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Sediment Density and Velocity Trends at ODP Pacific Paleogene Transect Sites

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Variation of sediment wet bulk density and compressional wave velocity at the eight sites that comprise the ODP Leg 199 Pacific Paleogene transect was examined to determine the paleoceanographic significance of the regional seismic reflectors. At these sites the thickness of sediment drilled ranges from 62 to 274 m, sediment age ranges from Holocene to Paleocene, and dominant lithologies are clay, nannofossil ooze/chalk, and radiolarian ooze. The extent to which core values of density and velocity vary as a function of sediment composition was tested with shipboard ICP bulk chemistry measurements and estimates of illite, smectite, calcite, and opal percentages provided by light absorption spectroscopy. Multiple regression results indicate that most of the variance in bulk density, as determined for discrete samples and by gamma ray attenuation techniques, is explained by differences in the abundance of calcareous constituents. Depth and clay abundance contribute to a lesser extent to the variation in density. Similar analyses of velocity, as determined for discrete samples and by the P-wave logger, indicate little compositional control and only a weak relationship with depth. The relationship between velocity and density (or porosity) varies with lithology. Low wet bulk density characterizes clays (1.1-1.5 g/cm^{3}) and radiolarian oozes (1.1-1.4 g/cm^{3}), and a relationship between velocity and bulk density is lacking. Velocities of the clays and radiolarian oozes are 1475-1575 m/s and 1500-1590 m/s, respectively. Nannofossil oozes are characterized by a larger range in density (1.15-1.75 g/cm^{3}) and lower velocities that vary over a narrower range (1480-1560 m/s). Velocity increases with increasing density for nannofossil oozes with bulk densities greater than 1.4 g/cm^{3}. As a result of the lack of consistent trends in velocities, variation in impedance primarily is a factor of changes in wet bulk density. Core velocities and densities were used to estimate in situ values of these parameters by estimating elastic rebound from the difference between core and borehole log data at Sites 1218 and 1219. The density rebound determined from this comparison is consistent with the rebound indicated by the comparison of the core data and published lithology dependent models for in situ density of pelagic sediments. The difference in log densities and core densities ranges from near zero at the top of the logged intervals (~80 mbsf) up to 0.2 g/cm^{3} at approximately 250 mbsf.

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