

Hydrothermal carbonate chimneys from Afar Rift

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Chimney-like structures (several meters tall) cluster in rows and groves at the shorelines of the Lakes Asal and Abhe (both within the Afar continental rift). Mineralogy and geochemistry (including C, O, Sr, U, Th isotopes) investigations of these chimneys showed that:

- they have concentric inner texture and are composed of carbonates: low-Mg calcite (Lake Asal and Lake Abhe chimneys) and aragonite (Lake Asal chimneys);

- the chimneys are poor in transition metals;

- the chimneys from the Lake Asal are richer in Li than the UCC and seafloor hydrothermal chimneys, whereas those from the Lake Abhe are richer in Ce, Eu and HREE than the UCC;

- PAAS-normalized REE distribution patterns of the chimney concentric layers show positive Ce anomaly (Lake Abhe chimneys) and Eu anomaly (Lake Abhe and Lake Asal chimneys);

- the chimneys had grown from the innermost layer towards the outermost chimney layer.

C, O and Sr isotope data suggest that the chimneys formed as a result of interaction between hydrothermal fluids and lake water, which had mixed at varying proportions during chimney evolution. Different chemistry of the reacting fluids (saline and hyper-alkaline Lake Abhe water vs hyper-saline and weakly acidic Lake Asal water) led to precipitation of chimneys with different mineralogy and geochemistry.