Technical Papers

Eocene Volcanism in Central Utah[1]

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Work during the past three field seasons in Long Ridge, central Utah, has disclosed several important stratigraphic relations in the regional geology of the area. They are presented briefly here in anticipation of a forthcoming longer paper so that they may be immediately available to other workers. Long Ridge is located about 10 miles east of the Tintic mining district and extends southward about 30 miles; the area specifically under consideration is at the southern tip of Long Ridge, about 7 miles southwest of Levan, Utah.

At this locality about 870 ft of thin-bedded Green River limestone and shale crops out in unbroken succession. In the upper 200 ft of the formation bentonitic tuffs are intercalated with the limestones, some of which contain much biotite. Conformably above this sequence is the Golden's Ranch formation, a series of tuffs, bentonites, and volcanic boulder conglomerates. This sequence can be seen along the new roadcuts of U. S. Highway 91 southwest of Levan.

Six miles to the northwest the same section is again found, except that the lower part of the Green River is covered. In addition, 820 ft above the base of the Golden's Ranch formation, a relatively pure limestone with abundant plant remains crops out. The plants in the limestone, which is here named the Sage Valley limestone member of the Golden's Ranch formation, have been determined as upper middle Eocene or lower upper Eocene by Roland W. Brown. A comparison of thin sections of boulders from the volcanic conglomerates *below* the Sage Valley limestone with those prepared from flows in the latite series of the Tintic area shows that the boulders are from the flow areas. Hence, the flows are clearly somewhat older than the boulders derived from them and are therefore middle or lower upper Eocene in age. Further, field tracing of the volcanic conglomerates in the Golden's Ranch brings to light the fact that they grade laterally into volcanic breccias that are an intimate part of the latite series in the northern part of the area and in the Tintic district (*1*).

The history of the area, during at least a part of the Eocene, as determined from the above observations, is briefly as follows: While calcareous and argillaceous sediments of the upper Green River were being normally deposited in a shallow lake, volcanic eruptions began in the Tintic area to the west. Flows and breccias were deposited on relatively steep slopes (*2*) while airborne volcanic products were being interbedded with the Green River sediments in the lake. Continued volcanism and the work of streams on the volcanic products resulted in the deposition of coarse volcanic conglomerates and tuffs and the cessation of lacustrine limestone deposition. At some time after the initiation of volcanism a new water body of probable local extent and irregular outline existed; in it was laid down the Sage Valley limestone. Above it were deposited more volcanic conglomerates and tuffs. Their age cannot yet be accurately determined.

The occurrence of plant fossils, associated with volcanics, together with the gradational relations between the well-dated Green River formation and the Golden's Ranch formation, and between the latter and the latite series, presents the first specific dating of the widespread volcanism of central Utah. Previously, this had generally been considered to be much younger (*1, 3*).

[1] The author gratefully acknowledges the financial support of the Atomic Energy Commission and of The Ohio State University.

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Inadequate Stimulation of Olfaction

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Several workers in the field of olfaction have reported difficulties in obtaining test spaces for research purposes with an absolute zero level of odor. Such spaces are needed in olfactory research to serve as control rooms for comparison with test rooms of low odor levels, to act as reservoirs for the introduction of odors near threshold concentrations, and for the operation of odor test panels.

The use of activated carbon as an air-cleaning device to remove all sources of olfactory stimulation from a test space can be successfully carried out provided certain precautions, as described here, are taken. In the absence of such measures, a test space in which air has been purified by activated carbon sorbents may give rise to an odor variously described as "yeastlike" or "alcoholic," which, though not unpleasant and often even unnoticed by a lay observer, interferes with an olfactory research program (*1*). The theoretical implications of this phenomenon are of great interest. We have found that the olfactory stimulation in such cases is related to an inert aerosol, and hence is an "inadequate" stimulation of olfaction in the sense that no gas or vapor is invloved.

Experimental generation of the odor. Fig. 1 shows an arrangement of apparatus suitable for a reliable olfactory detection of the aerosol in question. *A* is a

ball rotameter covering the range of 10–100 liters/min of air flow (Fischer & Porter Co., Hatboro, Pa.), and *B* is a 6- to 14-mesh granulation of an appropriate sorbent. Compressed air (usually foul in odor) is passed through the following in series: a glass wool filter, a 4-in. layer of anhydrous calcium chloride, a 4-in. layer of granular silica gel, and an appropriate humidifier, if desired. The air is then introduced into the rotameter *A*. An aerosol stimulation is then detectable in the exit gas when the granular material *B* is any grade of activated carbon, whether of gas or liquid adsorption type of pore structure.

Detection is facilitated when the nose is placed so that the exit gas from *B* is directed toward the nostrils. Some sophistication in odor detection on the part of the observer is necessary, but once this is acquired, the ability to identify the stimulus, with or without blindfold, never fails. Six subjects have been used in the tests in this laboratory. Foster (*1*) has similarly reported unequivocal detection of this stimulus.

Because the "yeasty" quality of the stimulus may suggest a microorganic origin, the following experiment was carried out. Activated carbon was transferred directly from the furnace in which it was manufactured, while glowing cherry-red, into a steam-cleaned Pyrex flask, then sealed with a ground-glass stopper and brought to the laboratory for test. The aerosol stimulation as described above was unchanged. This eliminates the possibility of microorganic origin.

The same quality of olfactory stimulation was obtained when various other black sorbents were substituted for carbon in *B*. These sorbents included (*a*) silver on silica gel, prepared by adding aqueous silver nitrate to silica gel in a hydrogen atmosphere, then drying the product; (*b*) cobalt oxide-nickel oxide, Co_2O_3—NiO, on activated alumina, prepared by impregnating the alumina surface with an aqueous solution of the nitrates, drying at low temperatures, and then decomposing the nitrates. Colored adsorbents substituted for the carbon in *B* gave olfactory stimuli of varying intensities and perhaps qualities. These sorbents included the following: *white*—activated alumina; *green*—chromium oxide, Cr_2O_3, on activated alumina, prepared by decomposing ammonium dichromate on the alumina surface; *blue*—cobalt aluminate, Thenard's blue, $Co(AlO_2)_2$, prepared by low-temperature wet decomposition of cobalt nitrate on alumina; *reddish-brown*—iron oxide, Fe_2O_3, on activated alumina, by decomposition of precipitated ferric hydroxide on the alumina. Untreated silica gel (colorless) does not produce the stimulus.

Examination of carbon for foreign vapors. A 300-ml (150-g) sample of carbon was heated to 100° C and evacuated at high vacuum, using a mercury diffusion pump, through 3 collecting traps cooled in ice, dry ice, and liquid air (*2*). Pumping was continued for 1 hr. The traps were then closed off, and the contents of each admitted to the sample system of a mass spectrometer. After atmospheric and background peaks were accounted for, the result was a complete blank. Since the volume of the traps was 50 cc, the leak pressure 1.2 cm, and the sensitivity of the instrument 12.5 scale divisions/mm of gas pressure, and assuming, conservatively, a minimum detectability of 1 scale division and a gas of mass 50, the maximum possible quantity of undetected impurities is 1.3×10^{-5}g. On the basis of a 150-g sample of carbon, the maximum amount of undetected impurities would be less than 9 millionths of 1%. The sample of carbon thus subjected to high vacuum degassing, when returned to the odor test apparatus, gives the same aerosol stimulation.

Aerosol filtration. The passage of the effluent air from the sorbent *B* (Fig. 1) through a suitable dry fibrous filter produces air at a zero level of stimulation. The filter recommended is that described by W. J. Smith and E. Stafford, of Arthur D. Little, Inc. (*3*), and should be used with a linear air flow of 5 ft/min through the filter bed. For suitable treatment of air for odor research purposes, a system combining cells or canisters containing efficient gas adsorption activated carbon (*4*) with the dry fibrous filter described by Smith and Stafford is therefore recommended.

The evidence disclosed indicates that inert aerosols can provide some olfactory stimulation. An attempt was made to examine the aerosol particles by passing the effluent air from *B* (Fig. 1) through a thermal

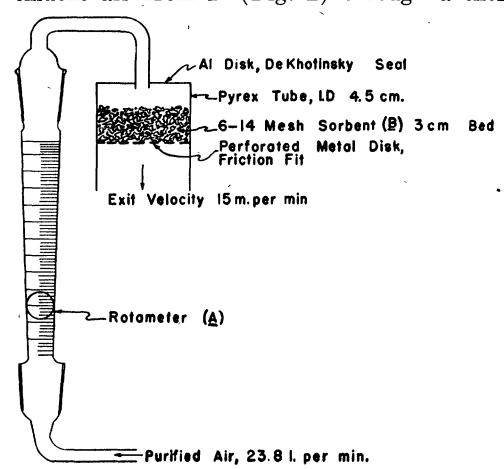

FIG. 1.

precipitator, using a cold plate coated with Formvar and by examining the collected matter with an electron microscope. Some particles in the size range around 5 μ were collected. No systematic study was undertaken, however, to relate the production of particles to the production of odors.

The experimental facts presented in this paper are consistent with the infrared absorption theory of odor of Beck and Miles (*5*) and would be interpreted by this theory as scattering or absorption of the infrared radiation by particles of different sizes, colors, and shapes in contact with the sense cells (*6*). Color variations would be indicative of variation of infrared absorption in the 7.5–15 μ region of postulated sensitivity. Particle shape would influence the maximum

of absorption. Size would influence both the amount absorbed and the scattering coefficient, which is maximal for 10 μ radiation when particles are in the size range of 5–15 μ. The evidence, however, is not to be taken as a proof of this theory.

The production of sorbent aerosols may well be related to thermal chipping caused by local temperature rises on the adsorbent surface caused by heats of adsorption of atmospheric moisture and possibly other normal atmospheric gases. A rise in the humidity of the air entering the sorbent, accompanied by increased adsorption of moisture, generally causes some increase in the intensity of the olfactory stimulus.

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A Simple Method of Mounting Gross Biologic Material in Plastic Boxes[1]

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A simple, quick, and inexpensive method of mounting gross biologic material in acrylic plastic[2] should be of wide interest. Gross slices of tissue fixed in formalin or other suitable preservatives are permanently mounted in nonbreakable, transparent boxes. Approximately 20 min is required to prepare each section, and no special equipment is needed. Specimens mounted in this manner three years ago have shown little change in color and no leakage.

A wide variety of biologic materials usually preserved in glass jars may be preserved by this method. Gross brain sections in plastic boxes are of great value in the teaching of neuroanatomy and neuropathology. Many other normal and pathologic human and animal tissues may be similarly mounted. Since the specimens are in nonbreakable containers, they may be handled freely and may be shipped anywhere. Material prepared in this way requires very little space for display in a museum. Indeed, a small museum may be contained in a standard filing cabinet ready for display any time.

The materials and method used in the mounting of gross brain material are presented as an example of one of the uses of this simple method.

[1] Specimens preserved by this method were presented as an exhibit at the meeting of the American Academy of Neurology, Virginia Beach, Va., April 11–13, 1951.

[2] Plexiglas (Rohm & Haas) and Lucite (Du Pont) have both been used.

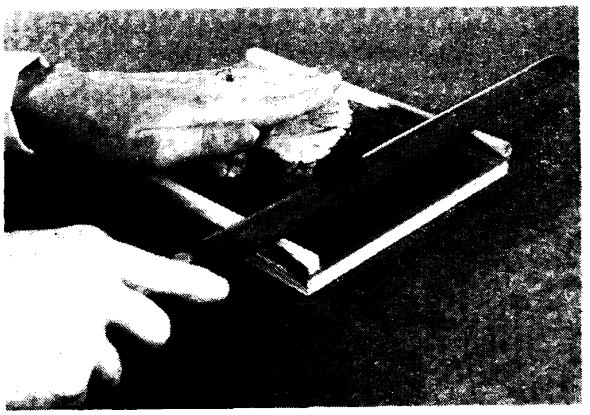

FIG. 1. Specimen being sectioned on a simple cutting board.

FIG. 2. Specimen is sealed in plastic box.

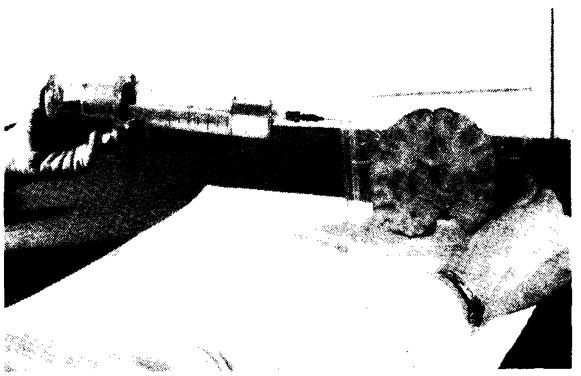

FIG. 3. Filling plastic box with formalin solution.

Transparent plastic boxes with fitted lids were ordered from a local manufacturer of plastic products according to the following specifications for each box:

A. A ⅛" rectangular plastic sheet for the bottom of the box cut in one of the following sizes: 7" × 5¾", 6¼" × 5½", or other size as needed. End pieces ¼" thick and ¼" high sealed to all four margins of the bottom sheet. A hole 1/16" in diameter bored in one of the end pieces.

B. A lid of ⅛" thickness in size identical with the bottom of the box.