AAPG Annual Meeting
March 10-13, 2002
Houston, Texas

Jim Boles[1] (1) University of California Santa Barbara, Santa Barbara, CA

Methane seepage along faults in the Santa Barbara coastal area, California: geologic and modern evidence

Tertiary sediments of the Santa Barbara basin are a prolific hydrocarbon source and there is good evidence that the basin has been leaking hydrocarbons, including methane, to the surface for least half a million years. Faults exposed onshore along the Santa Barbara coast have calcite cement that shows evidence of gas-fluid leakage. Some of these cements have textural evidence indicating multiple events that are contemporaneous with fault movement. Stable carbon isotopic values of the calcite are as light as $\delta^{13}C$=-42 per mil, indicating a methane carbon source. Inclusions in calcite indicate the presence of meteoric and saline aqueous fluids and hydrocarbons. Homogenization temperatures are around 80-95^{o}C. Thus, methane and hot fluids were leaking from 2-3 km depths in the basin and moving upward along faults on the basin flank. The leakage began at least 120,000 to greater than 500,000 years ago, based on U-Th dates from calcite (by Jim Chen, Cal Tech).

Today, extensive seepage of methane occurs offshore in the coastal waters of the basin. Some of the most extensive methane seepage is from high angle faults along the crest of anticlines. These modern seeps are "cold" and do not appear to be carrying significant amounts of basin fluids. Calcite cement has not been found at these modern seep localities. Thus, over a 10^5 year time scale, seepage has evolved from hot fluids and methane gas being carried up along basin flank faults to cold gas seepage along faults within the basin. Modern submarine seeps are sensitive to sea height (e.g. tides) and presumably long term differences in sea level could have significant effects on seepage rate.