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Magnetic Telechemistry of the Reykjanes Ridge: Implications for the Nature of the Iceland Hotspot

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The Reykjanes Ridge has intersected the Iceland hotspot for over 50 m.y. producing a record of this interaction in the spread crust of the North Atlantic basin. Here we use a new compilation of ship magnetic anomaly data to investigate the magnetization intensity of the crust and its implications for the nature of the Iceland hotspot. We find a magnetization low that extends across the entire North Atlantic basin along seafloor spreading flowlines centered on the ridge near 61°N. This low coincides with a previously recognized chemical boundary separating enriched Icelandic-type mantle to the north from more depleted MORB-source like mantle to the south identified on the Reykjanes Ridge axis and near the Greenland margin. An abrupt increase in mantle water content toward Iceland also coincides with this boundary. The boundary separates tectonic regimes formed by the Reykjanes Ridge where the axis remained linear to the north but fragmented to the south into offset ridge-transform segments following an abrupt change in opening direction. The coincidence of magnetic, chemical, and tectonic boundaries crossing the entire North Atlantic basin along spreading flowlines indicates that the Iceland hotspot is a zoned, stable, and passive mantle anomaly rather than the commonly assumed dynamic and rapidly flowing mantle plume head. We will discuss a possible model for how this zoned chemical anomaly formed by slow upwelling from the deep mantle, was emplaced beneath thick orogenic continental lithosphere and passively resided there until rifting, continental breakup, and seafloor spreading brought the mantle anomaly above its solidus depth and affected the tectonic evolution of the North Atlantic basin.