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TITLE: Seismicity of Southern Alaska

ABSTRACT

Alaska is the most seismically active state within the U.S. Although earthquakes occur throughout much of the state, the most intense seismicity is concentrated in southern coastal Alaska, where the northwest-moving Pacific plate collides with the North American plate. Along the Aleutian Islands, Alaska Peninsula, Kenai Peninsula and Prince William Sound, major shallow earthquakes result from episodic thrusting of the Pacific plate beneath the continent. This plate boundary segment has produced the second and third largest shocks of this century worldwide: 1964 Prince William Sound (M 9.2) and 1957 Andreanof Islands (M 9.1). The effects of such shocks are extensive because of the large area and shallow depth of the earthquake source. In southeast Alaska, the motion between the Pacific and North American plates is predominantly horizontal shear on the vertical Fairweather fault, an analog to the San Andreas fault. This segment most recently ruptured in two magnitude 7 shocks: M 7.7 in 1958 and M 7.4 in 1972. Between Prince William Sound and Yakutat, the plate boundary is transitional and tectonically complex. An M 7.6 shock occurred at the eastern end of this transitional zone in 1979, but the remainder has been devoid of large shocks since the entire segment ruptured in two M 8.1 shocks in 1899. The recent seismic quiescence and the geologic record of coastal deformation suggest that this segment is likely site for a great ($M \geq 7.8$) earthquake in the next few decades.

Significant seismicity also occurs within both the subducting Pacific plate and the overriding continental plate, away from the plate boundary. Shocks as large as M 7 occur in the subducted plate deeper than about 30 or 40 km and reflect deformation of the plate as it sinks into the mantle. A zone of deep earthquakes follows the volcanic arc along the Aleutian Islands and Alaska Peninsula and extends northward through the Cook Inlet region to about 64°N and eastward to the Wrangell volcanoes. The hazards from these earthquakes are less than those of shallow plate-boundary shocks because of their smaller maximum size and their depth. Potentially more hazardous are shallow shocks originating within the continental plate, which can exceed magnitude 7. Included in this class are shocks on surface faults, such as the Castle Mountain and Denali faults, and shocks associated with volcanoes. Less is known about this class of shocks because relatively few have occurred during the short recorded history and because few detailed geologic investigations of mapped faults have been undertaken to establish recency of movement.