The imprint of Astronomical cycles in the Ludlow part of the type-Silurian Cellon section in the Carnic Alps, Austria

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Abstract

The Cellon section is the original section which forms the basis for the current Silurian conodont zonation on which the current Silurian timescale is based. The Cellon section including its conodont zonation has been thoroughly analyzed, reviewed and revised over the years, but no age constraints (absolute via U/Pb ash bed dating or relative via the construction of astrochronologies) are available for the Cellon section. It therefore remains unknown how much time the section actually encompasses. To get age constraints a cyclostratigraphic study was conducted on a new high resolution (_˜1cm) pXRF record of the Ludlow part of the Cellon section. Astronomical cycles ranging from the precession to long eccentricity can be visually recognized in the CaO, Al2O3 and Fe2O3 pXRF records. A clear bundling of cycles is observed in the record with 5-6 cycles contained within 1 small bundle and with 3-4 small bundles forming a larger bundle. This bundling results in a ratio of 21:3.5:1, which is akin to the 19,2:110:405 (21:3.6:1) ratio between precession, short eccentricity and long eccentricity. Of all the recognized cycles the small bundle (short eccentricity) is most pervasive in the record and is therefore chosen as the main astronomical cycles which is traced in the wavelet spectra of the CaO, Al2O3 and Fe2O3 pXRF records. The result is a short eccentricity-based age-model with uncertainties. Previous biostratigraphic studies indicated that there is a hiatus at 28.47m at the base of the Lau event. To estimate the duration of this hiatus first the 405kyr eccentricity cycle is extracted from the CaO, Al2O3 and Fe2O3 records split at the hiatus. The duration of the hiatus was then calculated by subtracting the sum of the duration between the last 405kyr eccentricity peak/through below the hiatus and the duration between the hiatus to the first 405kyr eccentricity peak/through above the hiatus from a complete 405kyr cycle which results in a duration of 123 +/-18 kyr for the Lau event hiatus. The resulting age model allows us to assign durations to the conodont zones, the Lau event, the different lithological units, the Ludlow Series and the Gorstian and Ludfordian Stages. One surprising results of the age model is that the Lau event has a relative short duration of only 444 +176/-47kys. The durations for the Ludlow, Gorstian and Ludfordian, (4622 +374/-306 kyr, 1432 +120/-95 kyr and 3190 +254/-210 kyr) are of similar duration as the current geological timescale however our astrochronological age model assigned durations are accompanied by significantly reduced uncertainties. The results from

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this study demonstrates that the imprint of astronomical cycles in the Ludlow part of the type-Silurian Cellon section is pervasive and of high quality allowing one to assign durations to different subdivisions contained within the studied section.

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