Plumbing of Active Vents at the Southern Summit of Hydrate Ridge

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Abstract

In June-July, 2000, we conducted a high-resolution 3-D seismic survey of a 4 x 11 km2 region on Hydrate Ridge on the Oregon continental margin. The volume imaged includes the summit of southern Hydrate Ridge, where seafloor seep communities have been observed and from which massive hydrates have been recovered. It also includes a 30-m-high, actively-venting carbonate tower 400 m southwest of the summit. Here we discuss new information on the subsurface plumbing system feeding these active seafloor vents. The data show considerable stratigraphic complexity both above and below the BSR. We focus on a bright, negative-polarity stratigraphic horizon that can be traced to a subhorizontal "bright spot" underlying the BSR beneath the summit. We speculate that this surface is a primary conduit bringing methane-rich fluids toward

the summit of southern Hydrate Ridge and predict that variations in stratigraphic permiability favored fluid flow along this horizon, which may be an unconformity. We further speculate that diagenetic reactions have resulted in a feedback effect enhancing flow along this surface. This speculation will be tested in 2002 by ODP drilling during leg 204. Overlying the "bright spot" is a zone of chaotic bright reflectivity that extends from the seafloor to ~ 30 m depth. This pattern coincides with a zone where bubbles have been observed in the water column both acoustically (in 12 kHz data) and visually (during Alvin and ROPOS dives). We speculate that this reflectivity pattern indicates the depth extent of a zone of massive hydrate intercalated with sediment. The mechanism whereby methane migrates from the the subBSR "bright spot" to the seafloor remains enigmatic. In contrast to ODP site 892 near the northern summit, there is no evidence in the seismic data for distinct faults channeling fluids to the seafloor beneath the southern summit, although there is evidence for faulting related to subsurface fluid flow nearby (see related poster by Bangs et al.).

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