Ingle (*4*) has shown that the daily growth rate of Florida oysters in May and June may vary from 0.3 to 1.3 mm per day. The higher figures are doubtless daily maxima not maintained over the year, for otherwise oysters would attain a length of 12 in. in a year's time. Both his data and those presented here show, however, that the daily increment of shell on oysters in Southern waters is surprisingly high.

References

1. Gunter, G. *Pub. Inst. Marine Science*, **1**, (2), 7 (1950).
2. Woodring, W. *Carnegie Inst. Wash. Pub.*, No. 366 (1925).
3. Geyer, R. A. *J. Marine Research*, ix (July, 1950).
4. Ingle, R. M. *Science*, **112**, 338 (1950).

Organic Origin of Some Calcareous Sediments from the Red Sea[1, 2]

Rushdi Said

Department of Geology,
Mount Holyoke College, South Hadley, Massachusetts

This note describes a preliminary attempt to decipher the origin of the calcareous part of the finer fractions of some samples collected from the northern part of the Red Sea during a voyage of the R.R.S. *Mabaheth* in 1934–35.

Shukri and Higazy (*1, 2*) have discussed the distribution, general character, and mineralogy of the samples collected by the expedition, and certain of their special features have been studied by Mohamed (*3, 4*) and Said (*5, 6*). The submarine topography of the Red Sea basin has been considered in detail by Crossland and Badr (*7*).

The Recent Red Sea sediments are whitish "coral muds" of high $CaCO_3$ content. The coarse fractions of these samples ($> 20\ \mu$) consist largely of fragmentary organic remains (as determined volumetrically under the binocular microscope: 80% corals, 5% foraminifera, 15% echinodermata, mollusca, calcareous algae, etc.). In this investigation only fractions finer than 20 μ were separated by ordinary settling methods for study. The carbonate content of these finer fractions was determined by acid leaching. It was found that the carbonate proportions in them were the same as in the bulk samples. The finer fractions were then separated in bromoform. The lighter portion, composed mainly of calcareous material, together with small amounts of clay, quartz, and feldspar, were dried and weighed. The latter accessory components in no case exceeded 3% by weight.

Spectrochemical analyses of the light part of the finer fraction of sample No. 17, and of a fragment of coral picked from the bulk sample, were made by H. C. Harrison, of the Rhode Island State College, to whom grateful acknowledgment is given. Tables 1 and 2 present the results of these determinations.

TABLE 1

Distribution of Elements in Samples

	1*	2*		1*	2*		1*	2*
Si	B^-	B	Au	X	X	B	E	E^-
Al	C^-	C	Ba	E	E	Ce	X	X
Fe	D^-	C^-	Li	X	X	Y	X	X
Mg	B^-	B	Sr	B^+	B	Nd	X	X
Ca	A	A	Rb	Not determined		La	X	X
Na	B	B^-				Gd	X	X
K	Both less than 0.1%		Cs	Not determined		Pr	X	X
						Sc	X	X
Mn	E	D^-	Hg	X	X	Ho	X	X
Re	X	X	Zn	X	X	Dy	X	X
Ti	E	E^+	Cd	X	X	Yb	X	X
Zr	X	X	Ga	X	X	Er	X	X
Hf	X	X	In	X	X	Eu	X	X
Th	X	X	Ti	X	X	Tb	X	X
Pb	F^+	F^+	Co	X	X	Lu	X	X
Sn	X	X	Ni	X	X	Tm	X	X
Ge	X	X	Pt	X	X	Sm	X	X
Cr	E	E^-	Ir	X	X	S	Not determined	
Mo	X	X	Os	X	X			
W	X	X	Pd	X	X	P	Both less than 0.01%	
U	X	X	Rh	X	X			
V	E^-	E^-	Ru	X	X	F	Not determined	
Cb	X	X	Be	X	X			
Ta	X	X	As	X	X			
Cu	E^-	E^-	Sb	X	X	Te	Not determined	
Ag	F^-	F^-	Bi	X	X			

1* Coral fragment.
2* Calcareous part of the finer fraction of sample 17, *Mabaheth* expedition.
$^+$ Higher end of concentration range.
$^-$ Lower end of concentration range.
X Sought but not found.

TABLE 2

Summary of Distribution of Elements in Samples

	A (over 10%)	B (10–1%)	C (1–0.1%)	D (0.1–0.01%)	E (0.01–0.001%)	F (< 0.001%)
1*	Ca	Si, Mg, Na, Sr	Al	Fe	Mn, Ti, Cr, V, Cu, Ba, B	Pb, Ag
2*	Ca	Si, Mg, Na, Sr	Al, Fe	Mn	Ti, Cr, V, Cu, Ba, B	Pb, Ag

The analyses show that the calcareous part of the finer fraction of the sample is almost identical in composition to that of the coral. The sample, however, contains higher percentages of Si, Al, and Fe, which is quite expectable since it was impossible to remove all the clay and other light minerals. The fact that V, B, Ag, Pb, and other trace elements exist in the calcareous part of the finer fraction, as well as in the coral, strongly suggests that the sediment owes its origin for the most part to the accumulation of abraded organic remains. The fact that corals comprise 80% of the bulk sample, and that the spectrochemical analysis of the individual coral sample closely resembles the finer fraction, seems to indicate that such

---

[1] This work was done during the summer of 1950 while the author was working under a fellowship awarded him by the Woods Hole Oceanographic Institution.

[2] Contribution No. 540, from the Woods Hole Oceanographic Institution.

organisms have contributed the largest amount of the calcareous part of the finer fraction. Some other organisms, however, may also have contributed, since additional spectrochemical analyses made for comparison did not differ greatly from that of the finer fraction (*cf.* [*8*]). The data did not completely preclude the possible existence of chemically precipitated carbonate in the sediment, however.

The conclusion that the sediments are largely organic in origin seems most significant in view of the fact that Red Sea oceanographic conditions should be, according to many proponents of the chemical deposition of $CaCO_3$ (*9–11*), ideal for such a mode of accumulation. First, the temperature of the entire water column is high throughout the year and seldom falls below 22° C even at depth during the winter. Second, the salinity ranges from $40^0/_{00}$ to $41^0/_{00}$, which is exceptionally high and is, in fact, among the highest recorded in any existing open sheet of water. Third, the diversified topography of the bottom varies from large shallow flats to deep and highly irregular basins. Fourth, the coast is reef-bound, and a tremendous supply of $CaCO_3$ nuclei should be present as the result of normal marine erosion and attrition. Fifth, although the phytoplankton is not too abundant, it is by no means inconsiderable. Sixth, some areas are continuously agitated; others essentially undisturbed. From the evidence here cited that these Red Sea sediments do not possess significant quantities of chemically precipitated $CaCO_3$, it seems valid to conclude that chemical deposition of $CaCO_3$ is negligible, at least in the present-day seas.

The optimum conditions for formation of calcareous deposits in the Recent seas are: (1) an environment conducive to proliferation of $CaCO_3$ shell-building organisms, (2) conditions under which large quantities of contaminating terrigenous materials are prevented from reaching basins of deposition, thereby masking the calcareous organic debris. For example, basins with reef-bound coasts and virtually no runoff because of aridity are probably the most favorable environments for accumulation of carbonate deposits. In the Red Sea itself, the carbonate percentage increases progressively offshore, irrespective of depth. It seems, therefore, that influx of terrigenous material, normally maximum near shore, reduces the total relative carbonate percentage.

It may also be worth while to note that the mineralogy of the finer calcareous fractions of the samples studied, as determined by x-ray diffraction measurements, indicate they are mainly calcite, with very little aragonite. This observation is of interest, as the coarser calcareous fractions from which the fine fractions are derived consist largely of aragonite (*2*). It seems, therefore, at least in the Red Sea, that inversion of aragonite to calcite requires not too much time during abrasion and transport. The stability of aragonite has long been a controversial subject, but these observations of the Red Sea sediments add evidence of the facility with which aragonite inverts to calcite under the described conditions.

References

1. SHUKRI, N. M., and HIGAZY, R. A. *J. Sediment. Petrology,* **14**, 43 (1944).
2. *Ibid.,* 70.
3. MOHAMED, A. F. *Proc. Roy. Soc. (London)*, **B**, **128**, 306 (1940).
4. ———. *Am. J. Sci.,* **247**, 116 (1949).
5. SAID, R. *Spec. Pubs. 26,* Cushman Lab. Foram. Research (1949).
6. ———. *Contribs. Cushman Found. Foram. Research,* **1**, 9 (1950).
7. CROSSLAND, C., and BADR, A. *Publs. Marine Biol. Station,* Ghardaqa (Red Sea), **1** (1939).
8. SAID, R. (In press.)
9. CLOUD, P. E., and BARNES, V. E. *Univ. Texas Pub. 4621,* 79 (1946).
10. SVERDRUP, H. U., *et al. The Oceans.* New York: Prentice-Hall (1946).
11. WATTENBERG, H., and TIMMERMANN, E. *Ann. Hydrogr. u. Marine Meteorol.,* **64**, 23 (1936).

A Tissue Culture from Potato Tuber: The Synergistic Action of 2,4-D and of Coconut Milk[1]

F. C. Steward[2] and S. M. Caplin

Botany Department, University of Rochester, New York

The conditions that enable actively proliferating tissue cultures to be established from otherwise mature nongrowing cells are of interest because they may contribute to an understanding of normal and abnormal growth—or furnish material by which the differences between growing and nongrowing cells may be investigated. Our work with these systems has been in progress for some time. This note describes a technique by which it has been possible to establish an actively growing tissue culture from the parenchyma of the potato tuber.

Proliferation of the parenchyma beneath lenticels is a familiar feature of cut potato tubers kept in a very moist atmosphere. Nobécourt (*1*) attempted to obtain a tissue culture from slices of potato tuber kept either on moist cotton or on an agar surface. These tissue slices were relatively large (250 mg), and although proliferation occurred and protuberances formed, the relative growth was small (the fresh weight doubled in 4 months). We, however, have established, apparently for the first time, actively growing tissue cultures from potato tuber which increased in fresh weight approximately 50 times in 5 weeks, and subcultures from these continue to grow actively. The technique by which this was accomplished has obvious and far-reaching implications. It seems appropriate, therefore, to describe it here.

The mature parenchyma cells of the potato tuber are certainly able to divide. When cut slices are exposed to moist air, the cell divisions near the surface lead to the formation, within the mature parenchyma, of a cork phellogen. Henceforward, the divisions of this cambium are orderly, but the behavior of the cells

---

[1] This work was carried out with the aid of a grant to one of us (F.C.S.) from the Cancer Institute of the National Institutes of Health, U. S. Public Health Service.

[2] Present address: Botany Department, Cornell University, Ithaca, N. Y.