nillin in ethanol and then acidifying the mixture with three drops of concentrated $H_2SO_4$. Resistant and highly susceptible varieties gave no color. Moderately susceptible varieties gave dark purple, indicative of flavanol (*5*). The presence of oxidized or reduced compounds in mechanically injured pericarp tissue was determined by thoroughly crushing pieces of pericarp in five drops of an aqueous solution of $FeCl_3$ and $K_3Fe(CN)_6$ (each 0.3 percent). Resistant varieties gave a greenish-black color; moderately susceptible varieties gave a bluish-black color; and capsules of highly susceptible varieties gave a clear blue color (Prussian blue). The development of blue or green colors with the reagent occurs with reduction or oxidation of iron ions. The black color is characteristic of many oxidized phenolic compounds.

The relation of the reactions with the two reagents to the resistance to the hydrolytic enzymes was determined from tests with capsules of 228 plants segregating for resistance. Ten or more capsules of each plant were tested with Pectinol 59L for enzyme susceptibility, and four or more capsules of each plant were tested with the two reagents. A correlation coefficient of .79 was found for resistance to the enzymes and the "resistance" reactions with the reagents. Although capsules of many plants showed intermediate reactions with the two reagents and the enzyme, it is significant that none of the capsules that showed resistance reactions with the reagents were susceptible to the enzyme.

The experiments indicate that the resistance of castor bean capsules to *Botrytis* can be determined easily by the enzymatic tests and by the reactions with vanillin and $H_2SO_4$ and with $FeCl_3$ and $K_3Fe(CN)_6$. Chromatographs show the vanillin-reacting flavanol to be present only in moderately susceptible tissue. Other phenols appear to be present in tissues of all levels of resistance. Oxidation of water extracts of resistant tissue in the presence of pectic and cellulolytic enzymes results in considerable inactivation of the enzymes. Resistance, as reported for certain other diseases (*4*), appears to be due to enzyme inactivation by oxidation products of polyphenols. Phenols differ in their ability to inactivate enzymes (*4*), and differences in polyphenols in the capsules of varieties of castor bean may be important in determining differences in varietal susceptibility. However, oxidation of the phenolic compounds by polyphenoloxidase in injured tissue also is involved in resistance (*4*), and this may be involved in the reactions of the crushed tissue in $FeCl_3$ and ferricyanide. In preliminary experiments, it appears that the peroxidase activity of resistant capsule pericarp is significantly greater than that of susceptible tissue (*6*).

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## Age and Accumulation Rate of Dolomite-Bearing Carbonate Sediments in South Australia

Recent studies of the sediment forming in shallow, ephemeral lakes and in the Coorong, a shallow arm of the sea, in the southeastern part of South Australia indicate that a calcian dolomite and a magnesian calcite are forming today by direct precipitation from saline waters (*1*). The waters range in salinity from half to about four times the salinity of sea water, but the ionic balance is very close to that of sea water. Further studies in the same general area (*2*) have shown that other ephemeral lakes with a different water composition precipitate aragonite, magnesite, and hydromagnesite. The season during which the carbonates have been observed to precipitate is a short period in early summer (October and November) when water accumulates to a depth of 1 to 2 feet in the lakes and vigorous plant growth takes place.

One of the ephemeral lakes (Lagoon M, 36°40'S, 139°54'E) in which precipitation has been observed on several occasions (*3*) was studied intensively by one of us (H.C.W.S.). A bore hole put down in the center of the lake in 1957 revealed carbonate sediment 30 inches thick. A 10-g sample taken 1 to 2 inches below the surface contained equal amounts of calcite and dolomite, with traces of quartz and clay minerals. A 20-g sample taken 19 to 20 inches below the surface consisted predominantly of calcite but contained minor amounts of dolomite and traces of quartz and clay minerals. Both samples were subjected to radiometric analysis to determine their absolute ages by the carbon-14 method. The sample obtained 1 to 2 inches below the surface (field sample No. S4-2; laboratory sample No. W-1100) was too small to be dated any more precisely than "less than 600 years" ago. It is unfortunate that a pure dolomite fraction could not be separated for testing; since this sample contained equal amounts of dolomite and calcite, some of the carbon-14 activity must reside in the dolomite. The maximum possible age of the dolomite is 1200 years; this makes these South Australian deposits the first authenticated modern dolomite locality.

The age obtained for the sample from a depth of 19 to 20 inches (field sample No. S4-20; laboratory sample No. W-1101) was 3000 ± 600 years, indicating an age difference between the two samples of approximately 2500 years. Thus, during an interval of approximately 2500 years, 457 mm (18 in.) of carbonate sediments accumulated, indicating an average rate of accumulation of approximately 0.2 mm per year. The computation requires the assumption that there has been neither a radical change in water depth nor a significant change of climate that would cause a prolonged break in the sedimentation record.

Two other estimates of the rate of accumulation of carbonate sediment have been made. Alderman (*4*) calculated a possible sedimentation rate from the composition and depth of water in one of the ephemeral lakes. His figure of 1 foot per 700 years corresponds to a rate of approximately 0.44 mm/yr. C. von der Borsch (*5*) arrived at a similar figure by counting laminae, presumably annual, in the aragonite-hydromagnesite sediments.

Alderman and Skinner (*1*) reported that a water sample with fresh precipitate still suspended had a sediment content of 0.05 g per 100 ml of lake water,

and that the sediment consisted of equal amounts of calcite and dolomite. The precipitation is believed to be due to elevated *p*H of the waters caused by photosynthesis of the aquatic plants. This would certainly produce wide local variations, and undoubtedly conditions suitable for precipitation of carbonate minerals would be fortuitous rather than usual. The phenomenon certainly does not occur every day during the plant growth period, and indeed in some years—for example, 1957, an extremely dry year—no precipitation would occur at all.

Nevertheless, a calculation can be made from the value for suspended sediment if we make some assumptions, and the value thus derived agrees quite well with the values already given. If we assume a density of the compacted sediment of 2.5 g/cm$^3$ (about 10 percent less than the density of the pure solid phases), a mean water depth of 50 cm, and precipitation on 5 days annually, we find that the sediment will accumulate at a rate of 0.5 mm/yr, with an uncertainty of ± 0.5 mm for any particular year. Since the area is under study, there is reason to hope that more precise data will be available in the future, but we feel that the range 0.2 to 0.5 mm/yr can be accepted with confidence as a realistic estimate of the rate of accumulation of these carbonate sediments.

As pointed out by Deffeyes and Martin (*6*), textural evidence that some carbonates may be Recent may be invalid, and all such carbonates should be analyzed by the carbon-14 method. The measurements given here prove unequivocally that the carbonates reported are Modern, and they support the suggestion (*1*) that these carbonates are still forming today.

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## Self-Maintained Visual Stimulation in Monkeys after Long-Term Visual Deprivation

Abstract. *Newborn monkeys reared in darkness for 16 months, except for daily 1-hour periods of exposure to unpatterned light, were allowed to press a lever to obtain unpatterned light. The animals showed apparently insatiable responding, at rates that were extremely high as compared with rates for normally reared control animals.*

It was established in an earlier study (*1*) that the amount of visual stimulation a monkey will give itself is a function of the duration of deprivation from light just prior to the test period. At the same time it was suggested that the response rate is also a function of the long-term level of visual input from the environment. In the study reported here, monkeys with very different histories of exposure to visual stimulation were compared with respect to their rates of self-maintained visual stimulation after deprivation from light of fixed duration immediately prior to the test.

Within the first month of life two monkeys [one a *Macaca mulatta,* one a *Macaca irus* (a cynomolgus)] were taken from their mothers and maintained separately in totally dark air-conditioned boxes that were partially sound-proof and large enough to allow adequate exercise (*2*). These boxes were located in a light-tight room; bottle feeding, handling, and feeding with solid foods were carried out in total darkness or with the animal's face effectively masked. To prevent retinal degeneration and blindness (*3*) the monkeys were exposed to diffuse unpatterned light for 1 hour daily, as follows. Each animal was removed from the living quarters in total darkness and seated in a restraining chair. Its neck was placed in a horizontal pillory which restrained the head comfortably and prevented the admission of light from below. Two domes of frosted Lucite, placed one inside the other, were positioned over the head of the animal so as to admit only unpatterned light from an incandescent light source housed in a chamber which covered the top of the chair. After this daily 1-hour exposure to light the monkeys were returned to the dark living quarters. The control animals were two monkeys (one a *Macaca mulatta,* the other a *Macaca irus*), of the same age as the experimental animals, that had been raised normally.

After 16 months under these conditions a phase of daily test sessions was initiated in which the rate of self-maintained visual stimulation was measured for both groups. Each animal was placed in a restraining chair and allowed to press a lever with its hands. Each lever press produced light for 1 second inside the chamber above the translucent domes. The duration of the light was independent of the duration of the initiating lever press, and independent of lever presses made while the light was on. Two measures were recorded: (i) the total number of responses (lever presses) and (ii) the total number of illuminations. In this way it was possible to determine the total duration of light produced by the animal and to obtain some general index of the monkey's motivational state as measured by the total number of responses. The test session for each experimental animal was terminated when the monkey had produced light of total duration of 1 hour. The regimen established during the first 16 months of life was thereby maintained. In order that the control animals and the experimental animals should experience equivalent periods of visual deprivation in each 24-hour period immediately prior to the test session, the control animals were caged in totally dark living quarters, when they were not in the test apparatus, during the phase of test sessions. The test session for the control animals was arbitrarily fixed at 2 hours. Thus, both the experimental and the control animals were maintained in darkness for at least 22 hours each day during the phase of test sessions. All the animals were tested daily, with the exception of occasional missed days distributed randomly throughout the 19 weeks of the study.

Within the first week of test sessions the animals that had been raised in darkness showed rates of response strikingly higher than even the highest rates for the control animals of this or the earlier study (*1*). In the second week of test sessions the average response rate for the two experimental animals had risen to 3400 and 2350 responses per hour, respectively, as compared with averages of 100 per hour for the two controls. The dark-reared animals maintained this high rate of response consistently in test sessions extending over a period of nearly 5 months;