I. SUMMARY OF PHYSICAL PROPERTIES—LEG 32

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POROSITY AND DENSITY

The GRAPE and syringe measurements of porosity and density were confined almost exclusively to the unlithified sediments. These soft-stiff sediments are typically moderately to intensely disturbed during drilling, which suggests that their porosity is somewhat greater and wet bulk density somewhat less than the in situ values.

With the exception of Site 304, where the grain density of the pelagic clay is significantly higher than that of the siliceous oozes, the syringe data show that the variations in wet bulk density of the sediments at each site are due largely to changes in porosity. The porosity was therefore measured by applying the average grain density as determined by the syringe data at each site to the GRAPE wet bulk density measurements.

The porosity of the near-surface sediments is least in the calcareous oozes, 65%-70%; greatest in the siliceous oozes, 85%; and intermediate in pelagic clay, 80% (Table 1). Conversely, the wet bulk density ranges from 1.2 in the siliceous oozes, to 1.4 in clay, to 1.5-1.6 g/cc in the calcareous oozes. The three sediment types have somewhat similar grain densities. The grain density averages 2.7 in the calcareous oozes, 2.9 in the clay, and 2.6 g/cc in the siliceous oozes (a somewhat questionable value because it is based on only two measurements).

Because of poor sediment recovery and sample disturbance, porosity and density measurements were restricted to one or two cores at many sites. At Sites 305, 310, and 313, however, measurements were made from the surface to a depth of about 200 meters. As expected, the porosity decreases with depth, especially in the upper 100 meters. The porosity of the calcareous oozes at Sites 305 and 310 decreases from 65% to 70% at the surface to 55% to 60% in the sediments between 100 and 200 meters. The porosity of the calcareous ooze at Site 313 decreases from 70% at the surface to 55% at a depth of 150 meters, where the ooze becomes a semilithified chalk. The porosity of the chalk is quite variable, possibly due to different degrees of disturbance, but appears to decrease to about 45% at a depth of 270 meters. The porosity of the calcareous ooze, apparently chalk pulverized by drilling, from a depth of 270 meters at Site 306 is also about 45%.

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TABLE 1
GRAPE Porosity and Average Density Data

Hole	Calcareous ooze				Siliceous ooze				Pelagic Clay			
	D	ϕ	ρ_B	ρ_G	D	ϕ	ρ_B	ρ_G	D	ϕ	ρ_B	ρ_G
303					65	85	1.3	2.81 (1)[a]	180	80	1.3	2.80 (1)
304					110	85	1.2	2.58 (2)	220	80	1.5	3.12 (1)
305	0 100	65 55	1.6 1.8	2.75 (42)								
306	3 270	65 47	1.6 2.0	2.89 (1)								
307									4	80	1.4	2.83 (1)
308									0	60	1.7	2.63 (1)[b]
310	0 90	70 60	1.5 1.7	2.70 (20)					95	55-75	1.8-1.3	2.74 (2)
310A	100	60	1.7	2.74 (3)								
311									7	75-85	1.4-1.3	2.92 (4)
313	0 150	70 55	1.5 1.8	2.71 (8)								
	150 270	55 45	1.8 1.9	2.72 (2)[c]								

Note: D–Depth (m); ϕ–Porosity (%); ρ_B–Wet bulk density (g/cc); ρ_G–Average grain density (g/cc).

[a]Syringe sample clayey.

[b]Altered volcanic ash (mud).

[c]Semilithified chalk.

Number in parentheses indicates number of samples for which average was calculated.

SONIC VELOCITY

The compressional sound velocity, *Vp*, of the various sediments and rock types recovered during this leg ranges between 1.5 and about 5 km/sec. As expected, the velocity increases with the rigidity or degree of lithification of the rocks.

The velocity of the soft sediments is remarkably uniform—1.5 to 1.6 km/sec in both the calcareous and siliceous oozes as well as the pelagic clays. The *Vp* of the stiffer, less disturbed sediments is, on the average, slightly greater than that of the soft, more intensely disturbed sediments. The small and somewhat inconsistent difference between these *Vp* values suggests that the drilling disturbance has not seriously reduced the velocity.

As the sediments become progressively lithified, the velocity increases markedly. Whereas the average *Vp* measured in the chalks is 1.8 km/sec, not significantly greater than that of the calcareous oozes, the average *Vp* of the limestones is 2.6 km/sec (Table 2). In a similar manner, the average *Vp* is 2.7 km/sec in the porcellanites and increases to 4.7 km/sec in the cherts. The subvitreous cherts from the top of Hole 307 help span this gap with velocities as low as 3 km/sec. The velocities in the nonbiogenic, sedimentary rocks are similar to those in the limestone and porcellanite. The average *Vp* is 2.4 km/sec in the claystone and slightly greater, 2.8 km/sec, in the volcanic turbidites (sandstones).

The *Vp* of the basalts falls typically in the range 4.5-5.5 km/sec. The velocity of highly altered basalt is significantly lower. The effect of alteration on basalt *Vp* is particularly noticeable at Site 307. Here the velocity decreases from 5.0 km/sec in the slightly altered interior, several meters below the top of the basalt, to 3 km/sec near the basalt-sediment interface where extreme weathering(?) has almost reduced the basalt to claystone. The velocity of the carbonate-cemented hyaloclastite that is interlayered with the pillow basalt at Site 307 is 3.8 km/sec.

TABLE 2
Average Sound Velocity Data (km/sec)

Site	Calcareous Ooze	Chalk	Limestone	Siliceous Ooze	Porcellanite	Chert	Pelagic Clay	Claystone	Sandstone	Basalt
303				1.5 (3)	2.2 (1)	4.7 (8)	1.5 (1)			4.6 (6)
304				1.5 (1)	2.6 (4)	4.9 (5)	1.5 (1)			5.5 (10)
305	1.5-1.6 (20)		2.6 (4)			5.1 (7)		2.9 (3)		
306		2.1 (4)			3.0 (4)	5.0 (3)				
307					2.3 (1)	3.9 (7)	1.5 (2)	1.8 (1)		4.3 (6), 3.8 (2)[a]
308							1.6 (1)		3.3 (3)	
310	1.5 (18)	1.8 (1)			2.4 (1)	5.2 (2)	1.6 (3)	2.3 (2)	2.8 (4)	
311							1.5 (2)			
313	1.5 (1)	1.7 (6)	2.6 (16)		2.7 (1)	4.8 (1)		1.7 (1)	2.6 (9)	4.6 (6)
Leg Avg.	1.6	1.8	2.6	1.5	2.7	4.7	1.5	2.4	2.8	4.9

[a]Carbonate cemented hyaloclastite.
Number in parentheses indicates number of samples from which average was calculated.