8. SUSPENDED SEDIMENTS IN SEAWATER OFF WESTERN AUSTRALIA[1]

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INTRODUCTION

Suspended matter in offshore surface waters has been studied recently in several areas such as off the eastern United States (Manheim et al., 1970), in the East China and Yellow seas (Wageman, et al., 1970), in the Gulf of Guinea (Bornhold et al., 1972) as well as in the southeastern Atlantic (Emery et al., 1973) and in several oceans of the world (Lisitzin, 1972). The concentration of such matter ranges from a few milligrams per liter near shore and near the mouths of rivers, to less than 0.1 mg/l for many open-ocean areas. Values quoted by Lisitzin (1972) are frequently larger than this, but the technique he employs is slightly different from that of the other authors mentioned above.

Aside from the presence of rivers the nature of the suspended matter is determined by: (a) the concentration of biological material (heavy in upwelling areas and varying diurnally with planktonic concentration) and (b) the amount of aeolian transported material. In some areas, ocean currents bring appreciable suspended matter from relatively distant but strong sources. Off western Australia there is extremely little river discharge into the ocean. All rivers, except the Swan, at Fremantle, are dry most of the year and have discharge principally at times of flash flooding during the rainy season. Temperature measurements did not indicate any areas of upwelling, except possibly south of Timor.

METHOD OF MEASUREMENT

Surface-water samples were taken from the bow of *Glomar Challenger* on approximately 4-hour intervals, whether underway or stopped on site. When stopped, great care was exercised to make sure that contaminated surface samples were not taken under stagnant surface conditions. Up to 7 liters were taken by the chemistry laboratory technicians with the temperature and salinity being measured at the same time. The water sample was filtered through a pair of pre-weighed 47-mm Millipore filters with a nominal pore diameter of 0.45μ after the method of Manheim et al., (1970). After filtering, the filters were washed with distilled water, set aside to dry, then returned to Woods Hole. Preweighings and final weighings were done there.

About halfway between Sites 259 and 260 a silver filter was used in place of the Millipore at every other location while the ship was underway. Silver filters were used so that X-ray analyses could be made of the suspended material. This would not have been possible with the Millipore filters. As it turned out there was not sufficient material on the silver filters to make an X-ray analysis.

It is customary in studies such as this to ash part of each Millipore filter to determine the organic content of the material and to examine the filters with a scanning electron microscope to learn something of the nature of the material. Neither of these studies has been undertaken yet.

ANALYSIS AND INTERPRETATION

The locations where samples were taken and Millipore filter determinations were made underway are shown in Figure 1. The values obtained from these sample locations are indicated in that figure. The other determinations, made on samples from drilling sites, suggest there is a strong time-varying biologic component to these measurements and that caution should be exercised in discussing the spatial variation without knowledge of the biological material.

The *Glomar Challenger* is a unique midocean platform for this type of study in that it is maintained at precisely the same location for several days. This offered the opportunity to study the time variations of the surface-suspended matter, a study which apparently has not been made before. The variation with time of the total suspended matter (greater than 0.45μ) is shown in Figure 2. Times shown are Greenwich Mean Time. Eight hours should be added to that time to get shipboard local time.

The curve for each of the five sites is considered to consist of a stable component (about 0.10 mg/l) plus a time-varying component (up to 1.0 mg/l at some sites) which is due to biologic material. The large peaks reached by this biologic component cannot be explained from this brief study, but the near-diurnal component to the suspended matter emphasizes that, for measurements taken from an in-transit ship, the time of day is an important factor and that the biologic, or organic component must be isolated in discussing the contribution of aeolian-transported material.

Compared to studies made in other areas, aside from upwelling areas, the ratio of organic to inorganic fractions is higher here than in many other open-ocean areas. This appears to be due to a higher value of organic material and a lower value for the inorganic material.

In spite of the time-varying biologic component there is reason to believe, from Figure 1, that the stable component is greater south of Timor than elsewhere. There are westward-flowing currents from the Timor

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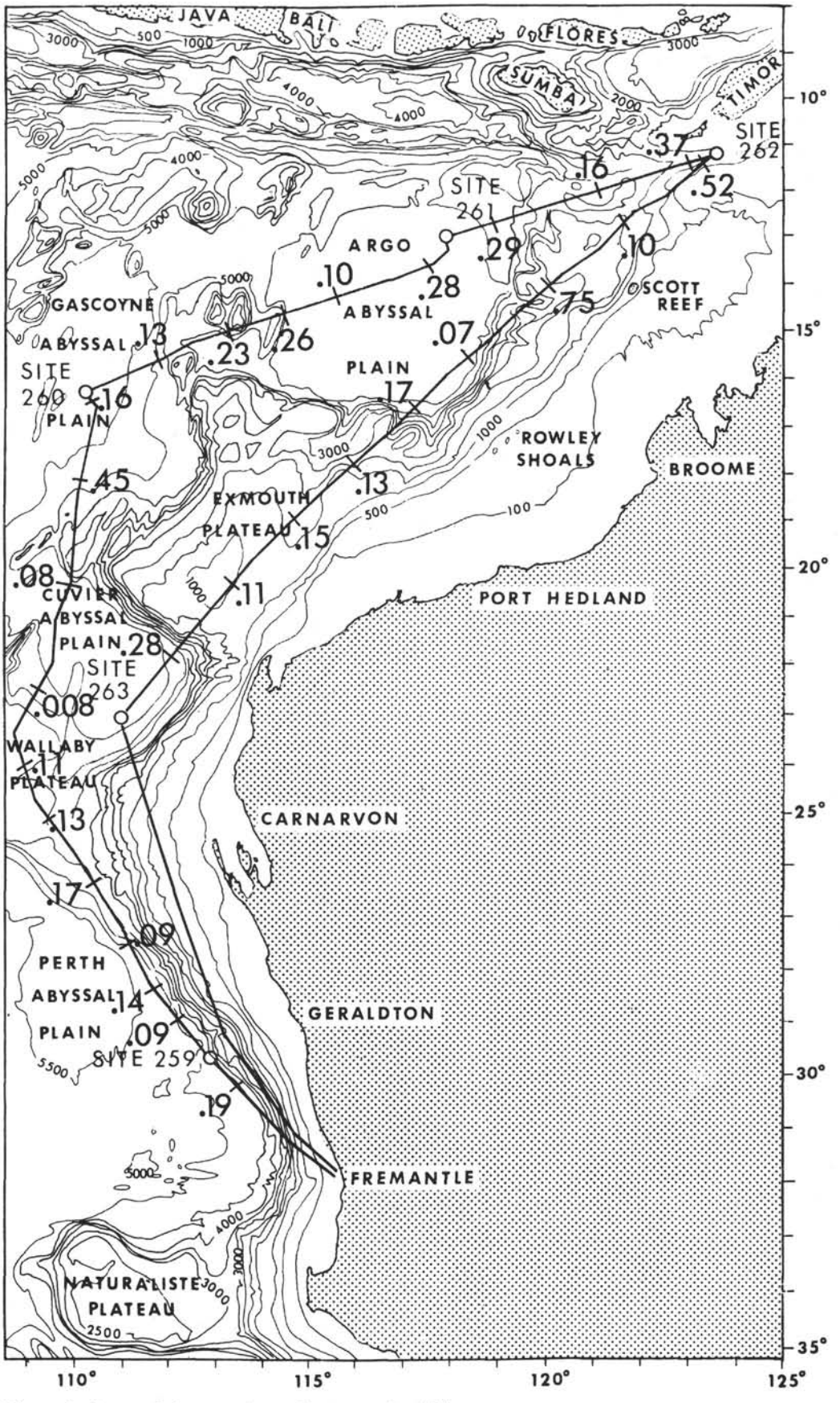

Figure 1. *Suspended matter in surface water (mg/l).*

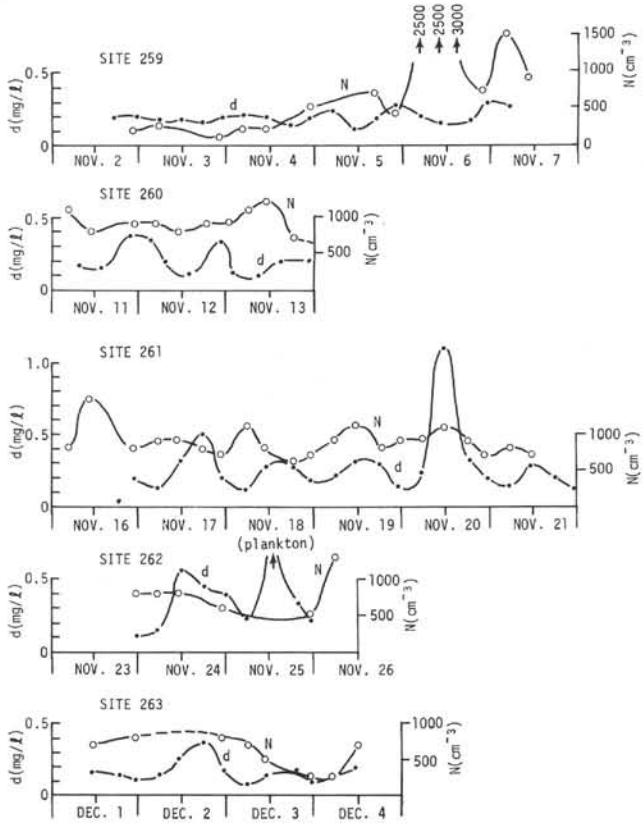

Figure 2. *Variation of suspended sediment load (closed circles) and atmospheric particle density (open circles) while on drilling sites.*

Sea that may carry a steady stream of organic and/or inorganic material from an upstream source area. This stable component seems less likely to be due to steady upwelling phenomena. Although upwelling is known to occur in this area, surface temperature and expendable bathythermograph measurements did not indicate such when the ship was there.

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