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42. CONSOLIDATION TEST RESULTS AND POROSITY REBOUND OF ONTONG JAVA PLATEAU SEDIMENTS[1]

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ABSTRACT

Consolidation tests were performed on 19 samples of calcareous ooze from the Ontong Java Plateau, obtained during Ocean Drilling Program Leg 130. Rebound curves from consolidation tests on Ontong Java Plateau samples yield porosity rebounds of 1%–4% for these sediments at equivalent depths up to 1200 mbsf. The exception is a radiolarian-rich sample that has 6% rebound. A rebound correction derived from the porosity rebound vs. depth data has been combined with a correction for pore-water expansion to correct the shipboard laboratory porosity data to in-situ values. Comparison of the laboratory porosity data corrected in this manner with the downhole log data shows good agreement.

INTRODUCTION

The Ontong Java Plateau is a broad submarine plateau located in the western equatorial Pacific. The unique geological setting of the plateau—its surface above the carbonate compensation depth throughout most of its history and its location near the equatorial zone of high productivity—has resulted in the accumulation and preservation of a thick sequence of pelagic carbonate sediments of Mesozoic and Cenozoic age.

Five sites were drilled during Ocean Drilling Program (ODP) Leg 130. Four of these sites (Sites 803, 804, 805, and 806) form a depth transect down the northeastern flank of the plateau. The depth interval (2500–3900 m) bracketed by the sites contains pronounced differences in degree of carbonate dissolution through time. These differences among sites are evidenced by differences in microfossil content and preservation, with considerable effects on physical properties and seismic reflectors (Berger and Johnson, 1976; Berger and Mayer, 1978).

This study examines the consolidation behavior of Ontong Java Plateau sediments. Samples were obtained from the oozes at all five sites drilled during Leg 130. Consolidation tests are used to assess the behavior of sediments under mechanical loading. The process of consolidation involves the expulsion of pore fluid and adjustment of the sediment grain structure as a result of stress applied to the sediment. Calcareous sediments have been reported as exhibiting unique engineering and compression behavior (e.g., Demars, 1982) primarily related to the type and preservation of their major microfossil constituents.

Rebound data from consolidation tests of Ontong Java Plateau sediments can be used to correct shipboard laboratory data to approximate in-situ conditions. Shipboard efforts to correct porosity data using Hamilton's (1976) generalized laboratory curve for rebound of deep-sea carbonates indicate that this rebound correction, which was derived from examining the unloading curves of consolidation tests, is not applicable to the Ontong Java Plateau sediments. Hamilton's (1976) carbonate rebound model included all sediments with a calcium carbonate content >30%. The Ontong Java Plateau sediments, with calcium carbonate content >90%, exhibit much different physical behavior.

PROCEDURES

Nineteen consolidation tests were performed for this study. Samples have been designated C1 through C19 for ease of reference. Table 1 includes sample number and site, core, section, and interval information for each sample. Samples were obtained as whole-round sections of core from oozes at all five sites drilled. Samples 10 cm long, still encased in core liners, were sealed with several layers of beeswax to prevent desiccation. The samples were kept in a refrigerator on the ship, and submerged in water in a refrigerator in the laboratory after being hand carried from the ship.

Samples were cut and trimmed just before placing them in the consolidation cell, to minimize moisture loss. A ring with a 6.2-cm inside diameter, a 4-cm-high thin wall, and a sharpened cutting edge was pushed carefully into the sediment sample encased by the liner. The sediment and embedded ring were extruded from the liner, and the ends of the sample were trimmed with piano wire to a smooth surface. This sample was further trimmed to approximately 2 cm in height, and then transferred to the consolidation ring and placed between two water-saturated porous stones. Sample trimmings were used to measure water content of the sample. Calculation of an initial void ratio (e_i) was made using the water content data measured from trimmings and the known volume and weight data of the actual sample.

Head (1986) discussed the general theory and techniques of laboratory consolidation testing. Specific procedures are described as follows. The tests were performed in back-pressured consolidometers. The sample was allowed to adjust to the back pressure overnight and loading was started the following day. A ratio of load increment to a load of 1 was used. Drainage was allowed from both the top and bottom of the sample. Sample height data was collected digitally and sent to a FLUKE data logger and computer, where a file of time elapsed and sample height was created for each load increment. The computer also provided continuous plots of square root of time vs. sample height so that the end of primary consolidation could be estimated as the data were collected. When the end of primary consolidation was judged to have been reached, the next load increment was applied. The time to the end of primary consolidation was approximately 1 min for most samples, indicating high permeability. When the load and unload increments were completed, the samples were carefully removed from the cells. Scanning electron microscope (SEM) and microfossil samples were obtained from each consolidated sample, and index properties were measured.

The methods used to measure porosity in shipboard laboratory, and downhole logging programs are detailed in Kroenke, Berger, Janecek, et al. (1991). In general, samples for laboratory determination of index properties were obtained at a rate of one or two per 1.5-m

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section of core. Wet samples were weighed to ± 0.01 g using a motion-compensating balance and placed in an oven at 110°C for 24 hr. Dry samples were weighed and then dry volumes were determined to ± 0.02 cm^3 using a helium-displacement pycnometer. Porosity was calculated as the ratio of the volume of voids to the total sample volume, and expressed as a percentage.

Porosity was calculated from the downhole logging bulk density data, using the equation

$$\varphi = \frac{\rho_b - \rho_g}{\rho_w - \rho_g},$$

where ρ_b = sediment bulk density, ρ_g = sediment grain density (2.72 g/cm^3 *assumed*), and ρ_w = density of seawater (with in-situ temperature and pressure effects accounted for).

RESULTS

Sample height vs. the square root of elapsed time data were used to determine the height (H_{100}) corresponding to 100% primary consolidation, using the method of Taylor (1948). The void ratio corresponding to 100% primary consolidation for each load was determined. Void ratio vs. log effective applied pressure was plotted, and the Casagrande (1936) construction was used to determine the preconsolidation pressure, P_c'.

For some of the *e*-log p' curves in this study, the change in slope defining the change from the reloading to the virgin compression sections of the curve is gradual. This phenomenon has been observed for other sandy or coarse-grained sediments (Marsters, 1986) and by previous investigators for calcareous sediments (Demars, 1982; Nacci et al., 1974). In these cases, a specific point of maximum curvature could not be defined, and minimum and maximum values were selected, resulting in a range for P_c' for the sample.

Figures 1 through 5 present *e*-log p' data for the 19 consolidation tests performed; the data are organized by site. Table 1 summarizes the consolidation test data, including effective preconsolidation pressures (P_c'), overconsolidation ratios, compression indices (C_c), recompression indices (C_r), and coefficients of consolidation (C_v; the value given is the average of the values for the load increments on the virgin compression line). The samples are described as white calcareous ooze, ranging in consistency from soft for the shallow samples to stiff for the samples near 200 mbsf. Sample 7, which is described as a light reddish brown stiff ooze, is the exception.

Overconsolidation ratio (OCR) is calculated as the ratio of effective preconsolidation stress to the effective overburden stress. Because the determination of P_c' is subject to some interpretation, a sample with an OCR ranging from 0.5 to 1.5 is considered to be normally consolidated. The majority of the samples tested exhibit apparent overconsolidation. P_c' and OCR data are presented in Table 1, but they are not discussed further. This study focuses on the rebound behavior of these sediments and the differences in results between samples that may be caused by variations in microfossil content and preservation.

A few testing/sampling problems require note. Sample 7 consisted of stiff, light reddish brown ooze. Difficulties were encountered in cutting and trimming the sample, with some patching of the ends required. The sample was tested despite these difficulties because it was obviously different from the other samples; however, the *e*-log p' curve must be considered to be a "disturbed" curve. Much higher values for C_c and C_r were measured for this sample than for any other. As the effect of disturbance is to flatten the slope of the virgin compression curve, the value obtained for C_c can be considered to be a lower limit of the possibly higher "undisturbed" value.

The values of C_c obtained for Samples 16 and 19 may be influenced by problems encountered with the apparatus pressure supply during the last load increment. Problems with the regulator at applied stresses >6000 kPa caused some drift in pressure during the loading; the determination of the end of primary consolidation for this load increment is difficult. The virgin compression lines for these deeper

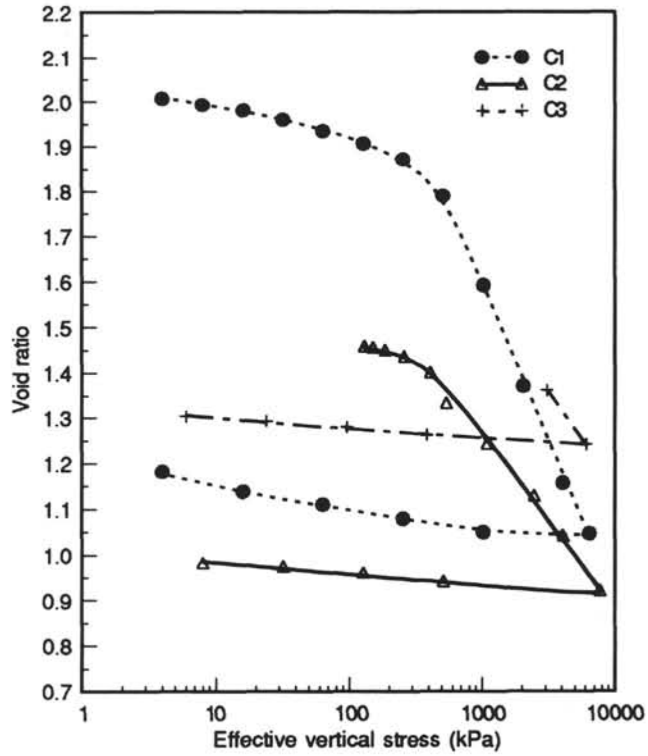

Figure 1. $e - \log p'$ curves for Samples 1, 2, and 3 from Site 803.

samples have been drawn through the last two points (two highest stress increments) on the curve. If the virgin compression line is not actually achieved until higher stresses are applied to these samples, then the line drawn based on the available test data would have too shallow a slope, and the C_c values obtained can be considered as lower limits of likely higher values.

Sample 15 requires a note with regard to possible disturbance. This sample, obtained from 118 mbsf, had the lowest pre-test void ratio of all the samples, even those obtained from more than 200 mbsf. Its starting void ratio is equivalent to a porosity of 55%. Examination of the shipboard Site 806 data (Shipboard Scientific Party, 1991b) shows porosity to be approximately 65% at this depth. It is possible that this sample is just an excursion from the trend seen in the shipboard profiles. However, it is also possible that this sample was disturbed during transport or handling, resulting in a reduction of porosity.

Testing problems have limited the usefulness of the results of three of the tests. Testing errors resulted in no data for pressures <100 kPa for Samples 2 and 12. The error resulted in a load increment ratio not equal to 1, and because of the effect on the slope of the virgin compression curve and the inability to estimate P_c' from the two *e*-log p' plots, neither P_c' nor C_c data are reported for these two tests. An error in the collection of height data for the first several load increments of Test 3 resulted in the attainment of only two values on the virgin compression line. The expansion portion of these three tests, however, is used for rebound calculations.

Hamilton (1976) describes a procedure to estimate rebound from consolidation test results. The unloaded portions of the *e*-log p' curves from the 19 tests have been used to estimate the amount of elastic rebound (increase in volume) that occurs when the stress applied to the sample during the test is removed and full pore-water drainage is allowed. It was assumed that the value of void ratio at 1 kPa on the *e*-log p' curves would approximate the value at atmospheric pressure. The rebound curve was extrapolated back to 1 kPa from the last unloaded increment (4 kPa for most tests). Although this extrapolation is a possible source of error, the procedure was performed with

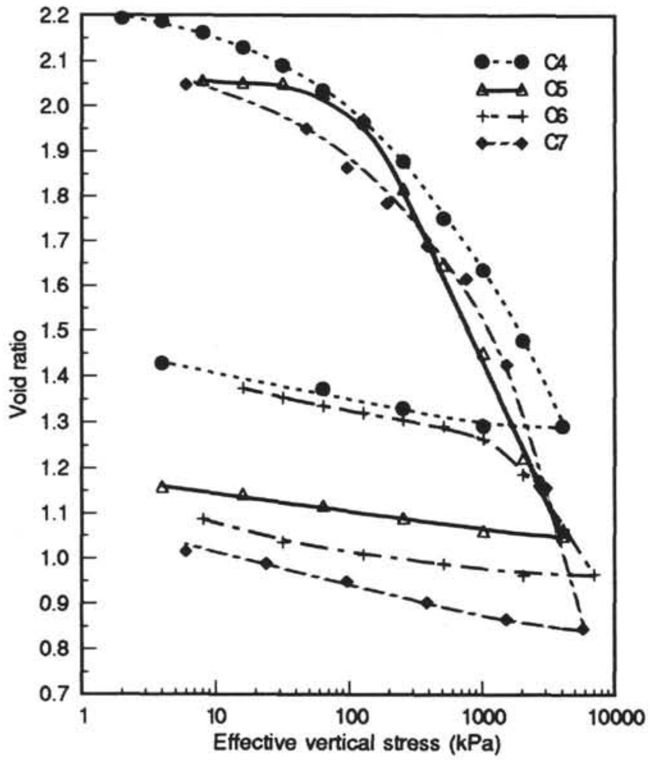

Figure 2. $e - \log p'$ curves for Samples 4, 5, 6, and 7 from Site 804.

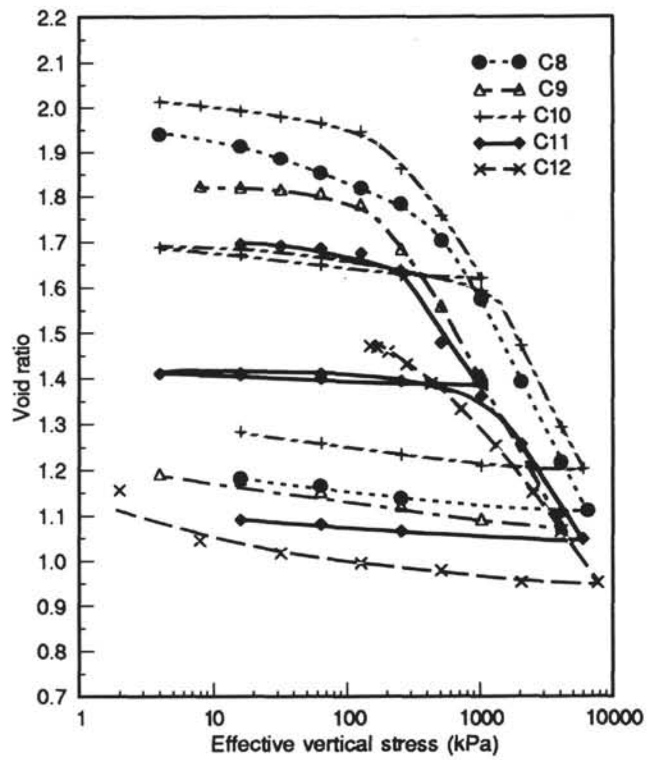

Figure 3. $e - \log p'$ curves for Samples 8, 9, 10, 11, and 12 from Site 805.

considerable confidence, as the curve connecting the last several data points of the unloaded section is linear for most of the tests. The void ratio corresponding to the maximum stress applied during the consolidation test and the void ratio at 1 kPa were converted to fractional porosity values using $n = e/(1 + e)$. The porosity rebound was then calculated as the difference in these two values, expressed as a percentage. Figure 6A shows rebound in porosity from pressures indicated to laboratory pressure for the 19 samples tested. The curve fit has the equation

$$\text{rebound} = 8.05 \times 10^{-4} P - 5.39 \times 10^{-8} P^2, \quad (1)$$

where P is pressure in kPa. The equation is constrained to zero rebound at zero depth.

To derive a rebound vs. depth relationship, the maximum stress reached during a test was converted to an equivalent depth. The pressure at any depth is the effective unit weight of the overlying sediment (assuming no excess pore pressures), or the average effective unit weight times the depth of the sample. An equivalent depth was determined from the maximum pressure by calculating the effective unit weight corresponding to that stress (using the void ratio obtained). This value was averaged with a value of effective unit weight calculated for the sediment at the top of the hole. The maximum stress was divided by this average effective unit weight to arrive at an equivalent depth. Figure 6B presents rebound in porosity vs. equivalent depth. The fit has the equation

$$\text{rebound} = 5.39 \times 10^{-3} D - 2.50 \times 10^{-6} D^2, \quad (2)$$

where D is depth in meters below seafloor (mbsf).

Sample 7, from Site 804, was described as a light reddish brown radiolarian ooze by shipboard sedimentologists (Shipboard Scientific Party, 1991a). Shipboard smear slide analyses estimate the composition at this depth as approximately 40% radiolarians and approximately 60% nannofossils. The sample exhibits considerably different consolidation characteristics than the other samples at that site or other sites. To provide the most reasonable rebound correction for the major sediment type (white calcareous ooze), this sample has been omitted from the calculation of a new curve fit (shown as a dashed line in Fig. 12). The equation then becomes

$$\text{rebound} = 4.67 \times 10^{-3} D - 1.97 \times 10^{-6} D^2. \quad (3)$$

DISCUSSION

Consolidation Behavior

The use of laboratory consolidation results to infer in-situ behavior has been questioned. In particular, the one-dimensional consolidation theory used in laboratory analysis does not allow for variations in permeability and compressibility of the soil as it consolidates, nor does it allow for large strains (Crawford, 1985; Lowe, 1974). It is also known (Crawford, 1965; Chakrabarti and Horvath, 1985) that the shape and slope of the laboratory test load curve is affected by sample disturbance and the load increment ratio and rate of loading used during the test. However, through careful sample preparation and following the same test procedures for a group of samples, the results may be used with confidence to compare differences within that sample set.

It has been observed (Schmertmann, 1955; Lambe and Whitman, 1969) that the shape and slope of rebound curves are not affected by sample disturbance or pressure from which the unloading began. The latter observation is supported by the e-log p' data for Tests 10 and 11 (Fig. 3). In each of these tests, an unloaded sequence was performed after the yield stress was reached. Then the sample was reloaded to the maximum stress and the final unloaded sequence performed. In each case, the two unloaded portions are parallel. Schmertmann (1955) and Hamilton (1976) discussed the applicability of laboratory results to field conditions. If the shape and slope of the unloaded portion of the curve depend on the properties of the sediment, and are not affected by disturbance or pressure, then it is reasonable to

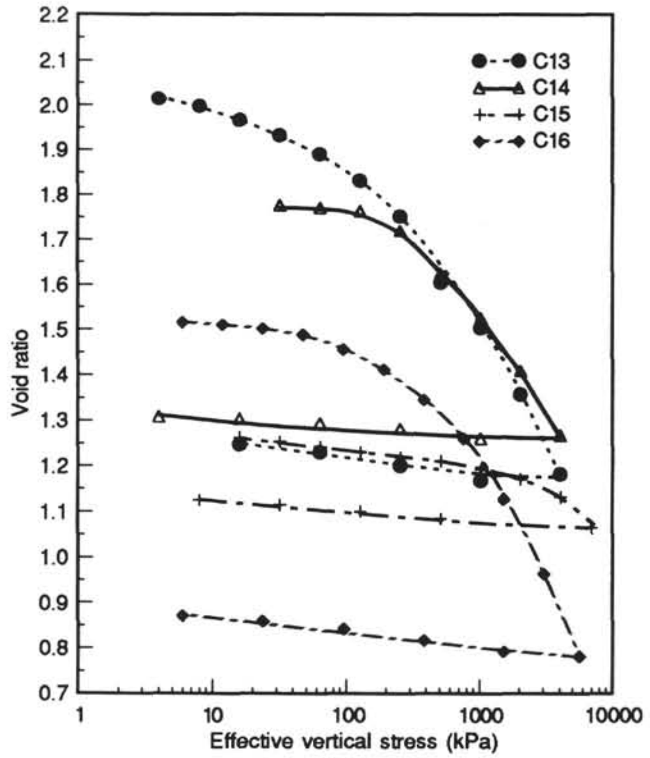

Figure 4. $e - \log p'$ curves for Samples 13, 14, 15, and 16 from Site 806.

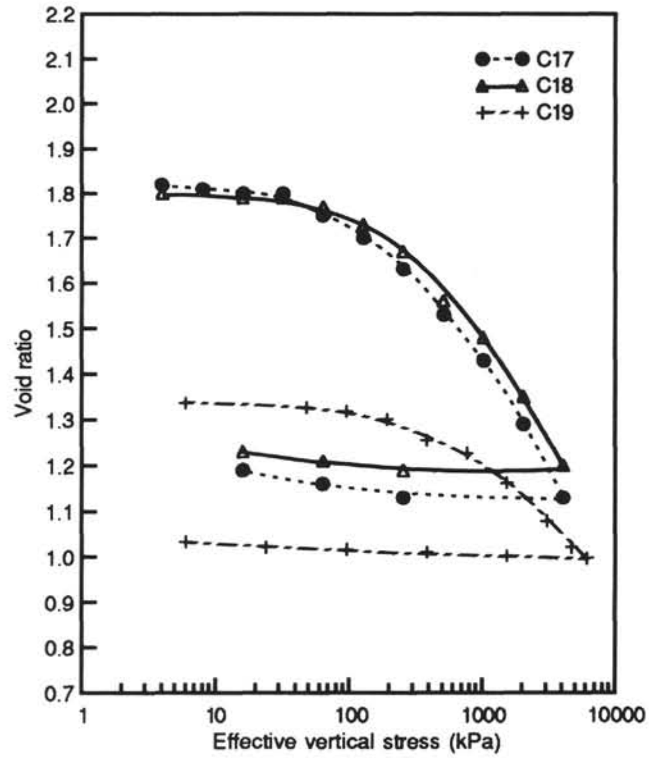

Figure 5. $e - \log p'$ curves for Samples 17, 18, and 19 from Site 807.

assume that geologic rebound or rebound upon removal of (or from) overburden pressure is approximately parallel to test curves for the same material.

The presence of intraparticle water in calcareous sediments and the possible effect on consolidation behavior has been discussed by Nacci et al. (1974), Demars (1982), and Valent et al. (1982). Choquette and Pray (1970) defined intraparticle porosity as porosity within individual particles or grains, and stated that it is an important part of the preserved porosity in carbonate rocks. The effect of intraparticle porosity on the physical properties of calcareous sediments is generally dependent on whether intraparticle water is released to the system through grain fracture and crushing. For example, release of intraparticle water during consolidation test loading would significantly alter the shape of the e-log p' curve (Demars, 1982). Most workers (Bhattacharyya and Friedman, 1979; Demars, 1982; Valent et al., 1982; Lind, this volume) have reported no significant crushing of whole microfossils during consolidation tests. Bhattacharyya and Friedman (1979) and Valent et al. (1982) suggested that the fine-grained fraction carries the loads applied and protects the foraminifer shells against crushing.

SEM analyses of samples taken from the consolidometers after testing was completed also show no evidence of significant grain fracture or crushing. This phenomenon was also observed much deeper in the sediment column. SEM analyses of chalks, recovered from greater than 300 mbsf, show large numbers of foraminifers still intact (R. Wilkens, unpubl. data). Destruction of the foraminifers that does occur seems to be caused by dissolution rather than grain crushing.

The consolidation test results from this study on calcareous sediments compare well to those of other researchers. The values of compression indices for these samples range from 0.4 to 0.7 (with the exception of Sample 7, which has a value of 1.14). Demars (1982) obtained C_c values that ranged from 0.35 to 0.65 for calcareous sediments (carbonate contents of 60%–90%) from the Eastern Atlantic. Morelock and Bryant (1971) obtained values of C_c that ranged from 0.45 to 0.6 for calcareous sediments (with a carbonate content of 80%–85%) from the West Florida continental slope. Recompression index values are also similar. This study obtained values of 0.01–0.06. Demars (1982) obtained values ranging from 0.04 to 0.11, and Morelock and Bryant (1971) obtained values from 0.02 to 0.07.

Porosity Rebound

The chief interest in the consolidation rebound curves in this study is the derivation of a rebound vs. depth relationship for the correction of laboratory porosity data to in-situ values. Downhole log data are considered to approximate in-situ data, although errors may exist in the logging process and its interpretation. Log data are not available for all sites or for approximately the upper 100 m in logged holes. It is useful to be able to correct the shipboard laboratory data to approximate in-situ conditions. The laboratory and log porosity data vs. depth below seafloor for Site 803 is shown in Figure 7. A systematic difference is present between the two data sets. This behavior was observed for all sites and is attributed to the effects of removing the laboratory samples from their in-situ positions.

Sediment rebound is a complicated phenomenon. Two mechanisms are likely to contribute to porosity rebound. When a sediment sample is removed from the total overburden stress state corresponding to its in-situ position, an elastic adjustment of the sediment framework occurs because of the decrease in the overburden stress state. During this expansion, water flows through the sediment and into the sediment pores. The expansion that occurs during retrieval of the core will depend on the coefficient of consolidation of the sediment and the length of the drainage path, and could be less than the expansion potential of the sediment.

The second mechanism for porosity rebound is pore fluid volume expansion caused by the release of hydrostatic pressure. Expansion of the pore fluid is caused by a change in seawater density and is related in magnitude to the water depth. The expansion of pore water calculated for the water depths for the sediments cored on the Ontong Java Plateau is in the range of a 1%–2% increase in pore volume.

Table 1. Sample information and consolidation test data for the 19 tests performed for this study.

Test no.	Hole	Depth (mbsf)	P_o' (kPa)	P_c' (kPa)	OCR	Coefficient of consolidation (cm/s)	Compression index	Recompression index
1	803D	14.93	74	490	6.6	0.016	0.72	0.052
2	803D	118.51	656	—	—	—	—	0.022
3	803D	212.03	1194	—	—	—	—	0.038
4	804C	4.22	21	190–280	9.0–13.3	0.015	0.62	0.051
5	804A	14.92	76	130	1.7	0.020	0.53	0.015
6	804C	99.22	525	1300	2.5	0.032	0.42	0.045
7	804C	202.23	1139	805	0.7	0.010	1.14	0.066
8	805C	15.23	75	510	6.8	0.016	0.58	0.036
9	805A	26.18	129	210	1.6	0.016	0.54	0.047
10	805C	31.22	154	305	2.0	0.017	0.54	0.038
11	805B	98.13	524	260	0.5	0.015	0.45	0.017
12	805B	204.12	1129	—	—	—	—	0.055
13	806B	18.94	96	280–400	2.9–4.2	0.013	0.58	0.036
14	806A	32.43	164	350	2.1	0.021	0.66	0.042
15	806B	118.41	620	4000	6.5	0.028	0.29	0.021
16	806B	211.91	1172	510–900	0.4–0.8	0.024	0.67	0.033
17	807A	14.84	73	260	3.6	0.034	0.53	0.049
18	807A	100.34	526	350–570	0.7–1.1	0.030	0.54	0.035
19	807A	206.34	1162	830–1050	0.7–0.9	0.037	0.36	0.011

It is difficult to quantify how the two processes—adjustment of the sediment structure to the removal of overburden and pore-water expansion—contribute to the total porosity change. The elastic adjustment of the sediment structure caused by the removal of overburden pressure is constrained to zero rebound at the seafloor. However, a small increase occurs in the porosity of even the surface sediments upon removal from in-situ conditions because of the expansion of the pore fluids related to the change in seawater density.

It seems likely that rebound is controlled by different mechanisms according to depth below seafloor. For sediments near the sediment/water interface, porosity rebound is controlled by pore-water expansion, resulting in a 1%–2% change in porosity, depending upon water depth. As depth below seafloor increases, the effect of overburden on the sediment increases, and the associated resulting elastic rebound when that overburden is removed also increases. It is unlikely that the porosity change ascribed to each of these processes should be added to correct the laboratory data. At least part of the pore fluid expansion must be accommodated by the elastic rebound caused by the removal from overburden that occurs concurrently. The pore fluid expansion from release of hydrostatic pressure may also release residual effective stress maintained within the sediment, resulting in a lowered tending of the sediment structure to expand along the rebound curve.

Although they can be interrelated, we emphasize that elastic rebound that results from the removal of overburden pressure is not solely the result of seawater density decrease and associated pore fluid volume increase. The data for these carbonates indicate that the elastic rebound with depth as determined from consolidation test results (Fig. 6) is in the 1%–3% range and close to the amount of pore-water expansion caused by the decrease in pore-water density. However, for other sediment types, such as silicious sediments (Lee et al., 1990; Marsters and Christian, 1990) and clays (Hamilton, 1976), the amount of elastic rebound far exceeds what could be accounted for by expansion of pore waters. Expansion of pore waters is dependent only upon water depth and is not influenced by sediment type or constituents; if it were the only mechanism responsible for porosity change in sediments upon removal from pressure, no variations in rebound would occur with varying sediment types.

Corrected laboratory porosity data vs. depth for the upper 150 m of Hole 803D are presented in Figure 8. The solid line shows the data corrected for rebound using the porosity rebound vs. depth relationship of Equation 3. The points are the data corrected only for expansion of pore waters, using the methods detailed in Urmos et al. (this volume). Because measured laboratory porosities are greater than log or in-situ values (Fig. 7), the corrections involve a decrease in porosity. Near the seafloor, the correction for seawater density is greater than that for rebound. With increasing overburden, the correction for rebound increases until the two corrections merge (at a depth between 100.7 and 123.2 mbsf for Hole 803D). Below this merge depth, the correction for rebound becomes increasingly more important with depth.

It seems reasonable to combine the two corrections into one. This has been accomplished by using the correction for pore-water expansion in the upper sediments, where it is more significant, than the rebound correction and by using the rebound correction below the midpoint of the range of depths over which the two corrections merge. Log porosity and corrected laboratory porosity vs. depth for Hole 803D are shown in Figure 9. Problems with the density log resulted in no logging data in the upper 220 m in this hole. The corrected laboratory data provide a good fit to the log data.

Log porosity vs. corrected laboratory porosity for Hole 803D is presented in Figure 10. Anomalous data in the logs, including the log data above 220 mbsf, apparently caused by malfunctions of the tool, have been excluded from this comparison. The light diagonal line represents the ideal relationship between the two data sets, with the equation log porosity = laboratory porosity. The data are a good approximation to the ideal relationship, indicating that the combined correction used is valid.

The rebound correction was derived from consolidation test data for oozes. The applicability of this correction to chalks must be considered. The rigid structure in cemented chalks could inhibit the elastic adjustment to the decrease in load that occurs in oozes. However, Lind (this volume) observed no obvious chemical compaction in the chalks. Consolidation test results for chalk yielded similar compaction trends as for oozes, and no evidence of cementation was seen in the SEM samples (Lind, this volume). Thus, similar rebound behavior in chalks and oozes would be expected.

A relationship may exist between microfossil content and porosity rebound. Sample 7 is described as a light reddish brown ooze and termed as a radiolarite by shipboard sedimentologists (Shipboard Scientific Party, 1991a). Shipboard smear slide analyses estimate the composition at this depth (202 mbsf) as approximately 40% radiolarians and approximately 60% nannofossils. Shipboard carbonate content analyses indicate a minimum calcium carbonate content of 65%–75% at this depth. Sample 7 exhibits a much higher rebound (and compression index) than any other sample; these properties may be related to its microfossil content.

Although preliminary analyses of SEM images of four of the consolidation samples indicate a relationship between the amount of

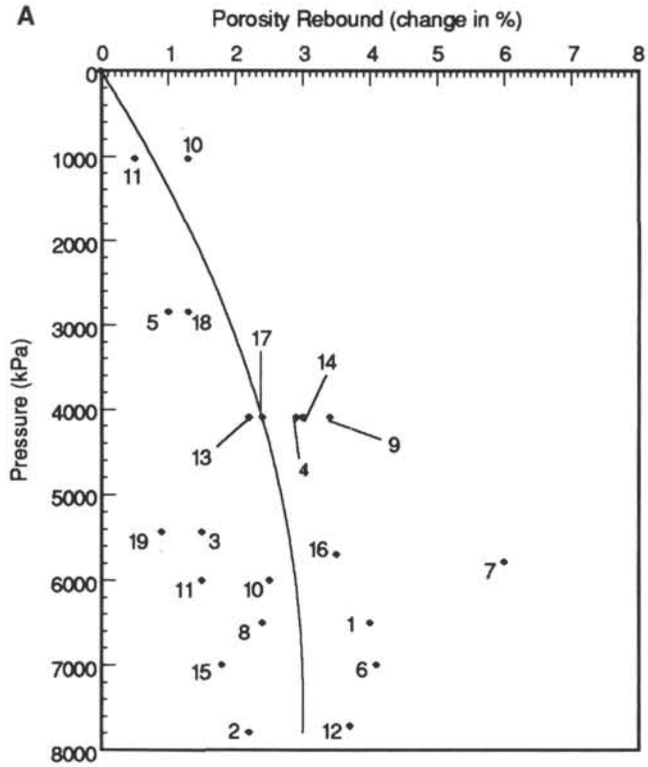

Figure 6. **A.** Rebound in % porosity change from pressures indicated to laboratory pressure for the 19 consolidation samples. The fit to the data has the equation:

$$\text{rebound} = 8.05 \times 10^{-4}\, P - 5.39 \times 10^{-8}\, P^2,$$

where P is pressure in kPa. **B.** Rebound in % porosity change vs. depth (calculated from pressures) for the 19 consolidation samples. The solid line is the fit to all of the 19 samples and has the equation:

$$\text{rebound} = 5.39 \times 10^{-3}\, D - 2.50 \times 10^{-6}\, D^2.$$

The dashed line is the fit to the samples excluding Sample 7, which is obviously different from the other samples. It has the equation:

$$\text{rebound} = 4.67 \times 10^{-3}\, D - 1.97 \times 10^{-6}\, D^2,$$

and is the porosity rebound-depth relationship used in the correction of shipboard laboratory porosity data.

rebound and the sediment constituents, results of microfossil analyses on four consolidation samples, using the methods of Marsters et al. (this volume), are inconclusive. Analyses of additional SEM images and of the microfossil constituents of the consolidation samples might provide stronger relationships between compression and rebound behavior and sediment microfossil content and preservation.

CONCLUSIONS

The analyses of the consolidation behavior of calcareous sediments from the Ontong Java Plateau have resulted in the following conclusions.

1. Rebound curves from consolidation tests on Ontong Java Plateau samples yield porosity rebounds (resulting from release of effective overburden stress) of 1%–4% for these sediments at equivalent depths up to 1200 mbsf. The exception is a radiolarian-rich sample, which has a 6% rebound.

2. A rebound correction derived from the porosity rebound from effective stress release has been combined with a correction for pore-

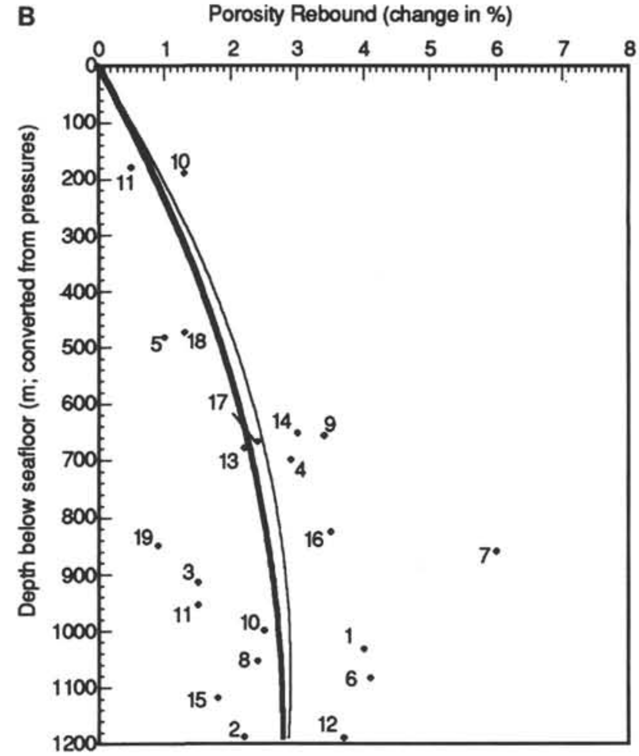

Figure 6 (continued)

water expansion to correct the shipboard laboratory porosity data to in-situ values. Comparison of the laboratory porosity data corrected in this manner with the downhole log data show good agreement.

3. This correction is a considerable advance on Hamilton's (1976) carbonate rebound correction for use with the Ontong Java Plateau sediments. Hamilton's correction is limited in its depth applicability and includes sediments >30% carbonate in the model. Such a correction is not applicable to Ontong Java Plateau sediments, which are nearly pure calcium carbonate, and which exhibit markedly different consolidation behavior.

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* Abbreviations for names of organizations and publication titles in ODP reference lists follow the style given in *Chemical Abstracts Service Source Index* (published by American Chemical Society).

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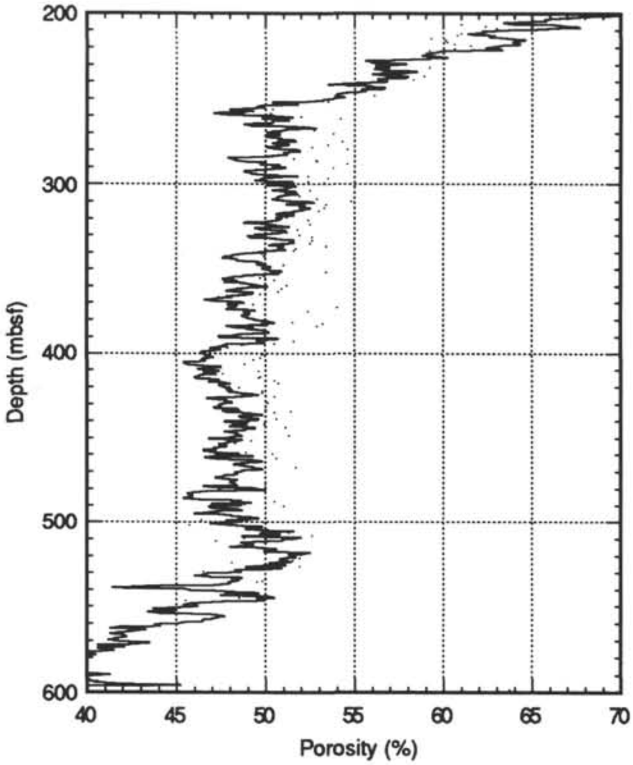

Figure 7. Hole 803D calculated log porosity (solid line) and uncorrected shipboard laboratory porosity (dots).

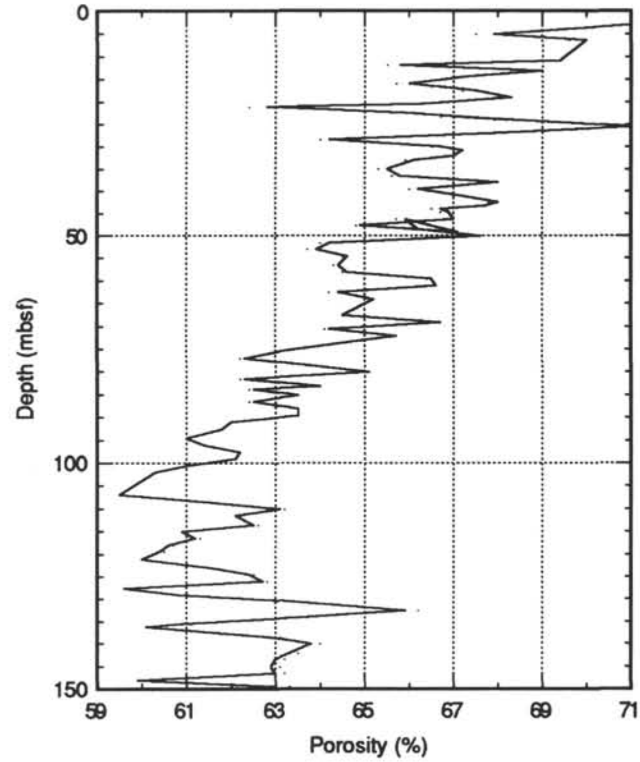

Figure 8. Hole 803D shipboard laboratory porosity data corrected for rebound (solid line) and for change in seawater density (dots).

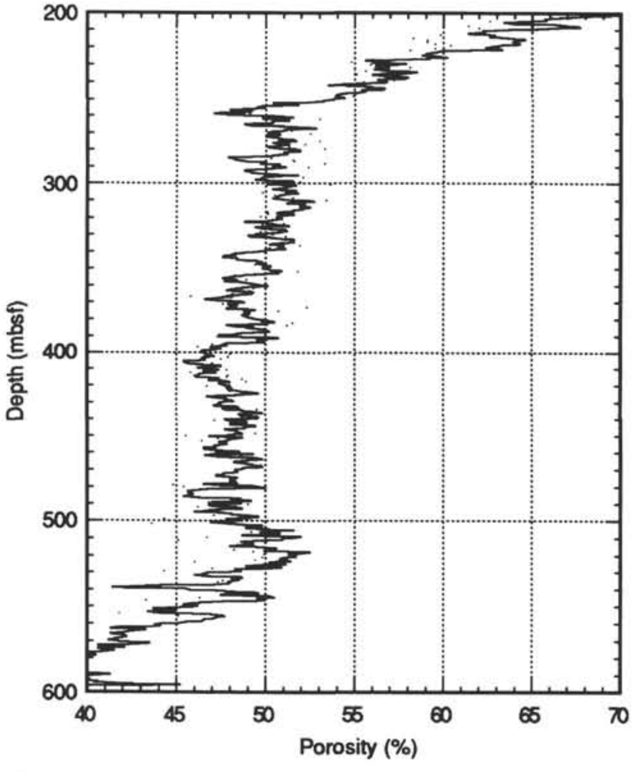

Figure 9. Hole 803D log porosity (solid line) and shipboard laboratory porosity corrected using combined rebound and seawater density correction (dots).

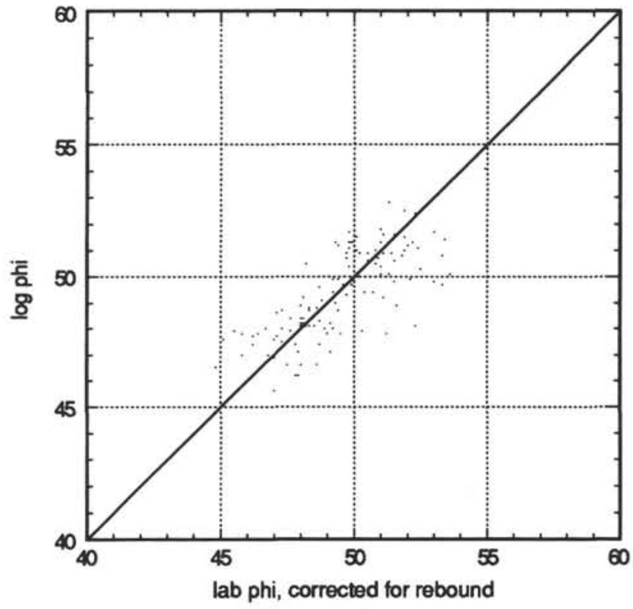

Figure 10. Hole 803D log porosity vs. laboratory porosity data corrected using the combined seawater-density and rebound correction as described in the text.