C. PELAGIC TERRIGENOUS SEDIMENTS

Nearly all terrigenous sediments in the pelagic environment are composed of very fine-grained material, the bulk of which is less than 20 µm in mean particle size. Coarse terrigenous sediments are confined to areas near the continents influenced by river input or delivery via ice-rafting (remember ice-rafted detritus). Because fine silts and clays have very slow settling speeds in the oceans they can in theory be transported long distances by water. A particle 2 microns in diameter should take about 40 years to settle 4 km! Average surface currents move water about 10 cm per second or some 3000 km per year. Tiny particles (clay-sized, 2 microns or less, and silt-sized, 2 to 63 microns) do not get transported this far however because filter-feeding zooplankton tend to package clay- and silt-sized particles into rapidly-settling fecal pellets near the point at which the detritus is introduced to the ocean. In addition, flocculation in estuaries encourages the deposition of fine-grained waterborne particles in coastal waters. Thus, the main vector for the carriage of fine terrigenous particles from the continents to the central deep-sea basins is the wind, and not water — pelagic clays are predominantly of wind-blown (**aeolian**) origin.

Quartz (SiO_2), a common constituent of granitic rocks, and **clay minerals** (platy, hydrated aluminosilicates produced mainly by chemical weathering of rocks and typically found as flakes <2 µm in size) are the principal components of aeolian dusts. **Volcanic ash**, from eruptions on both oceanic islands and the continents, can also be relatively widely distributed, although the volume of such material is comparatively small. Ash layers, often a few to several cm thick, are common in sediments in oceanic areas near volcanic arcs (e.g the eastern equatorial Pacific).

Pelagic clays are the predominant sediment type in the deep, central ocean basins below the CCD and in regions away from the high productivity belts, where opal becomes a major component of the underlying deposits. Originally called "red clays", a misnomer first used by Wyville Thompson aboard the Challenger in 1873, pelagic clays are actually brown in colour, due to the presence of Fe oxyhydroxides (akin to rust) which are both finely dispersed and present as coatings on sediment particles. Because there is essentially no accumulation of biogenic carbonate or opal in pelagic clays, and the rate of delivery of wind-blown detritus is small, rates of sedimentation are on the order of 1 mm per thousand years. In contrast, carbonate oozes in the equatorial region accumulate at a rate of about 30 mm per thousand years (as a very rough average).

Quartz concentrations are relatively high in several areas which are related to the aridity of continental source regions, particularly the distribution of deserts, and to the intensity and direction of flow of winds. The global distribution of this mineral in marine sediments is shown in Figure 1. Note the belt of high quartz content straddling the North

Pacific between about 20º and 40º N, and the high concentrations in the North Atlantic and west of the Sahara Desert.

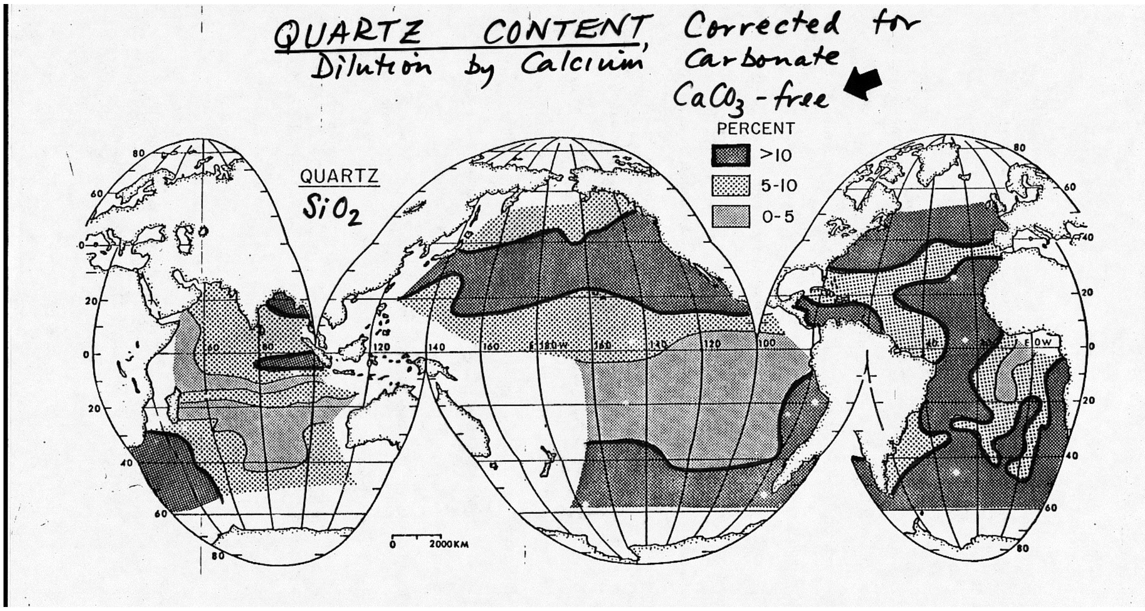

Figure 1. Quartz concentrations in marine sediments on a $CaCO_3$-free basis (after Windom, Chemical Oceanography, Vol. 5)

The North Pacific pattern reflects transport of quartz from central Asia (primarily the Gobi Desert) eastward in the mid-latitude but high altitude jet-stream flow, while the North and mid-Atlantic distributions result respectively from riverine input and from carriage of aeolian quartz by the northeast trade winds west and southwestward from the Sahara Desert. High quartz contents in the Southern Ocean reflect sources in the arid Australian interior and South Africa as well as contributions via ice-rafting from Antarctica. The strip of coastal desert along the western margin of South America also acts as a source area for aeolian transport of quartz to the southeastern Pacific.