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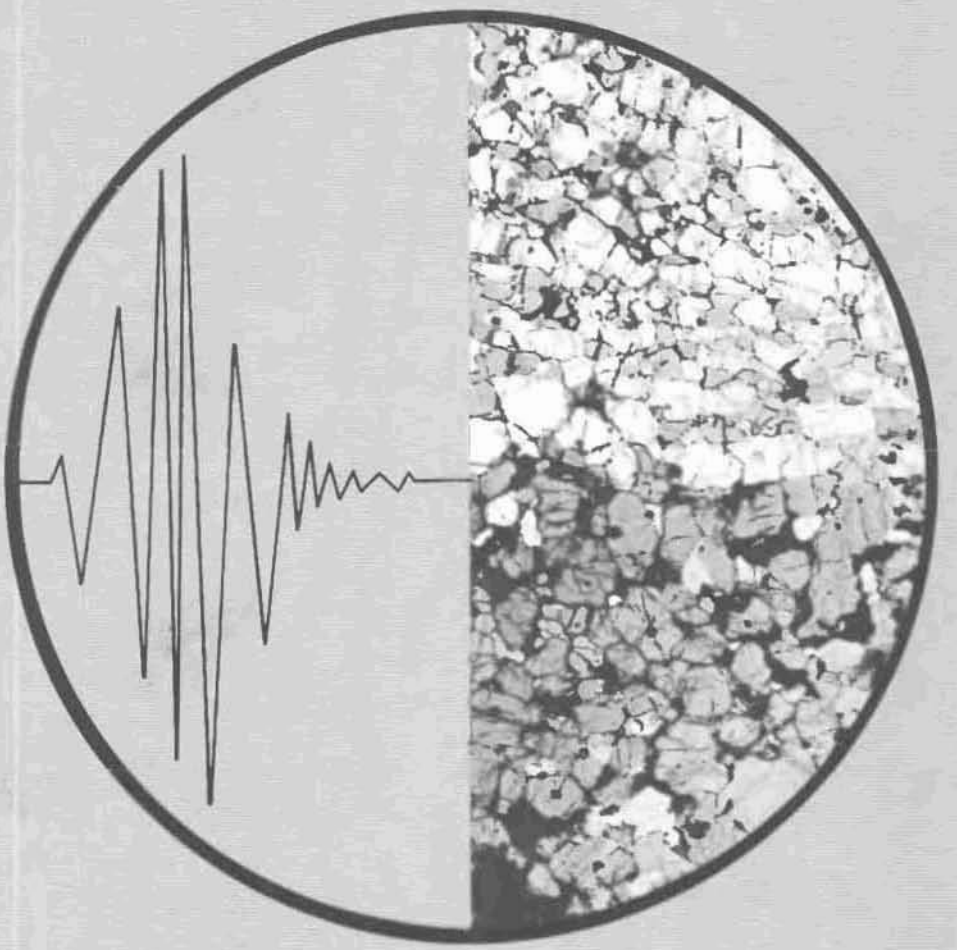

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A MECHANISM FOR THE INCORPORATION OF UPPER MANTLE MATERIAL INTO THE MIDDLE AND UPPER CRUST: EVIDENCE FROM SOUTHERN ALASKA

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Ideas regarding the possible composition of the lower crust are necessarily limited by what we view as "reasonable" given known geologic processes. Recent seismic refraction measurements in southern Alaska provide evidence for the incorporation of large amounts of mafic and ultramafic oceanic rocks into the continental crust. Underplating of the continent by paleosubduction zone complexes is the mechanism responsible.

Southern Alaska is an area that is generally agreed to consist of a mosaic of oceanic and continental fragments that have been accreted to the continental margin of North America in the past 200 m.y. Paleomagnetic studies indicate that these terranes have moved north thousands of kilometers relative to the North American craton since the early Mesozoic. The seismic refraction profiles described here provide the first information on the deep crustal structure of the various terranes.

Seven hundred kilometers of seismic refraction profiles were recorded in southern Alaska in 1984 and 1985. The profiles were shot as part of the Trans-Alaska Crustal Transect (TACT) program--a combined geological and geophysical study of the structure, composition, and evolution of the Alaskan crust from the Pacific Ocean to the Arctic continental margin.

Our interpretation of the seismic refraction data is that the accretionary Chugach terrane and the composite Peninsular/Wrangellia terrane are underlain by an extensive sequence of continuous, north-dipping alternating low- and high-velocity layers. Velocities within the high-velocity layers are appropriate for ultramafic rocks. Each layer could in fact be considered "Moho." We interpret these layers as a stack of oceanic plates that have been subducted, the deepest plate being the youngest and currently subducting plate, while the upper plates have already been incorporated into the continental crust. This interpretation implies that continental growth in southern Alaska is in part accomplished by the underplating of paleosubduction zones at the active continental margin. On the basis of similar results obtained on Vancouver Island to the south, we believe that underplating may be a generally important mechanism for the incorporation of mafic and ultramafic rocks into the continental crust.