day 2. No such effect was observed. The correlations between original bias and biases on days 2 through 6, respectively, were -0.34, 0.10, 0.09, 0.18, and 0.02. None of these was statistically significant. Also, such changes in bias as did exist from original test to subsequent test did not differ across days in any systematic fashion (F = 1.39, d.f. = 4.45, $P > .25$).

It seems reasonable to conclude, therefore, that the procedures used do not give rise to any systematic alteration of the bias of the beetle. Although alternative interpretations of our results may still be possible, the available evidence suggests that analysis of the phenomenon in terms of physiological and biochemical memory mechanisms is justifiable.

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Submarine Trenches and Deformation

Scholl, von Huene, and Ridlon report three traverses of the Peru-Chile Trench (*1*), showing flat-lying sediments with no evidence of compressive folding. They interpret this finding in terms of a widely used model: trench formation representing down-buckling consequent to horizontal compression. The origin of the stresses is not usually specified in the literature, but such stresses would have to be transmitted from far away, arising ultimately at the submarine ridges.

This common interpretation is not, however, in agreement with all the facts. At the trenches one finds the largest deviations from sea level, as well as by far the largest (negative) gravity anomalies. These facts indicate that the forces that generate and maintain the trenches originate locally rather than by transmission from very far away. As is well known, the downflow of oceanic mantle (and presumably of oceanic crustal material) occurs along seismically marked fault lines with a downward tilt toward the continent of about 45 deg. A body force on the descending material directed downward arises from two effects: (i) this material is colder than ordinary mantle material at the same level; and (ii) at greater depth the basaltic component is removed, to be added ultimately to the root of the mountain range.

Roughly speaking, there will then be a vertical tensile stress above the descending material, which, by Poisson's effect, leads to a horizontal compressive strain. But, since the upper mantle is not free but may be compared to a plate clamped at infinity, the effect of a local compressive strain will be a corresponding tensile stress. Thus all stresses above the descending material are essentially tensile; there should be no warping of the overlying sediments. The existence of downward movements near trenches is hard to deny in view of the vast gravity anomalies observed, but, as the observations quoted indicate, the associated forces are primarily of local origin.

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Fundamental to the hypothesis of a spreading ocean floor is the generation of oceanic crust at major ridges and rises, and a corresponding engulfment of this crust and younger superjacent sediment in trenches flanking continental margins (*1*). At the spreading rates proposed (1 to 4 cm/year), underthrusting should profoundly deform the sedimentary section deposited within the trench, provided sedimentary units deposited at the base of a continental margin respond to stress in a manner similar to that of their counterparts on land (*2*).

In the absence of a compelling reason for invocation of a special deformational process for trench sediments, we reason that the lack of structures in the trench fill that even remotely suggest pushing, swallowing (engulfment), or tectonic accumulation of sediment places a dynamic as well as a geographic limit on the hypothesis of spreading of the ocean floor. The principal purpose of our report (*3*), therefore, was to emphasize the incompatibility of our observation in the Peru-Chile Trench with the generally accepted model of spreading (*1*). Our observation that compressionally undeformed sediment occurs at the base of the continental margin has since been extended to include most of the margin of the Pacific basin (*2*).

Our hope to stimulate discussion of the tectonic implications of these observations for the Pacific basin has been rewarded by Elsasser's comment. Many of the effects that he proposes from a theoretical standpoint have in fact been observed by us in the Peru-Chile Trench, and by others in the Japan Trench (*4*), the Aleutian Trench (*5*), and the Middle America Trench (*6*). In all these areas only extensional features (that is, normal faults) are seen in the trench fill; compressional structures are either too small to be detected by seismic methods or absent. The fundamental trench structure appears to be a down-dropped block that has been rotated about a seaward hinge line and faulted against the base of the continental slope. Various lines of evidence from the area of the Peru-Chile Trench (*7*) also tend to support Elsasser's opinion that the tensile forces maintaining the trench are generated locally.

Unfortunately we cannot supply additional observational data that would aid in provision of a meaningful unifying model, other than what we have already proposed (*3*), to account for the *apparent* local (and tensile) tectonic origin of this trench and the *presumed* horizontal motion of the sea floor toward it.

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