

THE WALLS OF PORTLAND

By Ralph S. Mason*

Much publicity has been given in recent years to new construction in the Portland area, particularly to those sections undergoing urban renewal. Very little mention has been made, however, of the role played by the mineral industry in the creation of attractive, long-lasting, economical, fire-proof structures. Almost without exception, the recent advances in building construction have been concerned with improved techniques in the handling, fabrication, and erection of mineral industry products. Lift slabs, tilt-up walls, prestressed and post-tensioned structural members, and slip forms are but a few examples of these developments. Anybody who has watched a multi-silo grain elevator rising into the air in one long, continuous movement, or has seen a large, single-floor commercial building suddenly sprout walls overnight, has witnessed some of the more spectacular achievements made possible by the use of minerals in modern construction.

The most noticeable part of any building is usually its walls. Walls must be functional, giving support and protection to the building, but they can also be an ornament not only to the building but to the area as well. For the first time in history, the architect has no limitations as to length, width, or thickness of his materials. He has a wide choice of natural aggregates and cut stone, a great variety of ceramic and concrete pre-cast units, and numerous methods for incorporating them into a wall.

Brick Walls

Historically, the first use of a manufactured mineral product for the construction of a wall was the laying of one sun-dried clay brick upon another by a Persian bricklayer more than 5,000 years ago. Some time later, the art of brick making progressed to the firing of clay blocks in kilns and this has remained as standard practice.

Modern brick comes in many shapes, sizes, textures, and colors. The manner of laying up the brick ranges from the common staggered course to

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stacked bond with numerous designs incorporated by indenting or extending individual brick. Treatment of mortar joints also adds variations to brick walls with flush, raked, and slump mortar in various colors currently being used.

Common red-fired brick laid up conventionally is still an attractive wall covering, as evidenced by the several stores using it in the Lloyd Center. The west wall of Meier & Frank's store is a good illustration of the proper use of brick for covering large, unbroken surfaces. The wall is attractive and interesting at close range and still retains these same qualities, only slightly subdued, when viewed from a block or more away. Slight differences in the shades of the brick help to accomplish this effect. Another brick-faced building, occupied by Blue Cross of Oregon, on S. W. 5th Avenue uses jet-black brick for the first-story and dark blue for the second-story walls, thus achieving, if this is ever possible, an architecturally subtle pun.

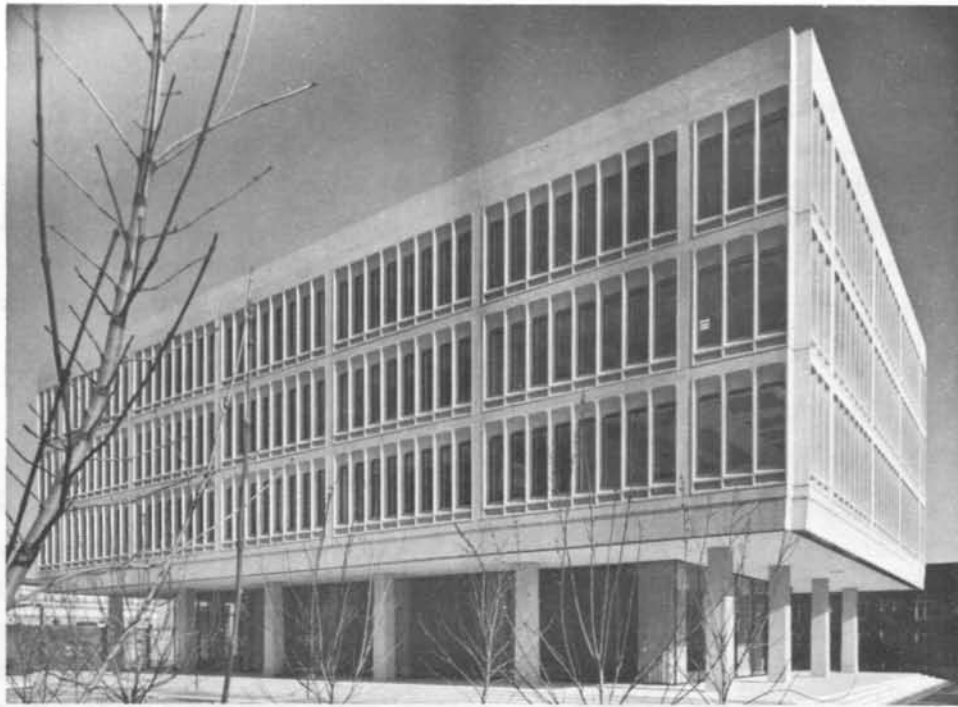
In recent years, used bricks, sometimes in rather a woebegone state of preservation, have been extensively employed for wall coverings. Properly applied, such brick add a certain charm, partly to their ties with the past and partly to their imperfections, and partly perhaps to the fact that used brick costs more than new brick.

Ceramic Tile Walls

Large wall areas of many downtown buildings, particularly in the upper stories, display ceramic tiles of various dimensions. These are applied in much the same manner as stone veneering. Almost without exception, the tiles are imported considerable distances from regions where high-quality clays are readily available. Large dimension tiles present a minimum of joints to the weather, and the glazed surface resists weathering to a high degree, making for low maintenance costs.

In the past few years a great number of buildings have been faced, at least in part, with one-inch-square tiles. The small unit size is well adapted to narrow areas between structural elements of the building and an infinite variety of design through selection and arrangement of colors is possible. The recently completed Pacific Northwest Bell Building in the urban renewal project on S.W. 4th Avenue uses wall panels covered with single-color tiles.

Two unusual applications of ceramic products to Portland walls have been produced by Bennett Welch of Pacific Stoneware. On the St. Helens Hall campus just west of Portland, the exteriors of the buildings are covered with hand-glazed tiles one-half-inch thick, wire-cut from standard green brick stock as they leave the pug mill. The tiles were made by



Equitable Savings & Loan Bldg., 1300 S.W. 6th Ave. Pre-cast wall panels of white concrete and quartz aggregate. Eight-window units one floor high were cast in one piece at Swan Island and trucked to the job. (Photo by W. H. Grand)



Portland Chamber of Commerce Bldg., 824 S.W. 5th Ave. (bottom). A complete renovation of the old building uses Cold Springs granite facings from Minnesota, and white concrete with white exposed aggregate pre-cast panels. (Photo by Ackroyd)

Willamina Clay Products' Tigard plant. The tile on the exterior walls are shades of brown; those on some of the interiors are of brighter colors. Welch also created the ceramic tiles above the Christian Supply Center at Lloyd's. Pounded clay was sculptured into vertical panels about three feet wide. They were cut into 12-inch-square tiles, then fired and glazed. Both of these treatments are unique and are not likely to come into general use, since unit costs would run much higher than those for any of the standard types of wall coverings now being employed.

Concrete Walls

Concrete block has been used extensively in wall construction in the Portland area for many years. Both standard-aggregate and lightweight blocks are available. Most of the lightweight blocks are fabricated from expanded shale produced locally. More than 100 shapes and styles of blocks are currently being utilized. One of the most interesting applications of block is in the creation of screen walls having a wide variety of designs. Although many of these blocks appear to be quite fragile, they possess considerable strength due to the manufacturing process, which uses vibration plus pressure to produce a sound block. Curing is improved by autoclaving in steam rooms. Careful mix control and the proper selection of aggregate also aid greatly in the making of high quality block. Several firms in the Portland area have completely automated block plants which operate without human assistance during the mixing, forming, stripping, and palleting stages.

The Lloyd Center has large quantities of concrete block in its basic construction, now hidden behind decorative coverings. A lacy screen wall of concrete block surrounds the ice-rink area. Similar walls are employed around town as sight screens for parking garages and other areas where adequate ventilation, attractiveness, and a visual barrier are required.

Concrete is a basic building material in modern commercial and industrial construction. Usually concrete forms the supporting element of a structure and its presence is often masked behind veneers of surfacing materials. Several recently completed buildings in Portland used concrete as a structural material, and also as the finished surface, without any attempt to dress it up with surface coverings. The IBM Building is an excellent example. Pre-cast wall panels 12 feet wide and 52 feet high provide, by means of a series of ingenious fairings, the exterior and interior wall, the window frames, and sunscreens. The wall units were manufactured in Tacoma, Washington, and were trucked to the site, where they were speedily placed into position and attached to the floors. Unlike similar wall panels, these units are actually load bearing, sharing the weight of the floors with the



Pioneer Broadcasting Bldg. (KGW-TV). Splayed poured-in-place concrete posts support the second floor, which features thin-shell concrete sunscreens. Uncompleted building is at 1500 S. W. Jefferson St. (Photo by Alan Hicks)



IBM Bldg., 2000 S. W. 1st Ave. (top). Thirty-eight smooth-surfaced concrete panels 12 feet wide and four floors high cover the structure and support the outer perimeter of the floors. Panels were cast in Tacoma and trucked to site. (Photo by W. H. Grand)

central core structure to provide an uninterrupted floor space. Another example of concrete used in this manner is to be found in the new KGW Building on S.W. Jefferson St. Here the building is supported by branching posts of concrete and the walls are embellished with concrete sunshades which are extensions of the walls. Both the IBM and KGW buildings have a compactness and pleasingly functional appearance which has been enhanced by a single building material.

Modern concrete technology employs such relatively new developments as lightweight concretes, high-alloy reinforcing steel, prestressing, post-tensioning pozzolan replacement, pumping, slip-forms, air entraining additives, and over-all improvement in concrete aggregates and mixes. The net result of all these advances is to provide the architect and the builder with a material that is essentially limitless in its application to modern building construction. For the first time, builders have a product that: (1) is available in practically any size and shape; (2) can be formed on the job, brought to the job ready for final installation, or brought to the job in modular units and set in place in an endless variety of ways; (3) improves with age, is rot-, fire-, water-, and termite-proof; (4) has inherently great compressive strength and can be fabricated so as to have high tensile strength as well; (5) can be given a surface ranging from perfectly smooth to rough, plus either raised or incised designs created by pouring against prepared forms, in any color which can be added either to the mix or applied later; (6) can be a base for attaching any type of siding or surfacing material; (7) can serve as a back-up for exposed aggregate panels poured face down or for hand-seeded panels formed face up; (8) is available in high or low densities, with aggregate hard enough to scratch glass or soft enough to drive nails into; (9) can be sawed, split, drilled, nailed, and chiseled when hard or molded, extruded, trowelled, poured, or carved immediately after mixing.

Aggregate Panel Walls

The use of exposed aggregate panels has increased greatly in the past few years. This type of wall covering has several advantages, since relatively low-cost aggregate rather than more expensive, large-size stone veneers can be used. Construction of either tilt-up or plant-poured exposed aggregate panels is essentially a bulk-materials handling operation, with its relative saving in costs as compared to the hand-laid masonry or veneer wall. Current practice in making exposed aggregate panels employs a retarder which delays the setting up of the outer surface concrete while the base concrete gains its initial strength. Immediately after the panel has attained sufficient strength to be moved, it is upended and the

retarded surface is either brushed, acid etched, or water sprayed to expose the aggregate. The choice of methods for exposing the surface depends upon the desired effect, which may range from flush through high relief. A recent example of exposed aggregate panels in Portland is to be found in the new Equitable Building, where 38-ton pre-cast units of white concrete faced with white quartz aggregate from Washington form the walls. A novel feature of this job was the incorporation of the air-conditioning ducts into the units just below the deeply embayed window openings. Other examples in the Portland area include the basalt river pebbles in the exposed aggregate on the Hilton Hotel base walls, the fronts of several Safeway stores which have brown quartzite cobbles obtained locally, and the University of Oregon Medical School Research Building, using white Washington quartz in through-the-wall panels measuring 7 feet high by 30 feet long and weighing approximately 20,000 pounds each.

Stone Veneer Walls

Sheets of stone veneer have been the standard wall coverings for commercial office buildings for many years, sharing the total field with brick and, to a much smaller extent, with dimension stone. Most of the veneers used locally are imported from considerable distances, and, although they are expensive on a first-cost basis, the upkeep is low and the stones normally have a long service period. The Oregonian Building is veneered with Cold Springs granite from Minnesota around the base course and topped with buff Indiana limestone. The same Cold Springs granite also appears on the lower portions of the State Office Building, the upper floors of which are covered with cream-colored ceramic tiles. The Interior (Bonneville) Building is covered with Georgia marble, as is the Executive Building. The remodeling of the Chamber of Commerce Building entails the use of Cold Springs granite and white-on-white precast exposed aggregate panelling for the upper floor. The lower portions of the Meier & Frank Co. store in the Lloyd Center are covered with slabs of a blue larvikite from near Larvik, Norway. The shimmering blue color is imparted by the feldspar anorthoclase, which often occurs as twinned crystals. Numerous buildings in Portland are faced with sheets of buff travertine. This banded stone, characteristically pitted with irregular small openings, comes from large quarries near Rome that have been in production for more than 2,000 years.

Natural Stone Walls

The day of the building constructed with walls of solid blocks of stone has practically gone, with the exceptions of federal structures in National

Parks where materials at hand are employed to enhance the scene. This type of construction is still in use for retaining walls, however, and an interesting example can be seen at the Standard Plaza Building on S. W. 5th Avenue, where rough blocks of Cold Springs granite have been laid up to form massive retaining walls that are part of the lower floors of the building.

In Portland quite a few walls have been erected with chunks of rubble. Most of these walls are of the tilt-up variety. This system uses a form, the thickness of the wall, which is laid flat on a concrete surface. In the form a bed of dry sand is spread to a depth of several inches then the rubble pieces are placed on it. Grout is next applied around the rubble, and then concrete is poured to fill the form. Structural steel, conduits, window and door frames, and any other necessary accessories can be incorporated in the panel before pouring. Once the panel has set, it is tilted up and locked into position; the outer surface is then cleaned to reveal the rubble. Standard stone masonry techniques have also been used for laying up rubble-faced walls. The Thunderbird Restaurant has walls studded with large chunks of silicified rhyolite rubble from the Warm Springs Indian Reservation near Mt. Hood, and the Americana Motel on S.W. 5th Avenue has portions of both interior and exterior walls composed of white magnesite rubble from near Chewelah, Wash. Several small commercial buildings in Portland have recently used an angular, elongated volcanic rock from southern Washington to produce a rustic, textured wall.

For quite a number of years long narrow strips of sandstone veneer have been laid up brick fashion to form wall coverings. Most of this type of stone is imported from Arizona, with smaller quantities coming from other states or originating in Oregon. Three Oregon quarries, the Rainbow Tuff quarry near Pine Grove in Wasco County, the Willowdale quarry in northern Deschutes County, and the Idanha quarry in Marion County, have been producing small amounts of veneer strips and ashlar. The Rainbow quarry is noted for brightly colored tuff with pronounced bands of color, the Willowdale stone is darker and the banding is less accented. The Idanha tuff resembles the Rainbow but the banding shows less contrast.

Walls of Lloyd Center

The most interesting collection of walls in Portland is to be found at the Lloyd Shopping Center. Here in gay profusion are excellent and imaginative applications of mineral-industry products to more than 100 shops. One of the problems in designing the walls of the Center was the necessity of providing distinctively different store fronts while making them all into a cohesive assemblage that would be both pleasing and practical. The decision to use mineral products proved to be a happy one, since it gave the

widest possible choice of materials and combinations of compatible materials.

An international flavor is imparted to the Center with the use of marble, travertine, and verde antique from Italy and of granite from Norway and Peru. Neighboring and distant states also supplied some of the materials, with quartzite and dolomite from Washington, sandstone from Arizona, granite from Minnesota, rose quartz from Nevada, brick from California, and slate from Vermont.

Ceramic products include clay brick and tile and one-inch-square glass tiles, many of which were imported from Italy. Several stores use specially crafted tiles with either fired or raised designs. A wide variety of effects has been achieved, however, with standard shapes and colors which are available in an almost unlimited selection. Natural stone has been used as a veneer, as rubble, as ashlar, in precast and poured-in-place units, and as exposed aggregate.

Again, far-away places account for many of the stones used. One interesting effect is obtained by utilizing sliced river pebbles of white marble from Italy in pre-cast units, another is obtained by using polished slices of Cold Spring Rainbow granite from Minnesota 4 inches square set in pre-cast units 24 inches square. Slate, which is normally thought of as a floor covering, also appears in the Center on several walls as a veneer, and common glass marbles used by children the world over form a hob-nailed surface for entire walls of one of the larger stores. Glass, incidentally, occupies a large proportion of the Lloyd Center walls. Glass is at its best when it is nearly invisible, and equally invisible to the lay public is the fact that glass is made from mineral products of very great purity.

EXAMPLES OF MINERAL MATERIALS USED IN LLOYD CENTER WALLS

BRICK (used, clinker, red, white, rug):
Manning's, Pancake Corner, Armishaw's,
Hippopotamus Restaurant, Safeway,
Meier & Frank's, J.C. Penney,
Tradewell, U.S. National Bank.

MARBLE:
Best's, Dean Witter & Co.,
Meier & Frank..

SANDSTONE:
Title & Trust Co., Hol'n One
Donut; Mario's.

SLATE:
Goldberg's Restaurant, Alpine
Hut, McCall Oil.

CERAMIC TILE:
House of Nine, Van Duyn's, Pay 'N Save,
First National Bank, Alpine Hut, Toyland.

GRANITE:
Meier & Frank, Fahey Brockman,
J.J. Newberry.

TRAVERTINE:
Rosenblatt's, Stevens & Son.

GLASS MARBLES:
Nordstrom's.

RIVER COBBLES:
Chandler's.

EXPOSED AGGREGATE:
J.C. Penney; Woolworth's, Lerner's, main stairwell.

Conclusions

From the foregoing it is quite clear that modern commercial buildings rely heavily upon the mineral industry for materials with which to wall their structures. Architectural styles in commercial buildings change from time to time. Currently there is a swing away from buildings walled almost completely with glass toward structures employing larger areas of solid walls. Mineral materials are ideally suited for this service. They are fireproof, durable, distinctive, and range in price from the low-cost, plain concrete wall to the high-cost specialty masonry job. The local demand for wall coverings attracts stone facings from distant lands and other products from many of the western states. Oregon has many attractive building stones, but very little use is made of them in the state.

Whether it is visible or not, every modern commercial building has considerable quantities of concrete in it. An essential part of concrete is the sand and gravel aggregate. Sand and gravel are low-cost commodities and a growing community needs large quantities of them close at hand if it is to remain competitive. Building stone commands a higher unit price and can be transported for greater distances than sand and gravel. Building stone sources as well as deposits of other industrial minerals must be kept available until they can be put to the best possible use.

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U. S. MERCURY REPORTS PUBLISHED

The U.S. Bureau of Mines has recently published "Mercury potential of the United States," as Information Circular 8252. The 376-page book provides information on all of the known mercury deposits of the country and gives an estimate of the domestic resources of mercury producible at various price ranges. Information Circular 8252 is for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The price is \$1.75.

The U.S. Geological Survey has issued "Mercury -- its occurrence and economic trends," by E.H. Bailey and R.M. Smith, as Circular 496. The 11-page booklet discusses the cause of the recent price spiral and the probable future of the mercury industry, and presents information on recent trends in price, production, and consumption of mercury. Circular 496 is free on application to the U.S. Geological Survey, Washington, D.C., 20242.

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TEKTITES AND OREGON'S VOLCANIC GLASSES

By Erwin F. Lange*

Small pieces of glassy materials that have been naturally etched by chemical action, eroded by wind-driven sand, or tumbled by running water are to be found in various localities in Oregon. These particles have been variously referred to as obsidianites, Apache tears, marekanites, and obsidian bombs. Often they resemble tektites and are sometimes mistaken for them. Since there is at the present time a great deal of interest in matter from space and in space research generally, and since the possibility exists that tektites are a form of space matter, a comparison of Oregon's volcanic glasses and tektites warrants careful consideration. The possibility also exists that tektites might be found in Oregon, although none have been reported to date. A general awareness of tektite properties is helpful in their identification.

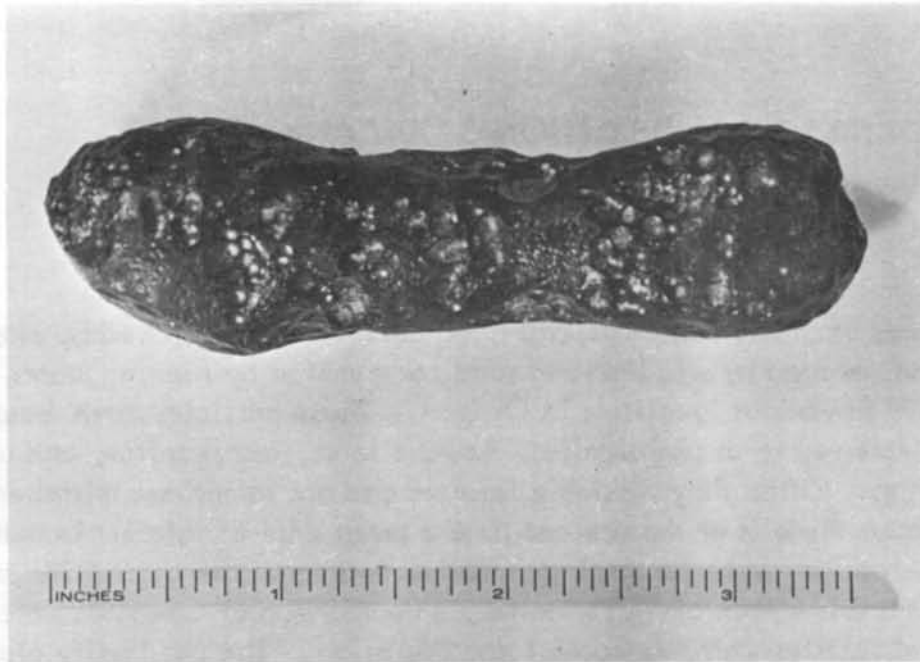
Tektites are small, naturally occurring glassy objects that have been found in a few somewhat restricted geographical areas throughout the world. They are generally characterized by peculiar shapes such as tear-drop, dumbbell, spherical, and disc, forms which indicate a rapid cooling from a molten state. The word tektite is derived from the Greek word for molten. Tektites are usually named after the geographical area in which they are found. The main localities and tektite names are as follows:

- Southern Australia - australites
- Philippine Islands - rizalites or philippinites
- Island of Billiton in Java Sea - billitonites
- Czechoslovakia - moldavites after Moldau River
- Indochina and Malayan Area - indochinites

In the United States tektites have been found in Texas (bediasites), Georgia, and a single specimen in Massachusetts (Martha's Vinyard). They have also been found along the Ivory Coast of West Africa.

The origin of tektites is unknown. In the early literature they were looked upon as a special kind of volcanic glass or as remnants of prehistoric glass makers. Some have suggested that they were fulgurites produced by

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Surface features of tektite from Thailand.



Surface features of obsidian pebble from Lake County, Oregon.

the fusing of sand or soil by lightning. Later they were regarded as glassy meteorites. In recent years, the formation of tektites has been considered to be associated with meteoritic, comet, or asteroid impact. One group looks upon the impact as occurring on the earth (Barnes, 1961), the other on the moon (O'Keefe, 1964). In either case, it is postulated that high temperatures and pressures produced by impact and explosion of large meteorites would splash materials outward and would form glassy objects shaped like tektites. Considerable support to the impact theory has developed by the discovery of nickel-iron spherules in a Philippine tektite by E.C.T. Chao of the U.S. Geological Survey and the more recent announcement* by Louis Walter of the National Aeronautics and Space Administration (NASA) of the discovery of coesite in tektites from Thailand. Coesite, a high-temperature, high-pressure form of quartz (SiO_2), is found in the great meteorite craters, and its presence is considered to be a criterion in the identification of craters formed by meteorite impact. Laboratory tests have shown that pressures and temperatures associated with volcanic activity are not sufficient to produce coesite.

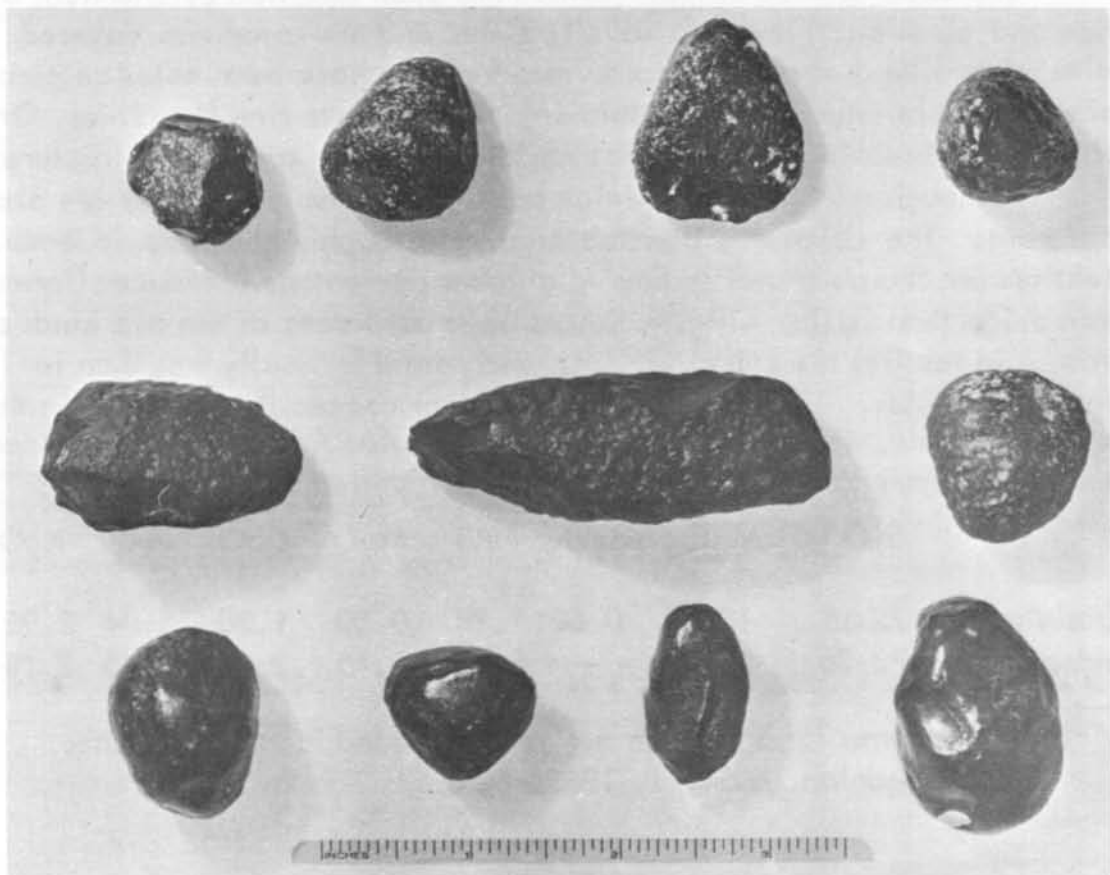
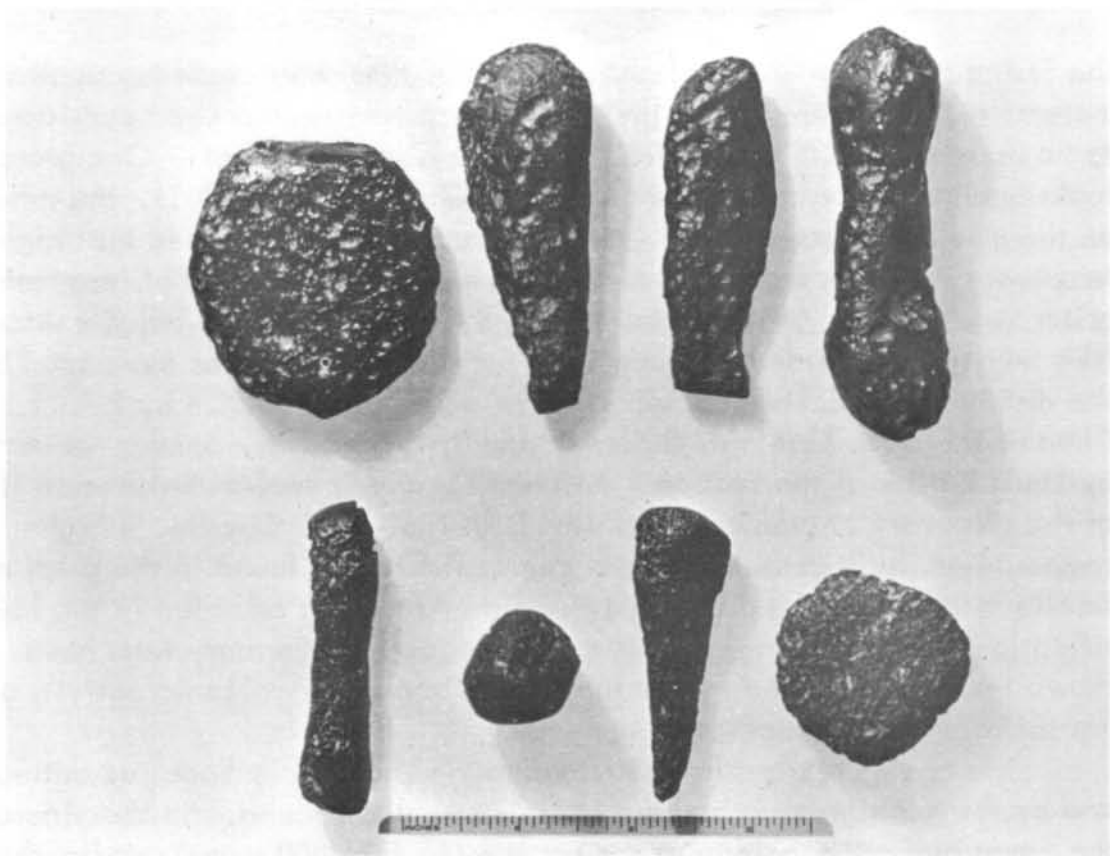
The age of tektites has been determined both by radioactive dating and by the geological formations in which they are found. Studies indicate the Texas bediasites belong to the Eocene (45,000,000 years), while the australites are the youngest group of about 5,000 years. All tektites from any particular group are of the same age.

The outer surface of most tektites has been modified by chemical action and abrasion. They are usually pitted and are sometimes covered with worm-like grooves. Similar surface features have been noted on pieces of western obsidian. Unlike obsidian, tektites have fine flow lines. On chipping or breaking tektites, like obsidian, exhibit conchoidal fracture.

Although tektites and obsidian are similar chemically, they are also different. The silica and alumina content is roughly the same in each. Tektites are characterized by having a higher percentage of reduced (ferrous) iron oxide than ferric, while obsidians have but traces of the two kinds of iron. In tektites the content of soda and potash is usually less than in volcanic glasses. The difference in chemical composition is shown in the following table, which lists an analysis for obsidian from Newberry Volcano and the analysis of an indochinite tektite as reported by Barnes (1940):

| | SiO_2 | Al_2O_3 | Fe_2O_3 | FeO | MgO | CaO | Na_2O | K_2O |
|-------------|----------------|-------------------------|-------------------------|--------------|--------------|--------------|-----------------------|----------------------|
| Obsidian | 72.35 | 13.98 | 0.60 | 1.78 | 0.30 | 1.30 | 5.04 | 3.92 |
| Indochinite | 72.26 | 13.18 | - - - | 5.32 | 2.15 | 2.42 | 1.43 | 2.15 |

* New tests show lunar surface may resemble sand found on beaches.
The Oregonian, March 1, 1965, p. 6.



Internally tektites exhibit strain patterns and often have glassy inclusions. Volcanic glasses have opaque inclusions which are rarely found in tektites.

A pronounced difference between tektites and volcanic glasses occurs on heating. In the laboratories of the Oregon Department of Geology and Mineral Industries, a number of tektites and a variety of obsidian glasses were heated to 2,000°F (1,100°C) for five minutes in a muffle furnace. All samples of obsidian exploded or expanded. One variety became a white, frothy mass similar to styrofoam. Tektite fragments of similar size from Thailand, Viet Nam, and Australia under the same conditions retained their original shape and form but became coated with a bright metallic luster. Further studies of tektites and volcanic glasses will be made as different kinds of materials become available. The writer would appreciate receiving samples of unusual tektite-like glassy objects found in the West.

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Explanation of photographs on opposite page.

Upper photograph:

Top row: Tektites from Thailand.

Bottom row: Tektites from Dalat, Viet Nam.

Note: All tektites from collection of Portland State College.

Bottom photograph:

Top row: Obsidian pebbles from Orval Butler ranch, Crooked River, Crook County, Oregon.

Middle row: Obsidian pebbles from Thorn Lake, Lake County, Oregon.

Bottom row: Apache tears from Wasco County, Oregon.

TEKTITES ON EXHIBIT

Tektites from Thailand, Australia, and Viet Nam are now on display in the Department's Portland office. All of the tektites are from the Portland State College collection and were loaned by Dr. Erwin Lange, author of the above article. The exhibit includes obsidian pebbles from central Oregon that look like tektites and also furnace-treated specimens.

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WILD RIVERS BILL WOULD AFFECT ROGUE RIVER

S. 1446, a bill to establish a National Wild Rivers System, has been introduced into the U.S. Senate by Church (Idaho) and 28 others. The bill defines a "wild river area" as a stream or section of a stream, tributary, or river -- and the related land area -- that should be left in its free-flowing condition, or that should be restored to such condition, in order to promote the public use and enjoyment of the scenic, fish, wildlife, and outdoor recreation values.

Oregon's Rogue River from Grants Pass to the Pacific Ocean is designated as a "wild river area." Other rivers thus named in the bill are segments of the Salmon River in Idaho, the Clearwater in Idaho, the Rio Grande in New Mexico, the Green River in Wyoming, and all of the Suwannee River in Georgia and Florida. Additions to this system are also recommended in the bill.

The bill would provide, among other things, that "Nothing in the Act shall affect the applicability of the United States mining and mineral leasing laws within the National Wild Rivers System, except that all prospecting, all mining operations, and all other activities on a mining claim perfected after the date of this Act, either before or after the issuance of patent, and all mining operations and other activities under a mineral lease, license, or permit hereafter issued, shall be subject to such regulations as the Secretary of the Interior, or the Secretary of Agriculture in the case of national forest lands, may prescribe to effectuate the purposes of this Act. Any patent so issued shall recite this limitation. All such regulations shall provide among other things for safeguards against pollution of the river. Any portion of a wildriver area that is within the national wilderness preservation system shall be subject to the mining and mineral leasing provisions of both the Wilderness Act and this Act, and in case of conflict the more restrictive provisions shall apply."

The Senate Interior and Insular Affairs Committee scheduled hearings for April 22 and 23; Interior Secretary Stewart L. Udall and Agriculture Secretary Orville L. Freeman were expected to testify on the proposal.

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