The origin of very low Eu anomalies in diogenites

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We investigated the trace element geochemistry of diogenites because these lithologies provide an important record of the magmatic history of their parent body, probably the asteroid 4-Vesta [1]. The diogenitic orthopyroxenes display a wide range of negative Eu anomalies (Eu/Eu*=0.04-0.76). The very low Eu/Eu* values suggest that the parental melts of some diogenites were contaminated by melt (s) displaying an extremely large negative Eu anomaly. Such melts could have been easily generated by low degrees of melting of the eucritic crust [2, 3]. Thus, these anomalies are the first firm indication that the parental magmas of some diogenites have intruded the eucritic crust, and consequently are younger than eucrites.

[1] Drake (2001) *MAPS* **36**, 501–513. [2] Barrat *et al.* (2007) *GCA* **71**, 4108–4124. [3] Yamaguchi *et al.* (2009) *GCA* **73**, 7162–7182.

Distribution, structure and temporal variability of hydrothermal outflow at a slow-spreading hydrothermal field from seafloor image mosaics

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To characterize hydrothermal outflow and quantify the heat flux associated with it, it is necessary to constrain its geometry and its temporal variability. We can achieve this with systematic and repeated seafloor image mapping. Seafloor image mosaics of the Lucky Strike hydrothermal site (~800x800 m) acquired in 1996, 2006, 2008 and 2009 allow us to identify active and inactive hydrothermal focused and diffuse outflow zones, their distribution, the associated ecosystems, and their relationships to the geological structure (substrate nature, faults and fissures, sediments, etc). Bacterial mats cover active venting areas, and are easily identifiable in the imagery. These diffuse and low-temperature outflows (typically <50°C), define discrete patches of 0.1 to 30 m in diameter, which are sometimes associated with high-temperature vents (200-334°C). At time scales of 1-10 years, the plumbing system is stable, as we do not document any news outflow zones, or the extinction of active structures. However, we document a decrease in the intensity of the hydrothermal activity. A detailed study of selected venting areas reveals a systematic reduction of the size and intensity of individual outflow zones. The imagery also reveals the structure of paleo-outflow at the scale of the site. Areas of fossil venting are characterized by dark hydrothermal deposits, that are clearly identifiable from either zones of active venting or the substrate. The largest areas of paleo-venting extend more than 100 m in diameter, and encompass within a number of smaller zones, while the smaller ones show no activity within. This distribution of present-day and paleo-venting indicates a systematic reduction in the size of the larger outflow zones, and an extinction of the smaller ones at long time scales that we cannot precisely constrain (100 to 1000's of years?), consistent with the short-term decline of the system. We attribute this decline in hydrothermal outflow and hence heat flux at Lucky Strike to the efficient cooling of the underlying magma chamber.