Holocene Earthquakes, Gas Hydrates, and an 11,000 Year Record of Slope Failures at Hydrate Ridge, Cascadia Margin

Details

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Authors	Johnson, J E*, Oregon State University, College of Oceanic and Atmospheric Sciences, 104 Ocean Admin. Bldg., Corvallis, OR 97331 United States Goldfinger, C, Oregon State University, College of Oceanic and Atmospheric Sciences, 104 Ocean Admin. Bldg., Corvallis, OR 97331 United States Nelson, H, CSIC/Univ De Granada Fac De Ciencias, Inst. Andaluz de Ciencias De La Tierra, Campus de Fuentenueva S/n, Granada, 18002 Spain Underwood, M, University of Missouri, Department of Geological Sciences, 101 Geology Building, Columbia, MO 65211 United States
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Abstract

Hydrate Ridge Basin-West (HRB-W) is an isolated slope basin located down slope of the well-studied gas hydrate-bearing Hydrate Ridge structure on the lower slope of the Cascadia accretionary wedge. Swath bathymetry and deep-towed sidescan sonar imagery indicate the western flank of Hydrate Ridge is dissected by a large submarine canyon, which serves as the major pathway for slope failure sediment transport into the basin. In June of 2002, we collected two piston and companion trigger cores and a kasten core from the stratigraphy preserved in HRB-W to obtain the Holocene record of slope failures (turbidites/debris flows) derived from Hydrate Ridge. Comparison of this record with the margin-wide earthquake triggered turbidite record (Goldfinger et al., 2003) will help determine (1) if earthquakes are the dominant mechanism for triggering slope failures along portions of the margin bearing gas hydrate and if so, the potential role they might play in destabilizing seafloor and subseafloor gas hydrates and/or (2) if the presence of gas hydrate weakens the sediment sufficiently to cause repeated slope failure, independent of earthquake shaking. The

recovered cores reveal a good record of Holocene turbidites across the slope basin floor. We have identified and correlated the five records within the basin, by detailed lithologic description, high resolution magnetic susceptibility and gamma density logging, core x-rays and digital photos, 210Pb analyses of core tops, and radiocarbon dating of individual events. We are currently running XRD analyses to determine the potential differences in clay mineralogy between hemipelagic and turbidite tail clays to better aid us in the interpretation of the exact number of individual turbidites preserved in our cores (as there are 3 tightly spaced sets of turbidites that may be individual events triggered separately in time or amalgamated turbidites triggered at the same time and deposited together). If we assume they are amalgamated events, then 20 turbidites have been deposited within the last 11,102 years B.P., yielding an ave. recurrence of 555 years, very close to the average recurrence (564 years) of earthquake triggered turbidites across the northern Cascadia margin over the same time interval. Continued radiocarbon dating of the individual turbidites and resolution of the tightly spaced portions of the record will test whether or not this initial interpretation remains valid, however, we are encouraged by these early results.

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