



Bathymetric characterization of tectonically active basins in the northern Gulf of California

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The Wagner Basin can be considered a “nascent spreading centre” that evolved from a half graben with a thick sediment cover that may mask magmatic activity at depth. The 200-210 m deep Wagner and Consag Basins are the northernmost of the 8 active extensional basins within the Gulf of California rift system and have been assumed to be mostly hydrothermally inactive; however, bathymetric data show dense deep faulting, mainly on the SE edge of the basins; additionally, the presence of extensive gas venting and heated sediments along the Wagner Fault was observed. Detailed bathymetry of the Wagner and Consag Basins shows the steep eastern edge of the basins bordered by the Wagner Fault. Bathymetry and profiler data revealed large vertical displacements due to faulting that disrupted the sedimentary column. More than 246 bubble plumes were mapped on the echo-sounder profiles, many rising to the surface from 65 -150 m depth and the area affected by low bottom pH, due to CO₂ discharge, was in excess of 365 km². Bubbles were observed breaking the sea surface from some large plumes. Only a minority of the vents present were mapped with the echo-sounders, since the closest survey lines were 1km apart. Based on the bottom coverage of the acoustic beam we estimate that there are at least 15,000 individual gas vents along the Wagner fault.

Profiler images showed gas channels and chimneys associated with sedimentary layers. The gas plumes originated from sites of intense disruptions of the upper sediments (synsedimentary faults, pockmarks, mud domes and diapirs and raised irregular hard reflectors). Beneath the plumes, there were enhanced sedimentary reflectors and acoustic blanking indicative of subsurface gas accumulation. One of the strongest vents was associated with a mud diapir. Cemented sediments were common inside pockmarks and around gas outlets; 13 (22%) of grab and box core samples in the outgassing area contained these but in many cases the grab was empty after hitting a hard bottom. The nodules analyzed contained on average 83% of quartz and barite, and 12% of pyrite and gypsum. Calcite contributed only a small percentage of the total minerals found.