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Morphology and Mineral Resources of Gorda Ridge and Blanco Fracture Zone, Northeast Pacific Ocean

The Gorda Ridge is a 300-km long segment of the Pacific mid-ocean ridge system located 250 km west of the northern California and southern Oregon coastline. It is bounded on the north by the Blanco fracture zone and on the

south by the Mendocino Ridge. This slow to medium-rate spreading axis exhibits numerous morphologic similarities to the slow-spreading Mid-Atlantic Ridge and is unique in this respect among Pacific ridge crests.

The axis of Gorda Ridge is characterized by a deep (3,200-3,800 m) axial valley flanked by steep ridges rising to depths of 2,000-2,500 m. The ridge is divided into three parts by right-lateral offsets of the axis at lat. 41°37′N and 42°26′N. SeaMARC II and GLORIA acoustic imagery and Seabeam bathymetry show the structural and volcanic features associated with active ridge-crest processes, including: (1) high reflectivity of the valley floor, indicating recent volcanism; (2) numerous small volcanic cones, discs, and pit craters; and (3) long continuous fault scarps on the ridge flanks that are parallel or subparallel to the ridge axis. Structures at the northern end of Gorda Ridge bend westward where they abut the Blanco fracture zone. Escanaba Trough, the southernmost ridge segment, contains more than 500 m of Pleistocene turbidites and hemipelagic sediment. Several discrete volcanic centers (3-6 km in diameter and spaced along the trough axis at intervals of 15-20 km) pierce the sediment fill of Escanaba Trough. Heat-flow values exceeding 1,200 mW/m^2 were measured over two of these intrusion zones.

Dredge hauls from the northeastern flank of a large extrusive body at lat. 40°45′N recovered mudstone slabs, basaltic glass, and about 4.4 kg of massive sulfides consisting primarily of unoxidized pyrrhotite and minor galena, sphalerite, and chalcopyrite. Bottom photographs of the axial-valley floor in the northern Gorda Ridge segment at lat. 42°45′N also indicate the existence of hydrothermal deposits, although no samples were recovered from that site. Four deep (4,500 m) extensional basins in the Blanco fracture zone are structurally analogous to pull-apart basins found along large strike-slip faults on continents and in the Gulf of California. Subsurface intrusive bodies, and domed and tilted turbidites in one Blanco basin (Cascadia Deep) indicate active volcanism and the possibility of associated hydrothermal systems.