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Ediacaran tubular fossils with Burgess Shale-type preservation, Arroyo del Soldado Group, Uruguay

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A quite diverse shelly fauna occurs in the upper Yerbal and lower Polanco formations of the late Ediacaran to lowermost Cambrian Arroyo del Soldado Group (ca. 565-535 Ma, [1]), including the cosmopolitan *Cloudina riemkeae*, the earliest agglutinated foraminifer *Titanotheca coimbrae* and the possibly phosphatic *Waltheria marburgensis* [2, 3].

Still unnamed fossil tubes occur 1100 m stratigraphically below the earliest occurrence of *Cloudina* in bluish-grey siltstones of the Yerbal Formation ("Quebrada de los Cuervos fauna"). The fossils are predominantly conical, solitary or arranged in "dumbbell" or star-shaped clusters (Figure 1). Cone-in-cone structures are typical of the fossils but, unlike *Cloudina*, cones are more deeply nested and may even share the same apex. Their size is relatively large, diameter ranging between 0.4 and 3 mm and length reaching 3 cm [3]. The following features suggest that the fossils possessed a mineralized, rigid exoskeleton: (a) strong orientation of the long axes of the tubes, (b) common occurrence of tubes oriented perpendicular to bedding, and (c) the fact that the fossils retained an inner cavity and were not collapsed during compaction. The original mineralogy of the shell is unknown.

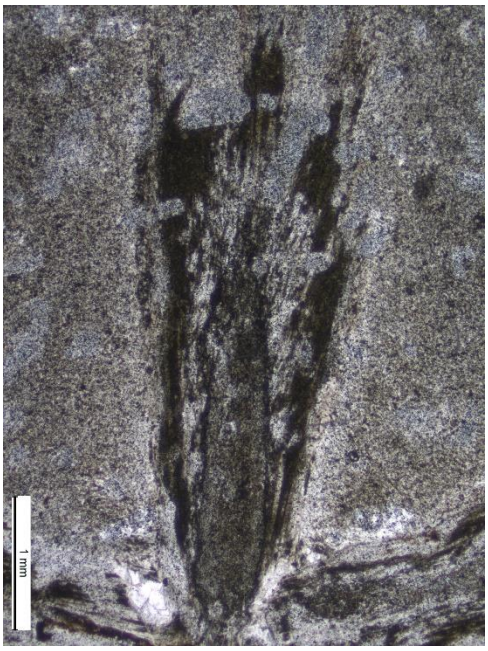

Figure 1: A specimen in a star-shaped cluster. Dark mineral is chamosite.

A significant obstacle towards unravelling the precise three-dimensional structure of the fossils is their preservation: they are replaced by silicates and cannot be isolated from the host siltstone by chemical procedures. On the other hand, the taphonomy of the tubes offers an interesting example of Burgess Shale-type preservation in the Ediacaran, which has only recently been recognized [4].

In particular, the fossil walls exhibit replacement by chamositic chlorite and sericite in alternated layers. The inner cavity is commonly filled by muscovite crystals up to 250 μm long, which grew perpendicular to the tube walls in a geode-like manner. The remaining space is filled by sediment similar to the host siltstone. The described preservation is very similar to that of fossils of the Burgess Shale Lagerstätte, for which suboxic diagenetic conditions and high Fe/C ratios seem to be determinant [5].

A high Fe content is indicated in the host siltstone by disseminated iron oxide concentrations of up to 26%. Ongoing digital tomography of fossils may help determine their precise morphology and affinities with extant or fossil organisms.

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