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Elemental Carbon in a Tropical Coastal Lagoon Sediment Core

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Sediment core from an unpolluted tropical coastal lagoon (17°4'N, 100°20'W) is examined for carbon particles. The measured concentrations (0.002-0.012%) produce a flux of 10×10^{-6} g C.cm^{-2}.y^{-1} which is low but comparable to other coastal systems studied previously.

Different studies have shown that carbon particles are characteristic of burned materials and under favourable conditions the combustion products are deposited and preserved in the sediments[1-3]. A core collected from a tropical lagoon has been studied to understand the characteristics and origin of elemental carbon.

Mitla lagoon, a Mexican coastal lagoon is affected by seasonal depositional processes. This shallow body of water situated in a narrow coastal plain, has been classified as a barred inner shelf type in which the barrier formation dates from the Recent Halocene[4].

Sediment core was taken in Feb. 1980 from Mitla lagoon (Fig. 1). The core was extracted with polyvinyl chloride pipe and frozen on board ship with dry ice. In the laboratory different longitudinal sections were obtained. One section was cut into four 15 cm portions for the elemental carbon analysis.

Carbon particles were isolated by techniques previously described[3,5]. Acid-soluble and silicate minerals were destroyed by HF-HCl dissolution, and the organic phases were removed by dissolution and oxidation with KOH/H_2O_2 mixture. The residues were fractionated on the basis of their size and density to yield a >38 μm fraction with a charcoal purity of $\sim 90\%$. This fraction was weighed and studied by microscopy. Unfortunately the large number of manipulations in the technique gives poor reproducibility (20% of the average has been reported[3]). Nevertheless, these estimations can be used to discuss important aspects concerning elemental carbon.

Several specimens were prepared for X-ray diffraction to confirm the presence of graphite in the fraction of <38 μm. A Philips-Norelco diffractometer with Cu Kα radiation was used for this purpose.

Mitla lagoon, unlike most Mexican lagoons, has no present communication with the sea. However the present oligohaline conditions suggest that when communication with the littoral zone ceased, the lagoon was fresh or brackish water[6]. The supply of freshwater to Mitla is from land runoff and small temporal rivers.

The characteristics of carbon particles and the elemental carbon flux may give information about the drainage area in relation to various aspects: (1) natural fluctuations in plant burning; (2) transformations of elemental carbon; (3) natural fluctuations in the flow rates; and (4) influence of fossil fuel.

Average concentration of elemental carbon (Table 1) and the sedimentation rate in the core taken from this lagoon are lower than those of the US West Coast and Palace Moat Tokyo samples (Table 2). Thus the flux of elemental carbon to the Mitla lagoon is 2 to 7 times smaller than those to coastal US zones, but 20 or more times smaller than those to the Tokyo area.

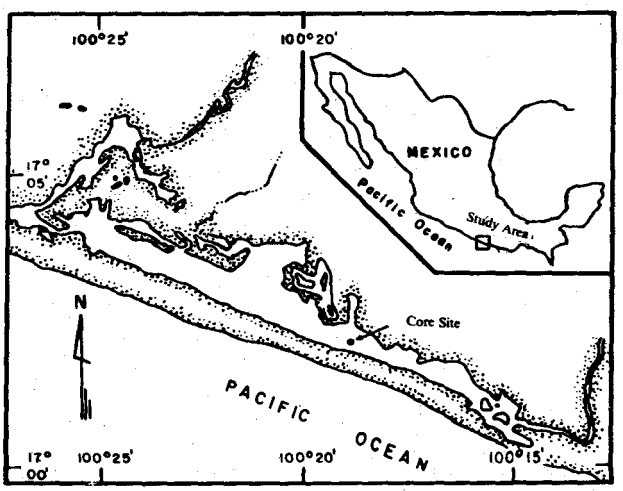

Fig. 1—Location of sediment sample in Mitla lagoon, Mexico

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Table 1—Elemental Carbon Concentration in Sediment Dried at 110°C

Sediment depth (cm)	WT (% C)	Sediment depth (cm)	Wt (% C)
0-15	0.002	30-45	0.003
15-30	0.005	45-60	0.012

Table 2—Elemental Carbon Flux

Location	Av. C conc. (wt %)	Rate of sedimentation ($g.cm^{-2}.y^{-1}$)	Carbon ($g.cm^{-2}.y^{-1}$)
Mitla lagoon	0.005	[a]0.196	10×10^{-6}
Santa Barbara basin	[c]0.029	[b]0.088	[c]26×10^{-6}
Saanich inlet	[c]0.055	[b]0.134	[c]74×10^{-6}
Palace Moat Tokyo	[d]0.541	[d]0.43	233×10^{-6}

[a]Páez-Osuna & Mandelli[7]; [b]Bruland[8]; [c]Griffin & Goldberg[3]; [d]Goldberg *et al.*[9]

SEM of charcoals reveals 2 groups of particles in the >38 μm fraction: (1) elongate-prismatic particles and irregular fragments with pits or cells, related with wood burning (Fig. 2a); and (2) particles of laminar form with pits which result from coconut burning (Fig. 2b). The presence of these latter particles suggests that the surrounding areas have an important influence in the type of charcoal present in the lagoon sediments. No particles that had the characteristics of oil and coal origins were evident.

Graphite, another form of carbon was identified in the 4 samples by X-ray diffractometry, its origin is not known. It is difficult with the available information to explain the origin of graphite in Recent sediments. However a possible explanation may be the transportation of it from the adjacent soils and rocks.

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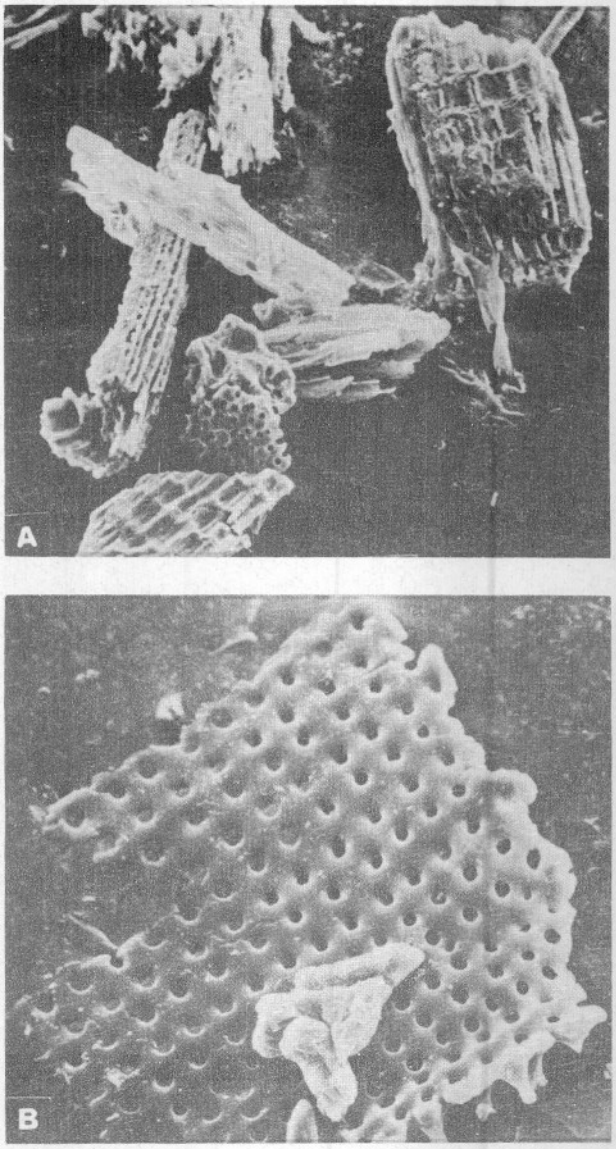

Fig. 2—SEM of particles from the Mitla lagoon core [(A) Representative of the particles produced by wood burning (1 cm = 59 μm). (B) Particle type resulting from burned coconut and coconut palm (1 cm = 23 μm)]

References

1 Griffin J J & Goldberg E D, *Science*, **206** (1979) 563.
2 Smith D W, Griffin J J & Goldberg E D, *Nature Lond*, **241** (1973) 268.
3 Griffin J J & Goldberg E D, *Limnol Oceanogr*, **20** (1975) 456.
4 Lankford R R, in *Estuarine process*, edited by M Wiley (Academic Press, New York) 1977, 182.
5 Griffin J J, (personal communication).
6 Castro C, Mandelli E F, Mee L D & Vazquez B A, *Estudio de los cambios ecológicos de la Laguna Mitla a través de sus sedimentos*, VI Congreso Nacional de Oceanografía, Ensenada Mex, 1978.
7 Páez-Osuna F & Mandelli E F, (in preparation).
8 Bruland K, *Pb*-210 *geochronologies* Ph D thesis, University of California San Diego, 1974.
9 Goldberg E D, Hodge V, Koide M & Griffin J J, *Geochem J*, **10** (1976) 165.