thesized in vivo with RF-DNA and the single-stranded DNA of the mature virus. Such experiments have been carried out and are described in detail elsewhere (*16*). The data demonstrate that in the intact cell only one strand is transcribed and that it corresponds to the complement of the one found in the mature virus particle (*17*).

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20. Abbreviations: ATP, GTP, UTP, CTP, adenosine, guanosine, uridine, and cytidine triphosphates, respectively; UMP, uridine monophosphate; cpm, count/min; PCA, perchloric acid; SSC, 0.15*M* NaCl, .015 Na citrate.

7 May 1963

Cretaceous, Paleocene, and Pleistocene Sediments from the Indian Ocean

Abstract. *Two deep-sea cores containing Cretaceous, Paleocene, and Pleistocene sediments from an oceanic rise approximately 500 miles southeast of Cape Town contained well-preserved fossil foraminiferal ooze made up of about 97 percent planktonic forms, including species of* Guembelina *and* Hedbergella. *High percentages of particles less than 53 μ in diameter in the Cretaceous and Paleocene sediments indicate a deep-water open-ocean depositional environment. These sediments are the oldest recovered so far from the Indian Ocean.*

Pre-Pleistocene rocks were first dredged in the Indian Ocean on the west side of Providence Reef (9°25.8′S, 50°56.8′E). Wiseman (*1*) has described these Eocene and Oligocene basaltic agglomerates. Wiseman and Riedel (*2*) found Tertiary Radiolaria in two samples of sediments of 20°40′S, 85°29′E, and at 8°45′S, 64°52′E.

In recent years, 87 long, submarine cores from the Indian Ocean have been collected by Lamont Geological Observatory. Two sets of cores taken from near the top of a rise are described in this report. One long, piston core and its short, trigger-weight core contained sediments of Paleocene age; the other piston and trigger-weight cores contained Cretaceous deposits.

The piston-core sediments are white compacted calcilutite overlain by 7 to 8 cm of light beige, friable Pleistocene foraminiferal calcilutite mixed with older sediments. The trigger-weight cores contain rounded pebbles, granules, sand, compacted calcilutite, and friable manganese oxide nodules. The old sediments contained planktonic Foraminifera, calcareous and arenaceous benthonic Foraminifera, Ostracoda, Radiolaria, and coccolithophorid plates. Discoasters were not found. A few fish-teeth fragments and echinoid spines were the only megafossils found. *Inoceramus* prisms were observed only in the Cretaceous sediments. The fossils indicate an open-ocean environment.

The microfossils were identified under a binocular microscope after the sediment had been washed through a sieve which retains particles larger than 53 μ.

Core V16-55. Location; 40°14′S, 25°15′ E. Core length, 179 cm; water depth, 2770 m.

Trigger weight core. Megascopic description: Several alter igneous rock fragments and compacted calcilutite and manganese oxide nodules.

Piston Core. Megascopic description: At 0 to 7 cm: Pleistocene, light tan, friable foraminiferal lutite. Contact blurred by burrowers.

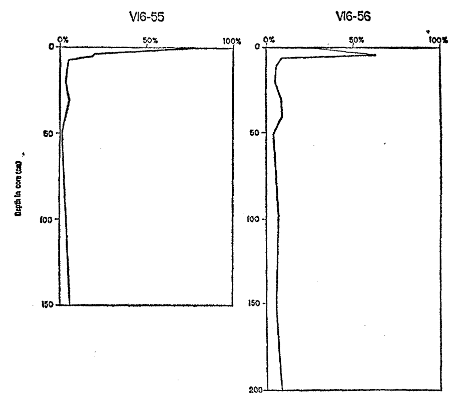

Fig. 1. Variation in percentage of coarse fraction (> 53 μ) in cores containing pre-Pleistocene sediments.

At 7 to 179 cm: white compacted Paleocene calcilutite.

At 100 to 179 cm: micronodules of manganese oxide present.

Calcium carbonate content: top, 90 percent; 100 cm, 89 percent.

Micropaleontological description: 0 to 1 centimeter: Pleistocene Foraminifera make up 98 percent of the total foraminiferal assemblage. Out of these, 2 percent are benthonic species. About 2 percent Paleocene Foraminifera were present at this level. In addition, echinoid spines, glauconite, and quartz grains were seen.

Between 4 and 6 cm in depth, the Pleistocene Foraminifera were still making up the bulk of the washed sample. The number of Paleocene Foraminifera increased, making up 5 percent of the faunal assemblage.

In the Paleocene section (7 to 179 cm), the following index species of planktonic Foraminifera were identified: *Globigerina triloculinoides, Globorotalia pseudobulloides, Globorotalia mokannai, Chiloguembelina victoriana, Chiloguembelina crinita, Globorotalia compressa, Globorotalia whitei, Globorotalia elongata* (*3*). Benthonic Foraminifera make up 3 to 4 percent of the washed foraminiferal fauna. In addition, Ostracoda, Coccoliths, and fish-teeth fragments were found.

Core V16-56. Location: 41°21′S, 26° 38′E. Core length, 240 cm; water depth, 2950 m.

Trigger-weight core. Megascopic description: several friable manganese oxide nodules were recovered.

Piston Core. Megascopic description: At 0 to 8 cm: Pleistocene, light tan, friable foraminiferal lutite mixed with Cretaceous faunal remains; base indefinite, blurred by burrowers. At 8 to 240 cm: white compacted Cretaceous foraminiferal calcilutite. The calcium carbonate content of a sample taken at 100 cm depth is 89 percent.

Micropaleontological identification: At 0 to 1 cm: Pleistocene Foraminifera make up 20 percent of the total foraminiferal assemblage. Benthonic Foraminifera make up 3 percent of the Pleistocene foraminiferal assemblage. *Inoceramus* prisms and echinoid spines were present. Cretaceous forms make up 80 percent of the foraminiferal assemblage.

Between 4 and 8 cm, Cretaceous microfauna, mixed with Pleistocene microfauna, were present.

At 8 to 240 cm, the following planktonic index fossils were seen: *Globigerinelloides eaglefordensis, Hedbergella brittonensis, Hedbergella delrioensis, Guembelina complanata, Guembelina globulosa* (*4*). Benthic Foraminifera make up 3 to 4 percent of the washed foraminiferal fauna. In addition, Ostracoda, Radiolaria, *Inoceramus* prisms, coccolithophorid plates, and echinoid spines were identified.

Variation with depth in the amount of the coarse fraction of sediment (Fig. 1) suggests conditions different from the present at the time of deposition of the old sediments. The high percentage of fine fraction in the old sediments is characteristic of deposits in deep and broad basins remote from strong bottom currents. The presence of manganese nodules and the larger percentage of coarse fraction (Fig. 1) of recent sediments are due to removal of the finer fraction by bottom currents (*5*). The induration of the old sediments is probably due to compaction under a former sediment cover and not cementation (*6*). If the stratigraphic unconformity is due to slumping of sediments which occurred as a result of local instability triggered by post-Paleocene tectonic uplift, then the missing sediments might be recovered on the slopes of the rise (*7*).

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13 March 1963

Ozone Damage: Protection for Plants

Abstract. *Tobacco plant leaves treated with dried particulate charcoal, diatomaceous earth, and powdered ferric oxlde so that a covering formed on the leaves were relatively undamaged by comparison with untreated controls when exposed to as much as 0.9 part of ozone per million in the atmosphere. A theory is offered to explain the results.*

Ozone in the atmosphere can damage plant leaf structure. Pathological lesions on the upper leaf surfaces and premature falling of leaves occur on grape vines in areas polluted by airborne ozone. The damage is designated as ozone stiple of grape leaf (*1*). The leaf stiple occurs in the vicinity of Los Angeles and San Francisco, areas where the concentration of ozone is high. In Connecticut and Massachusetts (*2*) weather fleck of tobacco has been identified with ozone injury. In New Jersey ozone damage has been observed on spinach, alfalfa, cereals, red clover, beans, parsley, and grapes (*3*). Many species of common plants can be readily injured by exposure to ozone. Certain compounds, utilized as fungicides, can protect tomato foliage in the field from damage apparently caused by excessive atmospheric ozone (*4*). Other chemical agents preventing ozone damage have been used in an experimental program to impregnate field tents for shade-grown tobacco (*4*). These "antiozonants" apparently protect the tobacco and tomato plant by destroying the ozone in the atmosphere surrounding the plants.

The polyvalent metals such as iron, cobalt, nickel, manganese, chromium, vanadium, and the platinum metals are excellent catalysts for the destruction of peroxides. In this case, I believe that the shade cloth was effectively treated with polyvalent metal ions which were responsible for the catalytic decomposition of the ozone. If one considers the reactions

$$O_3 \rightarrow O_2 + O \qquad \Delta H_1 = 24.1 \text{ kcal} \qquad (1)$$

$$M + 2O \rightarrow O_2 + M \qquad \Delta H_2 = -116.4 \text{ kcal} \qquad (2)$$

it becomes apparent that it is undesirable to have these reactions taking place directly at the surface of the leaf. ΔH is the heat of reaction and M is a third body.

Instead, it would be desirable to decompose the ozone at some distance away from the leaf surface. The endothermic decomposition of ozone by Eq. 1 is well known. The exothermic formation of oxygen molecules, according to Eq. 2 yields 116.4 kcal/mole. It would be undesirable to have the oxygen atom recombination of Eq. 2 take place directly on the leaf of the plant, since the reaction is a three-body collision in which the leaf surface could be the third body. This exothermic reaction would be expected to burn the leaf and to produce lesions.

In view of this theory, some further experiments were made on the effect of using finely powdered material such as diatomaceous earth, powdered charcoal, powdered ferric oxide, and other particulates as dispersions that would be reasonably effective catalysts for the decomposition of ozone. Such particulate matter, sprayed on the plants and dried, would produce an extremely high surface to volume ratio of catalytic surface substance, capable, by heterogeneous catalysis, of destroying the ozone at some distance from the surface of the plant leaf, so that the heat of reaction of Eq. 2 would leave the surface of the catalyst by radiation.

A glass-lined cube-shaped chamber for experimental fumigation, approximately 3 feet on edge, was equipped with an air-exhaust fan, a Welsbach-type of ozone generator, and flow meters for regulating the ozone concentration in the air at room temperature. Clean air was introduced into the chamber through a carbon filter; a hydrating device maintained the air humidity in the fumigation chamber at approximately 60 to 70 percent. The concentration of ozone was measured continuously and recorded by a potassium iodide–ozone measuring meter. The flow rate of gas to the chamber was

Table 1. Protection of plants by particular agents from damage by ozone. Injury scale: none, N; slight, S; moderate, M; heavy, H.

Protectant	Injury
3¾ hours at 0.4 part O_3 per million	
Diatomaceous earth	N–S
Charcoal	N–S
Fe_2O_3	N–S
Tulare clay	S
S	S
Kaolin	S
None	H
3½ hours at 0.9 part O_3 per million	
Diatomaceous earth	S–M
Fe_2O_3	N–S
Charcoal	N–S
Tulare clay	S
Kaolin	S
S	M
None	H