



## **Cyclostratigraphic analysis of the Middle to lower Upper Ordovician Postolonnec Formation in the Armorican Massif (France): integrating pXRF, gamma-ray and lithological data**

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The Middle to lower Upper Ordovician sections of the Crozon Peninsula area (Postolonnec Formation, Armorican Massif, western France) show multi-order eustatic sea-level changes (Dabard et al., 2015). The sections are characterized by siliciclastic facies, which were deposited in tidal to storm-dominated shelf environments. Dabard et al. (2015) analysed the facies, their stacking patterns, and gamma-ray data and applied backstripping to identify subsidence and several orders of sea-level change. The main stratigraphic constraints are coming from (chitinozoan) biostratigraphy. The 3th to 5th orders changes are hypothesized to correspond to various frequencies related to astronomical forcing.

This study investigates the potential added value of portable X-Ray Fluorescence (pXRF) and the application of spectral analyses. High-resolution (cm-scale) non-destructive pXRF and natural gamma-ray measurements were carried out on 14 m of section that was equally logged on a cm resolution. The pXRF measurements on the surface of the outcrops are compared with earlier results of wavelength dispersive XRF spectrometry and ICP-MS. The potassium records of the pXRF and gamma-ray logs are comparable and essentially reflect lithological variations (i.e. between mudstone and coarse sandstones). Other reliably measured elements also reflected lithological aspects such as clay-sandstone alternations (e.g. K, Rb, Ti), placer locations (Zr, Ce, Ti) and potentially clay mineralogy and condensation horizons (Ni, Zn, Co, Mn).

Spectral analyses of the various proxies (lithology, natural gamma-ray and pXRF) are compared with each other. Both the new high-resolution data (14 m of section) as well as the published low-resolution data (which span almost 400 m of Darriwilian-Sandbian) were analyzed. The study reveals strong indications for the imprint of obliquity, precession and eccentricity. Obtaining age constraints, in addition to the existing biostratigraphical framework is a challenge in these sections, but would help to resolve temporal uncertainties and confirm our interpretations. The relative strength of the potential obliquity and precession-eccentricity signals also can provide further insights in the global glaciation history of the Middle to Late Ordovician given that a larger obliquity component can be expected if there was a more developed polar ice sheet on the Gondwanan palaeocontinent.

Dabard M.P., Loi A., Paris, F., Ghienne J.F., Pistis M., and Vidal M. (2015): Sea-level curve for the Middle to early Late Ordovician in the Armorican Massif (western France): Icehouse third-order glacio-eustatic cycles. *Palaeogeography, Palaeoclimatology, Palaeocology*, 436, 96-111, doi:10.106/j.palaeo.2015.06.038