Hydrothermal Co-rich Mn nodules and stratabound Mn deposits from Galicia Bank (NE Atlantic)

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Extensive fields of Co-rich Mn nodules and polymetallic stratabound Mn deposits were discovered and sampled on the southern edge of Galicia Bank (NE Atlantic Ocean) [1]. Nodules cover the seafloor in patches and form mound structures with internally chaotic acoustic structure as seen on multichannel seismic profiles. Co-rich Mn nodules are composed of romanechite and todorokite concentric laminae around a nucleus. Mn-rich layers (up to 58% MnO) contain up to 1.8% Co and moderate to high contents of other metals, V, Ni, Cu and Mo. The REY patterns show strong positive Eu and Ce anomalies and little fractionation between LREY and HREY. Brecciated phosphorite pebbles and slabs are related to seismic-delineated dipiric structures that breached late Oligocene and early Miocene depositional sequences. The phosphorite shows thick basal stratabound layers consisting mainly of todorokite and goethite with up to 27% MnO and 15% Fe_2O_3, which impregnated and replaced the phosphorite. The REY patterns of stratabound Mn show enrichment in HREY, negative Ce anomalies and Y/Ho ratios varying over a wide range. Sr isotopes in CFA from brecciated phosphorites are strongly radiogenic (up to 0.714808). Co-rich Mn nodules and brecciated-replaced phosphorites exhibit hydrothermal characteristics: uncommonly high Co contents, positive Eu anomaly and Sr isotopes. We propose that the mineralization was driven by geothermal hydrothermal fluid circulation along fractures, promoting transport of metals for mineralization at and near the seafloor, during regional tectonic reactivation in the early and middle Miocene.

[1]González et al. (2016) Geochem. Geophys. Geosyst., 17 (2), doi:10.1002/2015GC005861.