APPENDIX 1 : DETAILS OF FLUID-PRESSURE CALCULATION

The fluid pressure calculation and its potential errors involve three issues:

1) How good is the density log, and how good is its transformation to void ratio? The quality of the density log at Site 948 is verified by its correspondence to the discrete physical property measurements made at Site 671 (Figure 2)(Mascle et al., 1988). The calculation of void ratio from density is sound because the grain densities are relatively well known.

2) How appropriate is the consolidation test data used to determine effective stress from void ratio? To examine the question of errors in the transformation from void ratio to effective stress, we have considered the statistical error in the combination of consolidation test results from the reference Site 672. The 95% confidence limit on the regression in Figure 3 generates variations in fluid pressure less than the range of corrections for stress variations between the prism and consolidation tests. Additionally we have created a pore pressure curve using individual consolidation tests sorted by lithology. Overall the curve is nearly identical to that in Figure 4, except at depths greater than 498 m; the single consolidation test representing this lithology transforms into fluid pressures ranging from well below hydrostatic to lithostatic over short vertical intervals. Clearly the test is not representative. Overall the averaged consolidation test data provide a reasonable transformation to effective stress; of course, additional tests, especially those carried out in a triaxial environment would be desirable (e.g., Karig, 1993).

3) How are effective stresses determined from the consolidation tests applied to the accretionary prism environment? In the consolidation test the maximum principal or vertical effective stress is the applied load. The lateral effective stresses are about 0.63 of the vertical effective stress for accretionary prism

sediments (Karig and Hou, 1992; Karig, 1993). In the prism the maximum principal stress is approximately horizontal and the lateral stress is vertical or equivalent to the overburden. We correct for this geometric inequity by conceptually rotating the consolidation test 90 degrees. The vertical effective stress for a particular void ratio in the prism environment is equivalent the lateral stress in the consolidation test necessary to produce that void ratio. Or, in our particular case the vertical effective stresses are about 0.63 of that measured in the consolidation test. This correction assumes the ratio of the principal stresses and the shear stresses is constant between the tests and the prism; this is important because void ratio is determined by both the normal and shear stresses (Atkinson and Bransby, 1978). Shear stresses are probably higher in the prism because it is in failure rather than just yield as in the consolidation tests. Examination of the critical state envelope indicates that occurrence of the same void ratio at a higher shear would require a lower minimum principal effective stress. A lower effective stress at any depth would translate into higher pore pressure; thus our assumption of constant shear stress results in conservative estimates of pore pressure. Lack of detailed information on the critical state envelope and on lateral stresses in the prism precludes more specific estimates of effective stress.

We determine "uncorrected" fluid pressures by equating the vertical stress in the consolidation test to vertical stress or overburden in the prism; these pressures lie dominantly below hydrostatic to nearly 400 m below seafloor, an unlikely scenario (Appendix Fig. 1). The correction resulting from rotating the principal stresses produces a pressure curve that lies slightly below hydrostatic to below 100 m, which is also unrealistic and consistent with the conservative nature of the effective stress estimate. Our preferred pressure curve is derived from an empirical correction that reduces the effective stress estimated from the consolidation tests (Fig. 3) to agree with a hydrostatic pressure gradient for the upper 100 m of the prism. The mean percentage correction is then used to reduce all of the effective stress values and systematically shift the fluid pressure curve to higher values to the center of the decollement zone.

The underthrust sequence is probably in an extensional state of stress; hence, we progressively equate the mean stresses from the state in the prism to the extensional state (vertical stress in the test equivalent to vertical stress in the underthrust sequence) from the center of the decollement zone (515 m) to the base of the logged section. This transition is applied to all corrected fluid pressure curves; hence they converge with the uncorrected curve at the base of the hole.

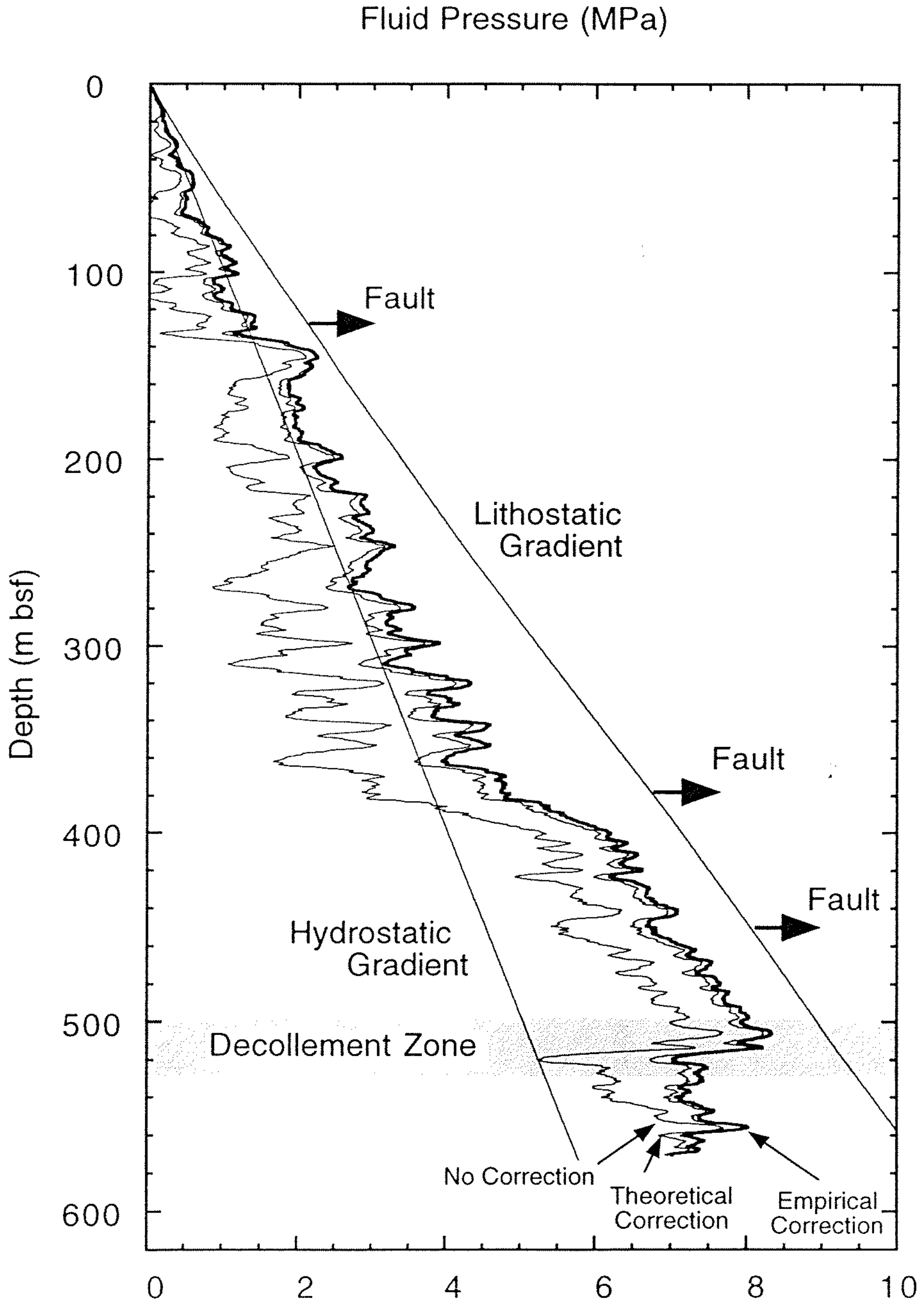
Fluid pressures estimated by analysis of the log data and from the packer tests and consolidation tests on individual samples agree remarkably well No corrections for lateral stresses were made on the latter and they may underestimate the real fluid pressures. Our fluid pressure curve is model dependent. Variations in assumptions and potential the errors all result in shifts the curve. But none eliminate the inherit character of the curve in fluid pressure and the association of variations with structural features.

REFERENCES CITED

Atkinson, J. H., and Bransby, P. L., 1978, The mechanics of soils: an introduction to critical state soil mechanics: Maidenhead, Berkshire, England, Mc Graw-Hill, 375 p.

Karig, D. E., and Hou, G., 1992, High-stress consolidation experiments and their geologic implications: Journal of Geophysical Research, v. 97, p. 289-300.

Appendix Figure 1. Fluid-pressure curve showing affects of various assumptions of lateral stress in calculation of fluid pressure. Fluid pressure curves are smoothed by 5 m moving average so they can be distinguished. Some spikes in data eliminated by this presentation are considered significant; thus preferred pressure curve in Figure 4 is not smoothed.



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Appendix Fig 1