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Time and Life in the Silurian: a multidisciplinary approach
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Silurian stratigraphy and paleontology of the Valongo anticline and Arouca-Tamames syncline, Central-Iberian Zone (Portugal and Spain)

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Silurian rocks crop out intermittently in a narrow belt, 320 km long, extending from the NW corner of Portugal to south of Salamanca, Spain. Although graptolitic shales have been known from many localities since the 19th Century, detailed knowledge on their stratigraphy and fossils is very limited and comes mainly from the classical Valongo and Tamames areas. The Silurian succession comprises three units that, in ascending order, are: a) ca. 100 m of black shales and lydites (lower "Xistos Carbonosos"); b) dark shales with alternating siltstones and lydites (upper "Xistos Carbonosos", of unknown thickness) and c) about 200 m of sandstones and siltstones (Sobrado Formation). The highest unit may include the Silurian-Devonian boundary or may be entirely Devonian on the basis of the Middle Devonian age of El Castillo volcanic rocks in the Spanish outcrops (Gutiérrez-Alonso *et al*., 2008).

Published graptolite data (Thadeu, 1956; Waterlot, 1965; Romariz, 1962, 1969 and references cited therein) allowed the lower black shales to be correlated to the Llandovery and the upper dark shales to the Wenlock. However, available graptolite lists show a remarkable inconsistency by the identification of some Aeronian, Telychian, Sheinwoodian or even Ordovician graptolite species from the same horizons, and sometimes associated on a single slab. The Wenlock graptolite assemblages of the upper shale unit were related to the so-called "Sardic faunas"; among them, 25 new species and "varieties" were described in the Valongo region (*Monograptus duriensis*, *Monoclimacis lusitanica*, *Pristiograptus valongensis*, a.o.: Romariz, 1962; Waterlot, 1965). This "Sardic fauna" was later reviewed by Piçarra and Gutiérrez-Marco (2001), who showed that all these local taxa are based upon highly deformed graptolites, unrecognizable at specific or even generic level.

The present authors examined most of the original material collected by the earlier workers from the Valongo and Tamames regions, as well as new localities sampled in the Arouca Geopark. Our results allow the preliminary identification of the Aeronian *Demirastrites pectinatus-D. triangulatus*, *Lituigraptus convolutus* and ?*Stimulograptus sedgwickii* biozones, as well as the Telychian *Rastrites linnaei*, ?*Monoclimacis griestoniensis*, ?*Torquigraptus tullbergi* and ?*Oktavites spiralis* biozones within the lower "Xistos Carbonosos". However, the best material comes from old localities presently

inaccessible (closed mines, urbanized areas). A good fossiliferous section needs to be located.

Graptolite-rich beds from the upper "Xistos Carbonosos" have also yielded, other than the unrecognizable "Sardic faunas", some assemblages indicating the presence of the Sheinwoodian *Cyrtograptus rigidus-Monograptus belophorus* Biozone and Homerian *Cyrtograptus lundgreni* Biozone including its *Cyrtograptus radians* Subzone without any doubt. The youngest graptolite records are of imprecise Gorstian age, as indicated by the occurrence of *Bohemograptus bohemicus* in the Tamames area.

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