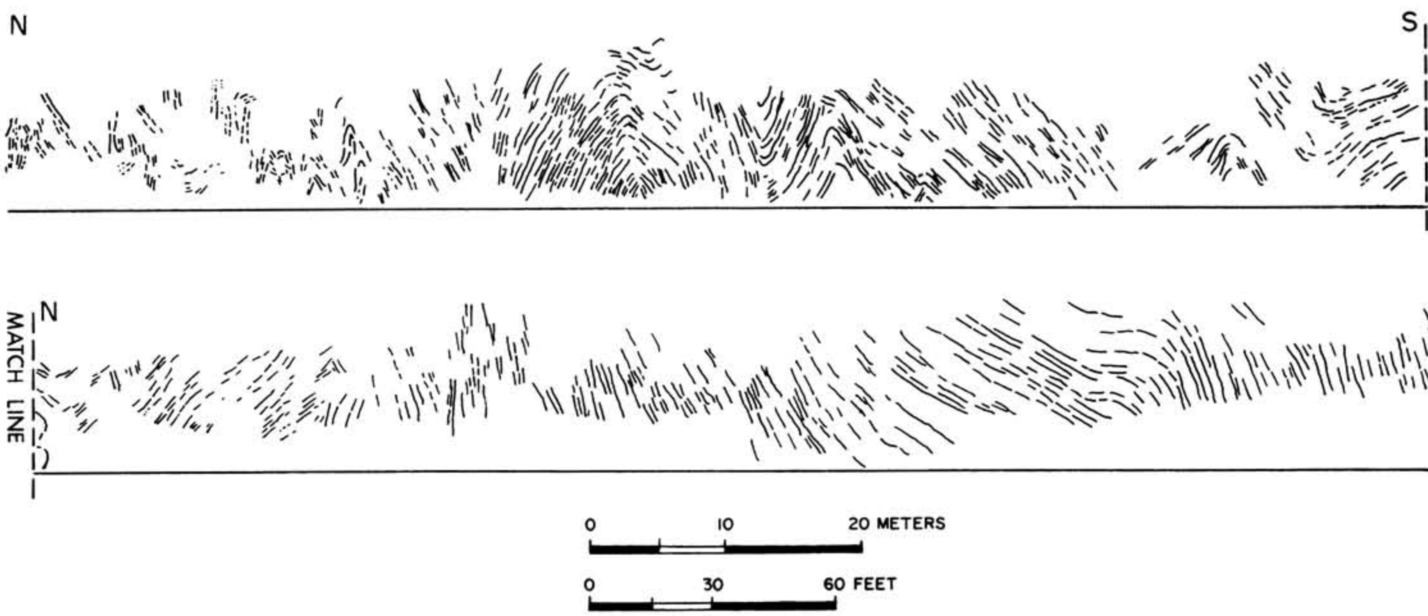
CURRENT DIRECTIONS

Current directions in the Roseburg Formation and in the Flournoy and Tyee Formations, as shown in Figure 2 and plotted in half-rose diagrams in Figure 5, are markedly different. Directions in the Roseburg Formation, based on scour marks (groove and flute casts, bounce and prod marks), show that the turbidity flows were mainly from the east. In contrast, Flournoy and Tyee currents (data mainly from Snavely and others, 1964) flowed northward from the Klamath Mountains province. Only Flournoy and Tyee current directions appearing on the map (Figure 2) are shown in the half-rose diagram (Figure 5); if all of the data of Snavely and others (1964) were included, the northward trend would be much more pronounced.

STRUCTURAL GEOLOGY

The large structures in the Sutherlin area are folds and associated faults which trend generally N. 60° E. (Figure 2), with wave lengths and amplitudes on the order of 10 km (33,000 ft) and 1,000 m (3,300 ft) or more, respectively. The folds are asymmetric; north limbs of the anticlines are typically steep and locally overturned, but south limbs are relatively gentle. The anticlines tend to have sharp hinges, whereas the synclines are open and relatively flat bottomed. Axial traces are sinuous, trending N. 45°-75° E.

Figure 3. Sketch of folds in the Roseburg Formation exposed in a roadcut east of Woodruff Mountain. Some of these folds are shown in the cover photograph.



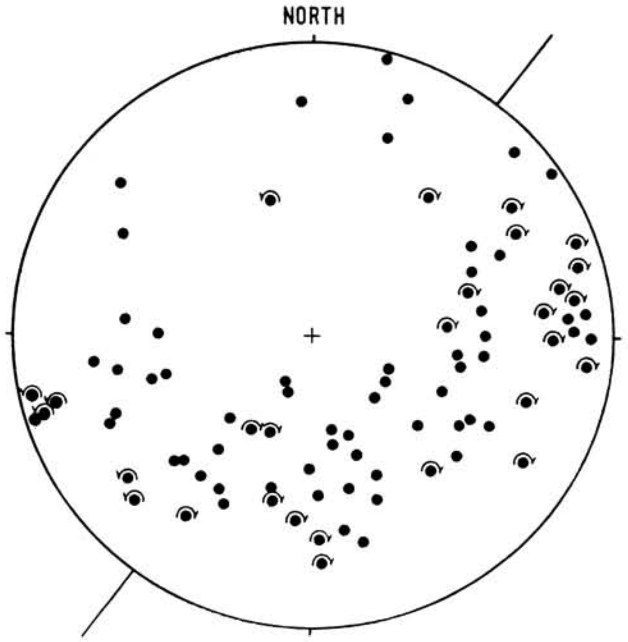


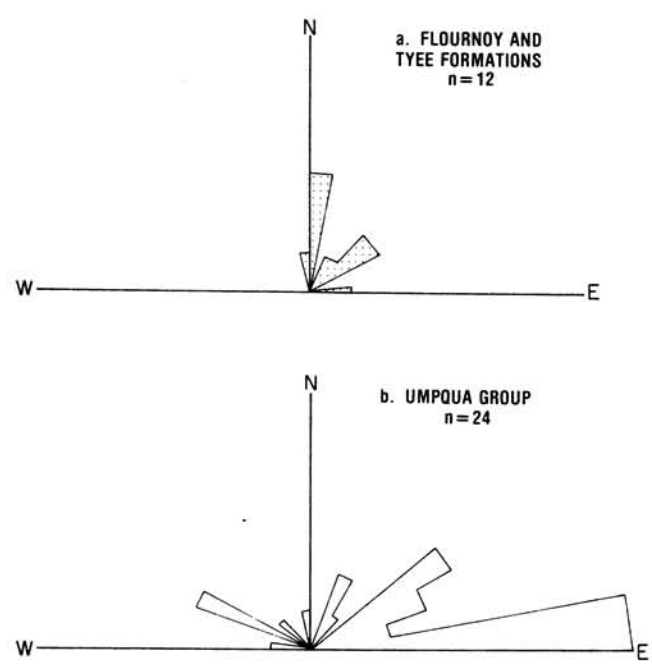
Figure 4. Equal-area diagram of fold axes in the Roseburg Formation near Woodruff Mountain. Arrows show shear (rotation) sense looking down plunge.

The best known fault in the Sutherlin area is the Bonanza fault (Figure 2), which trends northeasterly more or less parallel to the major folds and to the faults in the pre-Tertiary south and east of Roseburg. Baldwin (1964) described the Bonanza fault as a thrust. At the Bonanza mine, east of Sutherlin, the fault zone dips about 45° SE, with the Roseburg basalt moved up and over sedimentary rocks of the Roseburg Formation; dip-slip displacement (dip-separation) is on the order of 1,500 m (5,000 ft). The trace of the Bonanza fault is less certain to the southwest (compare Baldwin, 1964 and 1974, and Ramp, 1972). Near Woodruff Mountain, a branch of the fault apparently offsets the basal Lookingglass conglomerate by an amount considerably less than the maximum displacement in the Roseburg Formation, but the fault does not break the Tyee. Other similar northeast-trending reverse faults occur in the area but are generally of lesser extent and displacement.

Although dips are gentle in the synclines and fairly constant on the limbs of the large anticlines (such as the Oakland anticline), several zones of intense minor folding in the Sutherlin area are noteworthy (Figure 2). One of these zones is exposed along the banks of the Umpqua River just east of Woodruff Mountain. Chevron or accordion folds with wave lengths and amplitudes of 5-10 m (15-30 ft) are typical. A roadcut section about 200 m (650 ft) long, sketched in Figure 3, illustrates the style of folding in this zone. Individual folds are not restricted to a few beds, and the sandstone and shale beds were already considerably lithified before folding. The folds were probably formed at relatively shallow depths, judging from continuity of bedding and constant thickness of sandstone beds even in hinges. These folds are almost certainly not slump structures formed more or less contemporaneously with deposition. The style of folding is controlled by lithology; the accordion folds are best developed in thinly bedded, well-stratified rocks of the Roseburg Formation. An equal-area plot of fold axes (Figure 4) shows considerable scatter, but reversal of shear sense suggests a N. 40° E. (or S. 40° W.) tectonic transport direction (see Hansen, 1971). Given the relatively slight deformation of younger units, refolding is inadmissible as an explanation for the scatter; more likely the scatter happened as the folds were forming.

The origin of these folds is of interest. A preliminary hypothesis that the folds resulted from movement of the thin-bedded Roseburg units beneath the massive Lookingglass conglomerate of Woodruff Mountain is not entirely satisfactory. Deformation in thin Lookingglass beds adjacent to the conglomerate is much less severe, and other zones of intense minor folding are present in the Roseburg where the Lookingglass conglomerate is not present, for example, south of Tyee Mountain (Figure 2). The fold zone near Woodruff Mountain may be related to the Bonanza fault. South and east of Sutherlin, the Bonanza fault juxtaposes Roseburg basalt and sedimentary rocks of the Roseburg Formation. To the west, however, the fault trace splays out into sedimentary rocks, and the intense minor folding may take up part of the displacement. The Bonanza fault does not offset the Flournoy or Tyee Formations, but it may reappear in the Roseburg Formation some 35 km (22 mi) to the west, east of Myrtle Point (see Baldwin, 1974, map), from beneath the Lookingglass Formation.

Figure 5. Half-rose diagrams of current directions in (a) the Flournoy and Tyee Formations, and (b) the Roseburg Formation. Current directions were taken from map shown in Figure 2.



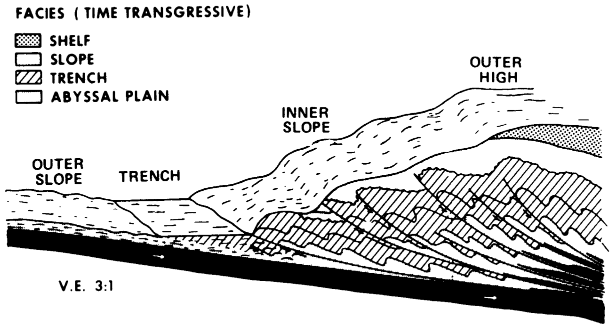


Figure 6. The Umpqua Group may have been deposited on an accreting continental slope and shelf in a fashion similar to that proposed by Seely and others (1974), with whose permission this illustration is reproduced.

SYNTHESIS

One explanation of the structures in the Sutherlin area could be that they were formed in a single deformational event after deposition of the Roseburg sediments and then uplifted and eroded prior to deposition of the Lookingglass Formation. However, the change in rock types going up in the stratigraphic column shows a logical transition from the thin, rhythmic, turbidite slope deposits of the Roseburg Formation to the deltaic or shelf deposits of the nearby Tyee Formation. The large, northeast-trending folds in the Sutherlin area were forming while the Roseburg sediments were being deposited on the continental slope. Decreasing deformation upward in the section also indicates a transition to a more stable shelf environment, and the relationship between stratigraphy and structure suggests that deposition and structural development occurred contemporaneously.

Currents carrying Roseburg sediments may well have been controlled by the growing, northeasterly-trending folds. By the time of deposition of the Tyee Formation, these structures had become inactive, and almost all were buried, although a few remaining topographic highs on the Tyee sea floor locally affected flow patterns, as near Drain. Turbidity flows originating near the top of the slope to the south and east would have been deflected by the developing ridges to flow down trough axes; as each successive trough was filled, or where the divide was low, flows would have overtopped the adjacent downslope ridge and contributed finer grained and progressively younger sediments to the next lower trough. This model, like a series of baffles across a slope, would explain both the Roseburg Formation current directions and the northward change to finer grained facies.

The modern continental margin of Oregon and Washington (Silver, 1971, 1972; Carson and others, 1974; Kulm and Fowler, 1974) is comparable to this model. Longitudinal ridges and troughs characterize the present continental slope. Seismic profiles show these ridges to be anticlinal and commonly bounded by steep faults; the intervening troughs are filled with younger, less deformed sediments, and essentially undeformed shelf deposits cover the slope units with apparent angular discordance. This model is illustrated in Figure 6.

The modern analog suggests that the Umpqua Group and Tyee Formation were sequential parts of an accreting continental margin, with depositional patterns closely related to structural development.

ACKNOWLEDGMENTS

Our thanks to Chris L. Nastrom, who assisted in drafting, to Ewart M. Baldwin for many discussions of Umpqua stratigraphy, and to our colleagues for critically reading the manuscript and patiently listening to our ideas.

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(Continued, p. 146)

A personal account of a nuée ardente on Mount St. Helens during the eruption of May 18, 1980

by Guy H. Rooth, Oregon College of Education, Monmouth, Oregon 97361

INTRODUCTION

On the afternoon of May 18, 1980, while watching the eruption of Mount St. Helens from a plane, I observed a rapidly moving pyroclastic flow (nuée ardente) on the south side of the mountain. Also in the plane was photographer Roland Giesbrecht, who captured the event on film.

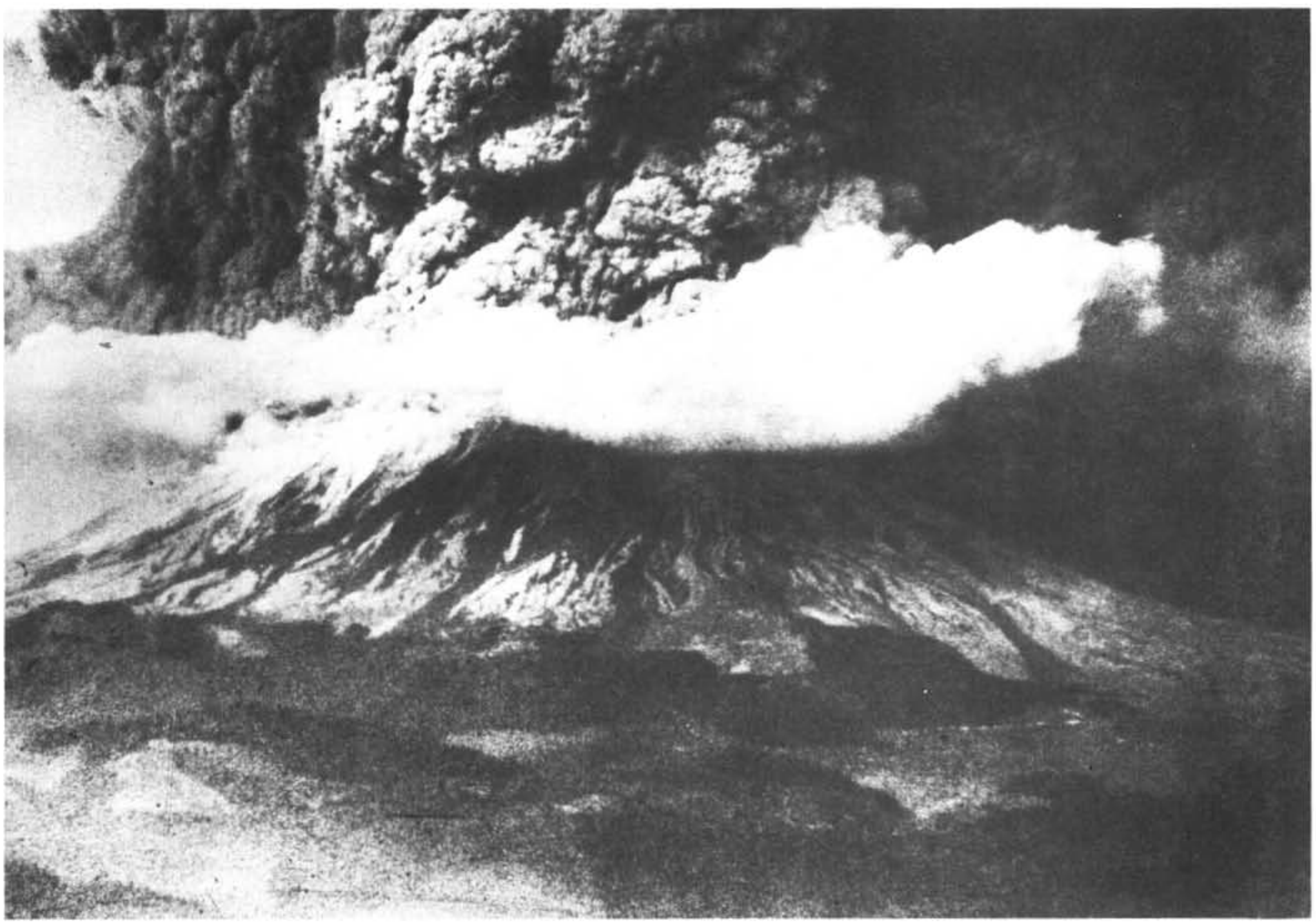
Eyewitness accounts of events of these features by geologists are rare. This may be the first such account from within the continental United States. The purpose of this paper is to describe the event and to encourage others who may have witnessed or photographed it to share their information.

Sheridan (1979) includes all denser-than-air avalanches, streams, and flows within the term "pyroclastic flow." Because two types of pyroclastic flows were observed simultaneously during the May 18 eruption, for purposes of clarity the general term "pyroclastic flow" is restricted in this report to slow-moving flows lacking a suspended cloud of ash. The terms "rapidly moving pyroclastic flow" and "nuée ardente" are used to describe material consisting of a basal avalanche and a suspended cloud of ash, all traveling at high speeds.

EVENTS PRIOR TO THE NUÉE ARDENTE

Our plane arrived in the vicinity of Mount St. Helens shortly after 2 p.m. on May 18, 1980, while the eruption was still in progress. For about an hour and a half, we photographed and observed the mountain from a distance of 20 mi due west, as required by the Federal Aviation Administration. Most of our observations were from an elevation of about 11,000 ft. During that time, the top of the column of eruptive material was hidden from view by a persistent layer of stratus clouds.

Figure 1. Eruption of Mount St. Helens viewed from the west at approximately 3:30 p.m., May 18, 1980. Slow-moving pyroclastic flows visible near summit on northwest side. (Photo courtesy Roland Giesbrecht)



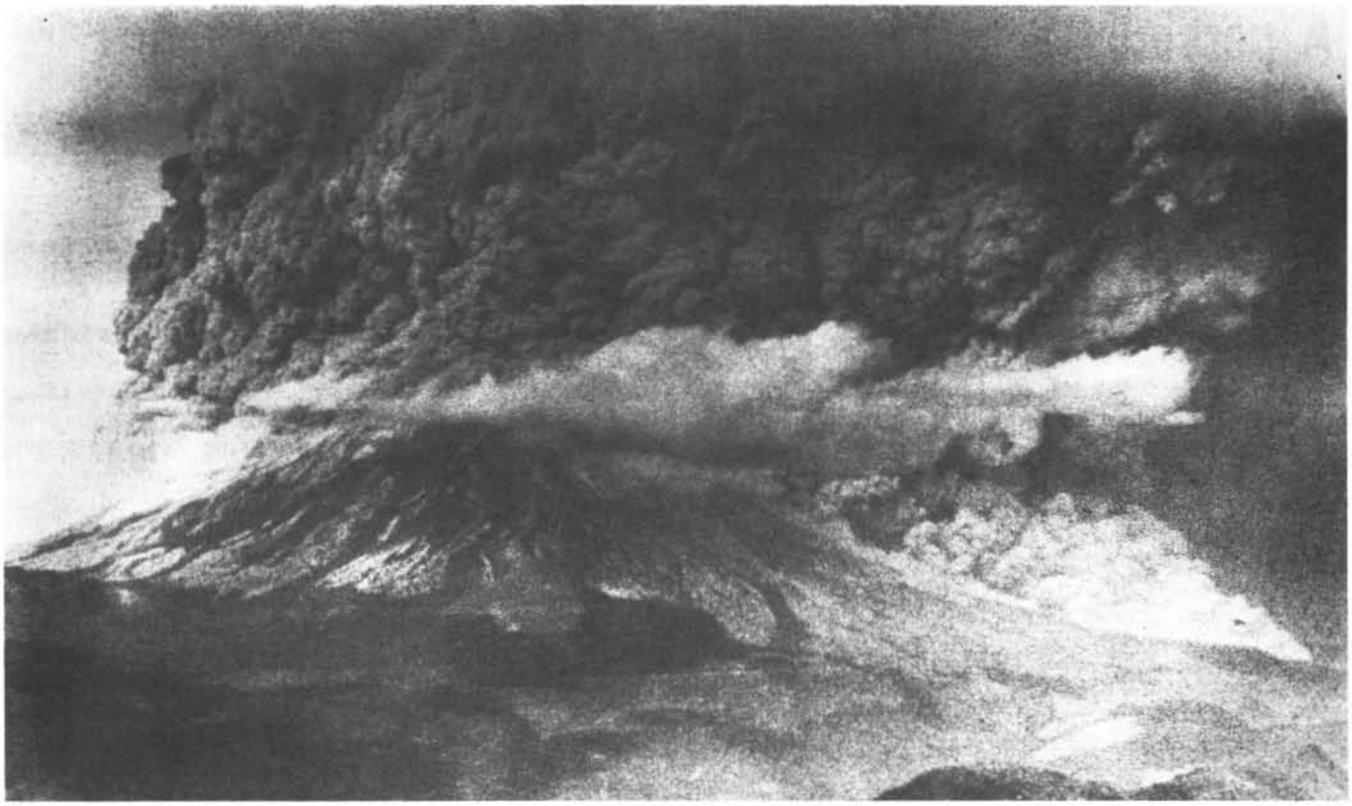
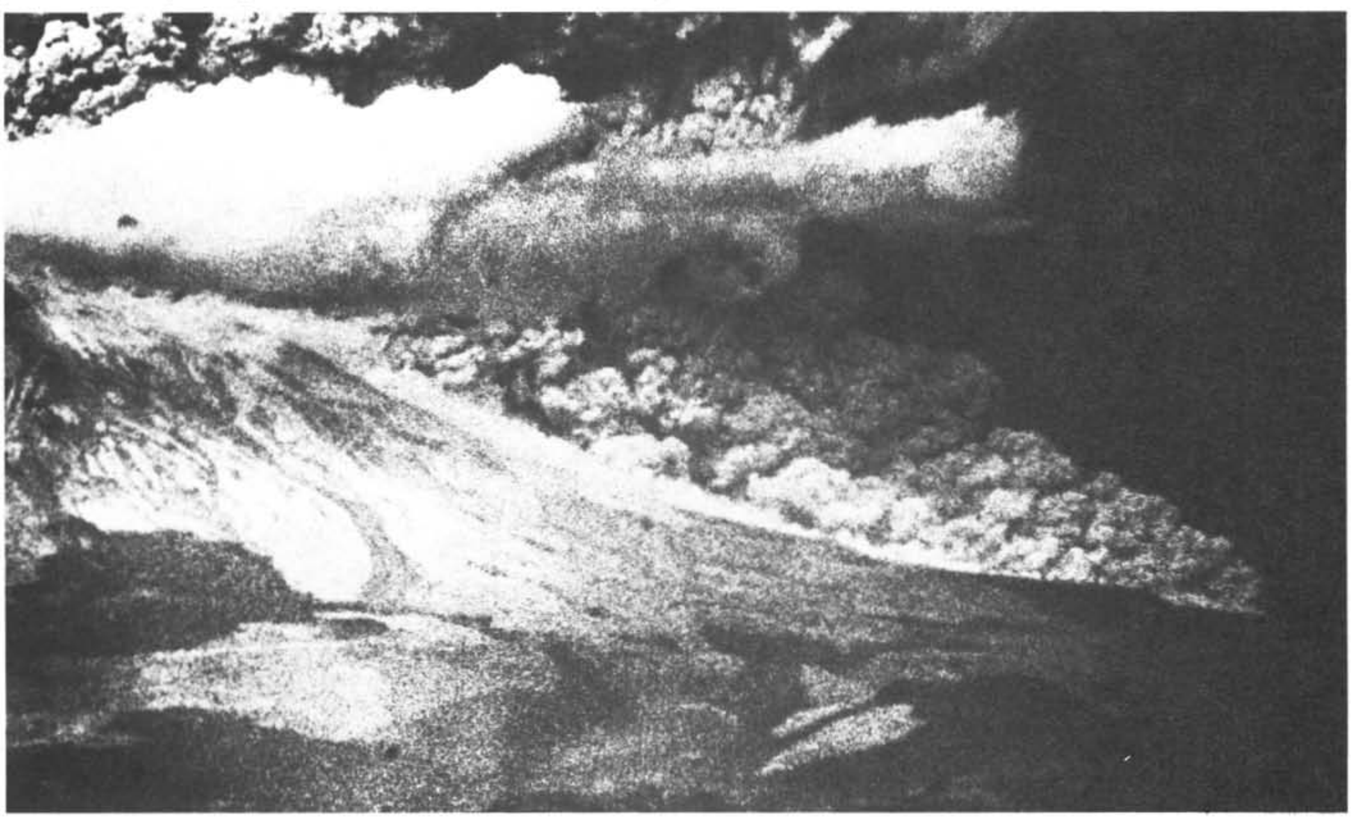


Figure 2. Rapidly moving pyroclastic flow (nuée ardente) on south flank of Mount St. Helens at approximately 3:53 p.m., May 18, 1980. Slow-moving pyroclastic flows still visible on northwest side. 135-mm lens. (Photo courtesy Roland Giesbrecht)

Figure 3. Rapidly moving pyroclastic flow (nuée ardente) on south flank of Mount St. Helens, May 18, 1980, a few seconds after Figure 2. 230-mm lens. (Photo courtesy Roland Giesbrecht)



A large gray column of pumice and ash poured forth from the summit of the volcano. It appeared to hang motionless in the air, but if one looked carefully at a portion of the column, the turbulent motion of the material became readily apparent. Lightning bolts were common. Very little material appeared to be falling near the mountain on the north, west, or south sides. All of the material appeared to be moving turbulently upward within the eruptive column.

Material was emanating equally from the entire summit of the volcano, and one could not tell from the eruptive cloud that a large part of the north slope of the mountain had been blown away during the initial eruption earlier that day.

From a distance of 20 mi, no instances of partial column collapse were observed. For more than half an hour, slow-moving pyroclastic flows could be seen on the northwest side of the volcano (Figure 1). However, at that distance, forward movement of the flows was not discernible.

OBSERVATIONS OF THE NUÉE ARDENTE

Shortly before 4 p.m., we had finished taking pictures and had turned the plane to the south to return to Salem, Oregon. The photographer, glancing back toward the mountain, called my attention to a change in the nature of the eruption.

I immediately noticed a rounded bulge of material descending from the eruptive column onto the south side of the mountain near the summit. We quickly turned the plane and began taking pictures. The bulge rapidly changed shape and appeared to flow at a high rate of speed down the mountain as a basal avalanche traveling faster than the suspended, turbulent cloud above it.

When the material was nearing the change in slope at the base of the cone of Mount St. Helens, I glanced at my watch, and it read 3:52 p.m. Shortly after that time, Roland Giesbrecht took the photograph in Figure 2 with a 135-mm lens. A few seconds later he took Figure 3 with a second camera equipped with a 230-mm lens. The distance the nuée ardente advanced past a small hill during those few seconds can be seen by comparing the two photographs.

Unknown to me at the time, Charles Rosenfeld of the Geography Department at Oregon State University was in an Oregon Army National Guard plane at a distance of slightly more than a mile from the mountain. His plane was flying from the west side of the mountain toward the south side. He saw the start of the nuée ardente and watched it pass from view beneath his plane in a matter of seconds (personal communication, 1980). He estimated the speed to have been 70 to 100 mi per hour. While he did not witness a collapse of the eruptive column at that time, he had seen a partial collapse a few minutes earlier farther to the west.

It took about two minutes for material to travel from the summit of the volcano out of sight into low hills at the base, a distance of 4 to 5 mi. For the next two minutes, additional material continued to flow down

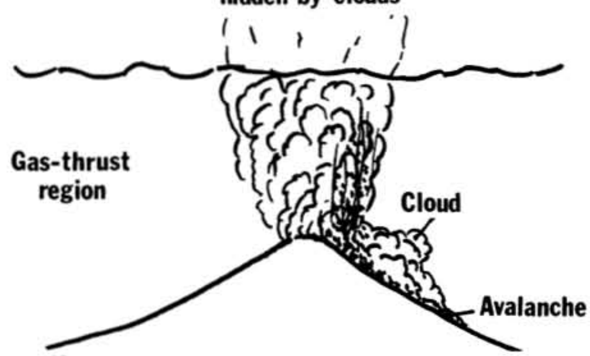


Figure 4. Schematic diagram of eruption of Mount St. Helens, May 18, 1980, showing possible collapse within gas-thrust region which produced the rapidly moving pyroclastic flow (nuée ardente) (after Sheridan, 1979).

the flanks of the mountain. The suspended cloud was several thousand feet high. Two minutes after the flow had stopped, the remaining suspended material settled to the ground, leaving empty space where the cloud had been. My watch read 3:56 p.m. after the cloud had settled. From the estimates given above, it seems likely that speeds from 60 to more than 100 mi per hour were attained by the rapidly moving basal avalanche part of the flow.

ANALYSIS

During the eruption, only the gas-thrust region of the eruptive column (as described by Sheridan, 1979) was visible. Material was carried upward by the explosive force of the escaping volcanic gases. The overlying convective-thrust portion of the eruptive column is said in newspaper accounts to have reached elevations in excess of 60,000 ft. However, it was not visible to us.

The nuée ardente was probably triggered by a partial collapse of larger tephra material falling back against the south side of the summit of the volcano and trapping gases to provide the high mobility and rate of flow observed (Figure 4). No preceding blast was noticed. Material appeared to fall vertically as a rounded bulge beneath the eruptive column. Once the material had fallen onto the flanks of the mountain, it appeared to flow rapidly as a basal avalanche and suspended cloud. Bolt and others (1975) describe similar occurrences during the eruptions of Soufrière on the island of St. Vincent in 1902 and the Russian volcano Bezymianny in 1956. Sheridan (1979) reports the formation of rapid pyroclastic flows resulting from gravitational collapse of columns during the eruptions of Komagatake in Japan in 1929, Mayon in the Philippines in 1968, and Ngauruhoe in New Zealand in 1975. The eruption witnessed on Mount St. Helens appears to fit into the small to intermediate types of eruptions described by Smith (1960).

ACKNOWLEDGMENTS

I am indebted to Roland Giesbrecht for taking, under very difficult lighting conditions, the photographs which accompany this article. David Woods and Ron Cooper prepared the black-and-white prints. Charles Rosenfeld contributed valuable advice and materials. The manuscript was reviewed by Ray Brodersen.

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A major dictionary of the earth sciences—the *Glossary of Geology*—is now available in an expanded up-to-date edition. It includes 36,000 terms, compared to 33,000 in the 1972 edition, and reflects changes in the geoscience vocabulary in the last decade.

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The new work was edited by Robert L. Bates, who is widely known for his monthly column in *Geotimes*, and Julia A. Jackson of the American Geological Institute. The editors worked with the help of nearly 150 specialists who reviewed definitions, added new terms, and cited references.

Robert L. Bates is emeritus professor at Ohio State University, author of a textbook on geology of industrial rocks and minerals, and an honorary member of the Association of Earth Science Editors. Julia A. Jackson is editor of AGI's newsletter, *Geospectrum*, and a member of AESE.

The *Glossary of Geology* (second edition) has 749 pages and sells for $60. It may be ordered from the American Geological Institute, One Skyline Place, 5205 Leesburg Pike, Falls Church, Virginia 22041. There is a 10 percent discount for bulk orders of 10 or more copies on one order. □

Types of scientific studies conducted on Mount St. Helens, July 1980

The left-hand column in the following table tells the types of scientific studies conducted at Mount St. Helens, Washington, during July. The second column indicates the number of U.S. Geological Survey (USGS) studies. The third column shows the number of entry permits that the St. Helens Coordinating Committee issued to other agencies so that they could conduct their studies.

Type of study	USGS	Other agencies
Educational	—	7
Photography	1	5
Vulcanism, general	1	2
Thermal imagery	2	3
Hazards	1	1
Geomorphology and deformation	1	2
Mud flows	1	4
Tiltmeter	1	1
Tephra	1	11
Geothermal, thermal	1	1
Petrology, geology	1	3
Biology	—	3
Debris flow	2	1
Gas analysis	1	1
Trace elements	1	2
Seismic	1	—
Gravity	1	—
SLAR (Side-Looking Airborne Radar)	1	—
TV	1	1
Engineering	1	—
Pyroclastic flows	1	—
Blast deposits	1	—
Hydrothermal and weathering	1	—
Eruption dynamics	1	—
Electromagnetic	1	—

—Data supplied by the St. Helens Coordinating Committee □

USGS bibliography of continental shelf and coastal zone available

Copies of the U.S. Geological Survey Open-File Report 80-467, *Bibliography of the Geology of the Oregon-Washington Continental Shelf and Coastal Zone, 1899-1978*, by Gretchen Luepke, are available by mail from the Open-File Services Section, Branch of Distribution, U.S. Geological Survey, Box 25425, Federal Center, Denver, CO 80225. Price is $3.50 for each paper or microfiche copy. Orders must specify report number and contain check or money order payable to the U.S. Geological Survey. □

The gold dredge at Whisky Run north of the mouth of the Coquille River, Oregon

by Ewart M. Baldwin, Professor of Geology, Department of Geology, University of Oregon, Eugene, Oregon 97403

The soaring price of gold will no doubt renew interest in gold mining and challenge the ingenuity of those interested in extracting the elusive metal. The many devices constructed to concentrate gold during previous cycles of gold-mining fever in Oregon have ranged from those mechanically quite sound to those that were wholly impractical. Few devices, however, were more bizarre than the dredge shown in Figure 1.

The origin of the photo is unknown, but it has been passed down in the photo files left by the late Warren D. Smith and James Stovall, former professors of geology at the University of Oregon. The location inscribed in pencil on the back of the photo is given as Ophir, at the mouth of Euchre Creek, but that is far from the dredge's final resting place at Whisky Run, in the old Randolph mining district, a placer area along the beach north of the mouth of the Coquille River.

One historical reference to the dredge is a brief comment made by visitors to Whisky Run and quoted by Peterson and Powers (1952, p. 371-372) as follows:

> A big piece of machinery was nearby in a red-rusted and far-gone condition. They judged it to be the remains of the $60,000 contraption brought to Whisky Run by some Minnesota men in 1910 to prove itself to be no good in short order.

R.R. Horner, who worked for the U.S. Bureau of Mines, is also quoted by Peterson and Powers (1952, p. 378):

> Smith R. Bassett, representing Minneapolis parties, designed and built a dredge, mounted on hollow cylindrical wheels about 6 feet in diameter and about 5 feet wide...probably the most unique mechanical curiosity of all the devices for recovering gold from the black sands. On the steel frame of the dredge was mounted an endless-chain bucket digging device operated by steam engine. The machine was propelled by its own power and was designed to work the beach deposits lying between high and low tides. It proved a complete failure, as it was unstable and nearly capsized on the first trial run. With great difficulty it was finally dragged back to a place above high tide, where it now rests. This venture is said to have cost between $60,000 and $75,000.

This author examined the files of the *Coos Bay Times* (forerunner of the *Coos Bay World*) for January 1, 1910, to August 10, 1910, but found no reference to the venture. Later files for 1910 were not available. Pre-1915 copies of the *Western World*, published in

Figure 1. Gold dredge at mouth of Whisky Run, about 1910.

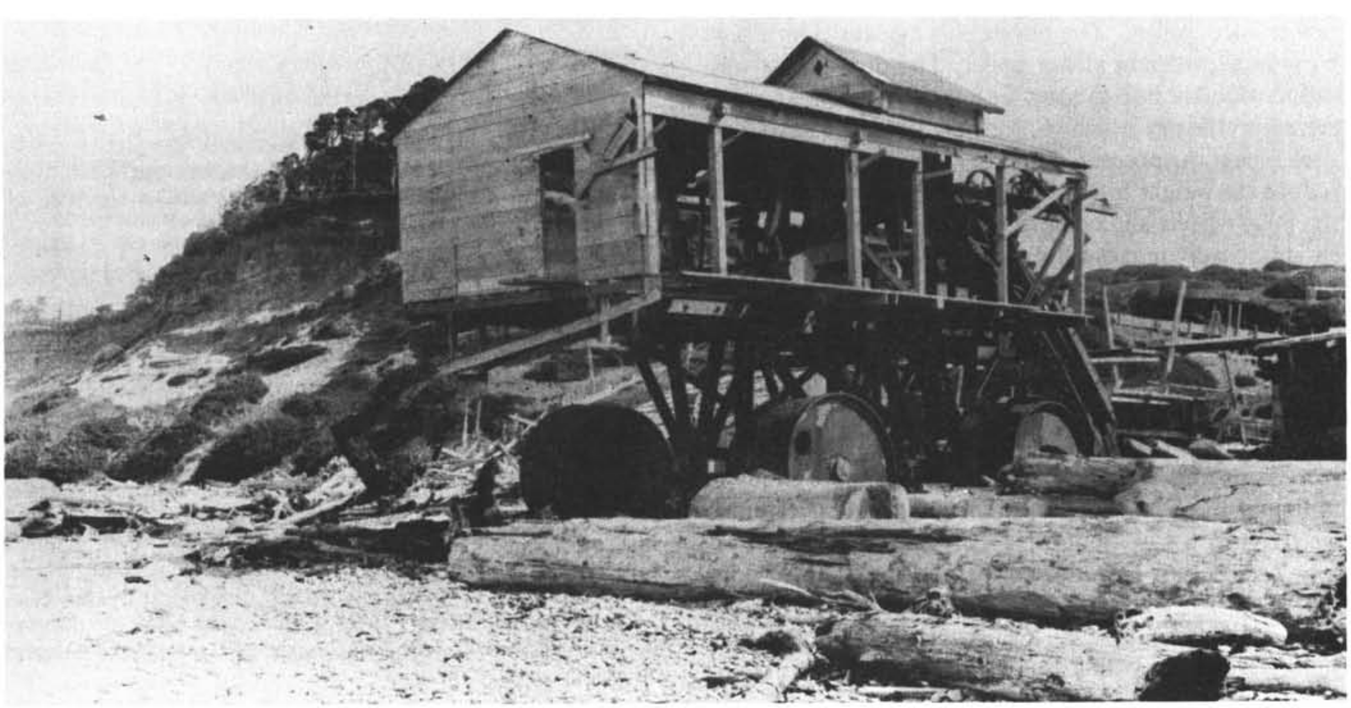

Figure 2. Large rear wheel of dredge, as it appeared in 1949. For scale: John McManigal, left; Len Ramp, center; and Robert Burke, right.

Bandon since 1912, were also unavailable.

The dredge was designed to roll on its large drum-like wheels, which were cleated in the rear where the power was applied. The power was evidently furnished by a small, upright steam boiler. The dredge was supposed to move into the surf at low tide, scoop up sand, retreat to the dry beach to work the sands for gold, and then repeat the process. The story is told that in order to reduce the weight of the dredge, valves were installed in the huge wheels and compressed air was injected, thereby supposedly making the structure lighter.

The dredge was evidently assembled in or near Bandon and moved under its own power along the beach northward to Whisky Run, a distance of approximately 6 mi. The terraces at Whisky Run had been mined off and on since the initial burst of activity in 1853-55, when the Randolph district was in its heyday. The area was revived during World War II, when chromite sands in tailings from some of the earlier gold mining ventures were mined for chromium.

This author first viewed the remains of the dredge in 1943 while working with the Coos County/Oregon Department of Geology and Mineral Industries coal survey (Allen and Baldwin, 1944). Figure 2 was taken during the summer of 1949. A visit to Whisky Run on March 3, 1980, failed to reveal any part of the machinery, but the driftwood was so abundant that metal objects could have been partially buried in the sand and covered by the wood.

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(**Umpqua Group**, *continued from p. 140)*

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