



Time and Life in the Silurian: a multidisciplinary approach
Sardinia, Italy - June 4-11, 2009

P-rich nodules and “hollow graptolites” in the upper Silurian of the Moncorvo synclinorium, north Portugal

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The Moncorvo synclinorium in the Trás-os-Montes region of N Portugal is located in the northern Central-Iberian Zone. The core of the synclinorium includes a 300-600 m thick Silurian succession of strongly tectonized and sparsely fossiliferous shales with some limestone intercalations. Sarmiento *et al.* (1999) described the Silurian succession as a relatively condensed sequence that is much thinner and stratigraphically similar to Silurian successions of the Ossa-Morena Zone, SE Sardinia and parts of north Africa. Their distal shelf characteristics resemble the “Thuringian triad” by the presence, towards the upper part, of a Ludlow-Pridoli scyphocrinoid limestone correlated by conodonts.

We report here the graptolite taphonomy of silico-phosphatic nodules (up to 15 cm in diameter) found ESE from Moncorvo in a metric bed of alum shale below the scyphocrinoid limestone. From these nodules we recorded a Sheinwoodian assemblage of 3D-specimens of *Pristiograptus dubius* (Suess), *Monograptus cf. flemingii* (Salter), *Monoclimacis cf. flumendosae* (Gortani), and *Retiolites* sp. They occur as “hollow”

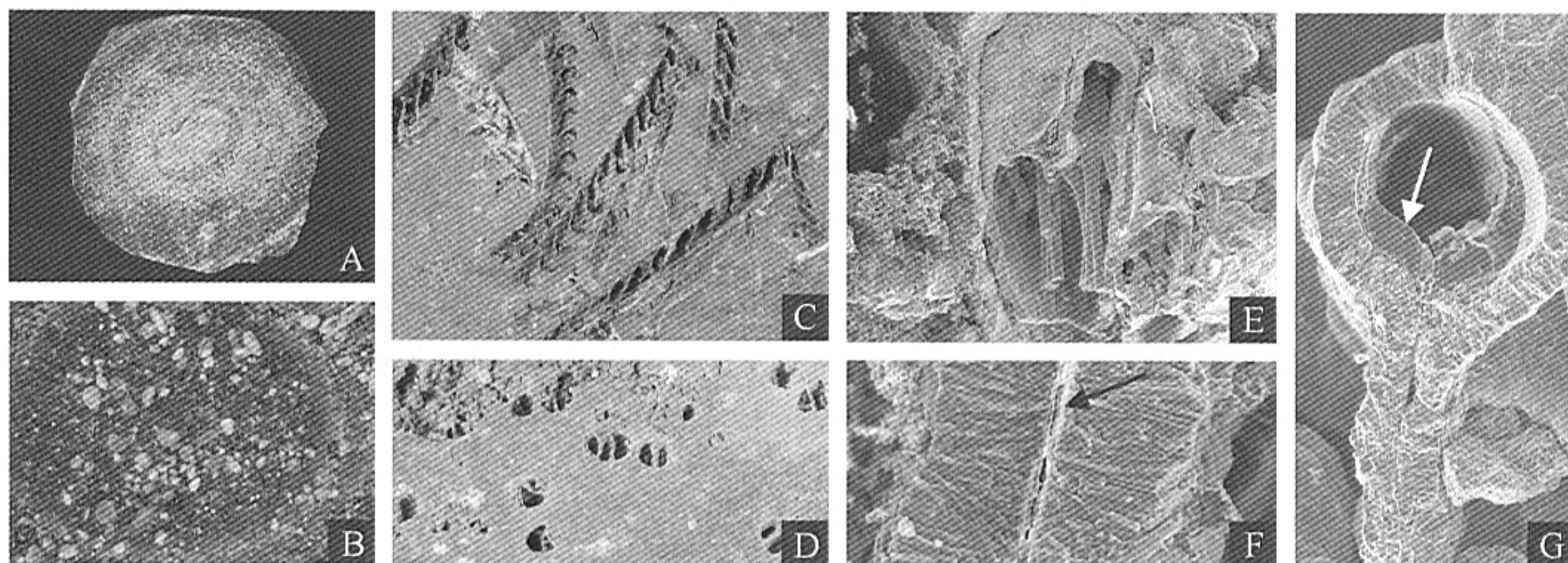


Fig. 1 - A) Equatorial section of a nodule, showing concentric rims (x 0.7); B) detail of phosphate grains (x 2.7); C) longitudinal sections of rhabdosomes (x 2.1); D) transverse sections of rhabdosomes (x 2.4); E) pseudo-stalactites of phosphatic minerals inside a rhabdosome (x 11.3); F) phosphatic overgrowth in both sides of the graptolite periderm (hollow space, arrowed) (x 116); G) geopetal silica (arrowed) at the base of an interthecal septum (x 66).

moulds in a siliceous matrix with coarse phosphatic grains. The organic periderm is not preserved, but features such as the fusellar tissue are finely replicated by phosphatic overgrowths that coated the inner and outer surfaces of the rhabdosome. Occasional “stalactites” of phosphatic minerals and colloidal silica partially occupied the empty spaces. A later alteration of the dispersed iron sulphides favoured the ferruginous impregnation of some rhabdosomes.

Our results corroborate the correlation between these Wenlock strata and the beds with “phosphoritknollen” that occur towards the middle part of the Lower Graptolitic Shales in Thuringia and SE Sardinia (Jaeger, 1976), being restricted to these Thuringian facies developed in offshore settings in northern Gondwana.

This work is a contribution to the projects CGL2006-07628/BTE (Spain) and PTDC/CTE-GEX/64966/2006 (Portugal).

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