Weertman cracks and the near sonic extraction of diamonds from the Earth's mantle (UNESCO IGCP 557)

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New evidence from the Jwangeng diamond mine in South Botswana reveals a possible mechanism of near-sonic speed diamond extraction. Our data support the formation of Weertman cracks as a transport mechanism for the diamond bearing kimberlitic-melt from the Earth's mantle to the surface. Weertman cracks are two-dimensional liquid-filled cracks, which can move with a velocity close to the Rayleigh-wave speed. We present new data that support the hypothesis that Weertman cracks can be responsible for the extraction of diamonds. Arguments for Weertman cracks are threefold: 1) The geometry of kimberlite pipes closely resembles the shape predicted by Weertman cracks; 2) Like Weertman cracks kimberlites themselves never develop an explosive stage besides the mechanism due to contact with groundwater; the melt often gets trapped near the Earth's surface; 3) The speed of the uplift of the diamonds from >150 km depth must be larger than 250 m/s to explain preservation of diamonds themselves and our OH-diffusion profiles in garnet recorded from quenched diamondiferous host rocks.

Benthic respiration and energy transfer in cold seep habitats

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Many biogeochemical seep studies focused on the distribution, structure, nutrition and food web architecture of seep communities and their interaction with seep geochemistry. However, overall respiration and energy flux at cold seeps received only little attention. We conducted *in situ* oxygen flux measurements in combination with ex-situ oxygen profiles, respiration measurements, as well as rate determinations of microbial methane and sulfate turnover to assess respiration pathways as well as carbon turnover at a novel seep habitat, that we recently discovered alongside the Hikurangi Margin offshore northern New Zealand. This habitat is dominated by extremely dense beds of tube-building, heterotrophic ampharetid polychaetes. About 63% of the average total oxygen uptake (84 mmol m^{-2} d^{-1}) from this seep habitat was consumed by these polychaetes. The strongly negative carbon isotopic signature of the ampharetid tissues (-52.9±5 ‰ VPDB) indicate a methane derived diet. However, carbon production via anaerobic oxidation of methane was too low (0.1 mmmol C m^{-2} d^{-1}) to cover the carbon demand of the ampharetid communities (38 mmol C m^{-2} d^{-1}). Mass balance calculations indicate, that a major proportion of the carbon flow through the ampharetid community is sustained via aerobic methane oxidation. This is in contrast to other seep habitats e.g. the Hydrate Ridge or in the northern Gulf of Mexico, where microbial sulfide oxidation represents the major oxygen consmption process. In these environments the energy bound in methane is partly transferred to sulfide via anaerobic methane consumption and finally consumed by sulfide-oxidizing chemoautotrophs providing carbon that subsequently enters the cold seep benthic food web.