

## Genus ONUPHIONELLA Kirjanov, 1968

*Type species.*—*Onuphionella agglutinata* Kirjanov, 1968.

*Diagnosis.*—Large (~6 mm diameter), cylindrical or slightly expanding membranous tubes with external layer of agglutinated mica flakes. Tubes flexible and fragile in life.

ONUPHIONELLA sp.  
Figure 5.7

*Description.*—Cylindrical tubular form, nearly straight, preserved compressed; diameter 6 mm; preserved length 35 mm. Cross-section is a flattened ellipsoid. Walls composed of agglutinated flakes of mica. Faint longitudinal striations visible.

*Material.*—One specimen, part and counterpart (LACMNH 12803).

*Occurrence.*—Lower Wood Canyon Formation, Montgomery Mountains, Nye County, Nevada (LACMNH loc. 17130)

*Discussion.*—This form is identical with the fossil agglutinated tube *Onuphionella*, originally described from Siberia (Kirjanov, 1968). *Onuphionella* was documented from the Lower Cambrian Campito and Poleta Formations of the White-Inyo Mountain region (Wiggett, 1978; Signor and McMenamin, 1988). In its size and light coating of mica grains without definite arrangement in rows, our specimen is most similar to *O. claytonensis* Signor and McMenamin, 1988, the older of two species described from the White-Inyo region. This is the first occurrence of *Onuphionella* in association with Ediacara-type soft-bodied fossils.

Wiggett (1978) and Signor and McMenamin (1988) listed close similarities between *Onuphionella* and the agglutinated tubes of extant polychaetes, notably *Owenia*, although they did not formally assign *Onuphionella* to the phylum Annelida. Dispersed mica flakes are moderately common in some layers of the host rock, and are visible on the slab.

## TRACE FOSSILS

Several trace fossils were noted in measured sections which are relevant to interpretation of local biostratigraphy, sequence correlations, onset of bioturbation in the southwestern Great Basin, and age of faunas described above. Although dubiofossils have been reported from the Stirling Quartzite (Langille, 1974b), the first definitive traces occur in the fine quartzites and siltstones of the lowest parasequence of the lmWCF. These assemblages include bed-parallel forms such as *Helminthoidichnites* (sensu Hofmann and Patel, 1989; Fig. 5.10), *Palaeophycus*, *Planolites*, and bilobate trails similar to small *Scolicia* (Fig. 5.11, 5.12), and record the onset of bed-parallel bioturbation in this region. In the Montgomery Mountains, *Planolites* and bilobate trails occur on the same bedding plane as *Swartpuntia*. The lowest occurrence of the trace fossil *Treptichnus pedum* (Fig. 5.8, 5.9) occurs higher in the section, approximately 1 meter above the dolomitic top of the middle parasequence in the Wood Canyon Formation. Such traces are thought to record the onset of bioturbation with a vertically oriented component. As such, the lowest occurrence of *T. pedum* is considered diagnostic of basal Cambrian strata (Narbonne et al., 1987). Although relatively rare in Lower Cambrian strata of the Great Basin, *T. pedum* can be documented in the upper submember of the lmWCF at all studied outcrops. This generalized succession of trace fossils closely matches the occurrence of trace fossils in the White-Inyo facies

of eastern California (Fig. 1; Alpert, 1974; Langille, 1974b; Lipps and Fedonkin, 1988).

## DISCUSSION AND IMPLICATIONS

*Stratigraphic implications.*—The succession of faunas documented herein complement previous  $\delta^{13}\text{C}$  chemostratigraphic interpretation of carbonates from the Stirling Quartzite and Wood Canyon Formation, which indicates a latest Vendian positive carbon isotopic excursion in the Stirling, and a probable Lower Cambrian negative carbon isotope excursion in the lmWCF (Corsetti, 1993, 1998). All evidence suggests that the base of the Cambrian occurs, at the very highest, at the top of the middle parasequence within the lmWCF (Horodyski et al., 1994; Runnegar et al., 1995). Although radiometric age constraints are not available for these exposures, and although there may be a significant hiatus in the upper part of the lmWCF (resulting from incision by the middle member), we have no reason to believe these faunas are significantly older than 544 Ma.

Our research confirms the discovery of Ediacara-type fossil assemblages extending up to, and even into, the Cambrian (Grotzinger et al., 1995; Hagadorn and Waggoner, 1998; Jensen et al., 1998). Although the thickness of the lmWCF varies across the ~50 km of contact which we have examined, the highest Ediacara-type fossils in our measured sections are, at most, 100 meters below the lowest occurrence of *T. pedum*. Considered together with their abrupt appearance at the onset of finer-grained deposition at the Stirling-Wood Canyon contact, we question whether their paucity in this region stems from rapid closure of optimal preservational conditions by local effects. In the Great Basin, conditions favoring Ediacaran preservation may be restricted by coarse-grained clastic input from regional braidplain-delta systems in the latest Vendian, and by the onset of intense bioturbation in the Early Cambrian (sensu Seilacher and Pflüger, 1994; Gehling, 1999).

*Correlation implications.*—The White-Inyo Mountains and surrounding areas have yielded taxa that are very similar to those in our assemblage, including cloudiniids, from the lower Deep Spring Formation (Signor et al., 1983, 1987; Grant, 1990). Precise comparisons between the White-Inyo material and our Great Basin material are difficult because of the great differences in preservation; our fossils are typically molds or casts in clastic rocks, whereas the White-Inyo fossils come from fossil concentrations in carbonate strata. Poor preservation of some White-Inyo material has caused some nomenclatural confusion (Grant, 1990) that creates further difficulties in comparing the faunas. However, when considered together with similar associations of tubular cloudiniids in siliciclastic strata of Namibia (B. Runnegar, personal commun.) these occurrences suggest that the appearance of shelly fossils may not be as facies-dependent as previously thought. Moreover, addition of this new faunal information corroborates Stewart's (1970) correlation of the three submembers of the lmWCF with the three members of the Deep Spring Formation in the White-Inyo facies; and perhaps also confirms suggestions that the base of these units may record an equivalent event (see summaries in Mount et al., 1991; Runnegar, 1998).

Lastly, faunas from the Death Valley region may have analogues in more southern Vendian-Cambrian successions in Mexico. For example, similar annulated and smooth-walled tubular

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FIGURE 4—*Swartpuntia* cf. *germsi*, LACMNH 12793, loc. 17130 near Johnnie, Nye County, Nevada. 1, complete fossil,  $\times 1$ ; 2, closeup of the distal end showing fine parallel striae on both sides of the rachis,  $\times 2$ ; 3, closeup showing double parallel rims and parallel striae, suggesting the presence of at least two fronds,  $\times 2$ .