

Re-Os depositional age of black shales from Araripe Basin: timing of proto-Atlantic Ocean ingress into interior NE Brazil

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The correlation of the Brazilian Early Cretaceous based on non-marine microfossils biostratigraphy is challenging. Re-Os geochronology provides both depositional ages and the Os isotopic tracer for organic-rich shales [1]. Dynamic sedimentary environments, however, remain challenging for Re-Os dating due to mixing of multi-sourced sediments of different ages and/or varying initial ¹⁸⁷Os/¹⁸⁸Os (Os_i) ratios. Here we present the first reliable Re-Os ages for shales from a shallow epeiric sea captured in the Romualdo Member (Aptian, local Alagoas Stage), Araripe Basin, NE Brazil. A Model 3 Re-Os isochron yields an accurate age of 112.1 ± 4.2 Ma (2σ; MSWD=4.0; n=9) with an Os_i of 2.032 ± 0.065. This age represents the timing of the proto-Atlantic Ocean ingress into the Araripe interior rift basin in the late Aptian. In addition, a conspicuous co-linearity of 5 data points yields a Model 1 age of 131.3 ± 2.3 Ma (2σ; MSWD=1.6) with an Os_i of 1.600 ± 0.04. This older age may be associated with older, eroded, organic-rich clastic debris during sedimentation. Together with the Os_i ratio, it is in agreement with available sedimentary provenance data [2] suggesting a paleogeographic scenario of non-marine Valanginian-Hauterivian shales and Precambrian source rocks delivering sediments to a restricted basin. In contrast, a third shale interval spanning only 2 cm has significantly lower Re and Os concentrations and yields remarkably homogeneous Re-Os isotopic data. Four analyses from this sample plot to the far left on the 112 Ma isochron. The uniformity of these analyses may be interpreted as a consequence of rapid deposition of a homogeneous mud, consistent with previously suggested fluctuations in sea-level and clastic input [3]. These results add new chronology to the basin and further highlight the value of Re-Os dating within dynamic sedimentary environments, opening the perspective of placing time pins in the pre-salt oil source rocks of Brazilian Early Cretaceous extensional basins.

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[1] Stein H. & Hannah J. (2014), Springer Encyclopedia of Dating Methods, 2nd Ed., 87-118

[2] Godot J. et al. (submitted)

[3] Kroth M. et al. (2021), Sedimentary Geology 426, 106025