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Effect of intense weathering and post-depositional degradation of organic matter on Hg sequestration in organic-rich sediments and its implications for deep-time investigations.

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Mercury (Hg) enrichments in sediments are increasingly used as a tracer for distal volcanism in time-time investigations. The impact of changes in organic-matter deposition and preservation on sedimentary Hg sequestration is, however, poorly understood. In this study, we evaluate the potential role of intense weathering and post-depositional organic-matter degradation on the sequestration of Hg in sediments. For this we investigate weathering profiles in organic-rich sediments from lowermost Toarcian sediments (T-OAE) exposed at the Lafarge cement quarry (Beaujolais, SE France) and organic-rich deposits, which compose the uppermost Cenomanian-lowermost Turonian Bonarelli level (OAE2) exposed at Furlo (Umbria-Marche Basin, Italy), Manilva (Betic Cordillera, Spain), Monte Velo (Trento Platform, Italy), and El Chorro (Betic Cordillera, Spain). The comparison of Hg data along a weathering profile in lowermost Toarcian sediments indicates that recent intense oxidation of the originally organic-rich deposits has removed up to 89% of the Hg signal originally contained in the non-weathered organic-rich succession. The organic-rich sediments of the Furlo and Manilva sections (Bonarelli level) are characterized by lower Hg/total organic carbon (TOC) ratios relative to the corresponding Hg contents, which suggest important Hg scavenging by organic matter (OM) deposition. Along these sections, pyrolysis data indicate that preserved OM mainly corresponds to type-II OM, which is assumed to be of marine origin. At the opposite, in equivalent successions, three significant positive Hg/TOC excursions persist at El Chorro and Monte Velo (Bonarelli level equivalent). There, the samples with low to moderate TOC contents (from 0.04 to 1.96 wt. %) exhibit low HI values in the field of type-III OM. This resulted from post-depositional degradation of marine OM type II to type III, which has largely modified the amount and the quality of OM but not the Hg content. Consequently, the recorded Hg/TOC ratios do not reflect original Hg drawdown but post-depositional oxidation, suggesting that extreme care is needed in the evaluation of the history of organic matter preservation when using Hg as a tracer of volcanic activity through geological history.