APPENDICES

APPENDIX 1: Taxonomic names of discoidal forms mentioned in Table 1.1

Details of discoidal forms are given below, with reference to the comprehensive listing of Ediacaran taxa in Fedonkin et al. (2007), in the order in which they are mentioned in Table 1.1.

Nimbia occlusa Fedonkin 1981

Nemiana simplex Palij 1976

Beltanelliformis brunsae Menner 1974

Chuaria circularis Walcott 1899

Medusinites asteroides Sprigg 1949

"Longmyndian *Intrites*", described by McIlroy et al. (2005) as similar to *Intrites punctatus* Fedonkin 1980

Ediacaria flindersi Sprigg 1947

Spriggia annulata (*Madigania annulata* Sprigg 1949)

Cyclomedusa davidi Sprigg 1947

Tirasiana disciformis Palij 1976

Irridinitus multiradiatus Fedonkin 1983

Hiemalora stellaris Fedonkin 1980; *H. pleiomorpha* Vodanjuk 1989

Eoporpita medusa Wade 1972

Tribrachidium heraldicum Glaessner 1959

Albumares brunsae Keller and Fedonkin 1977

Anfesta stankovskii Fedonkin 1984

Triforillonia costata Gehling et al. 2000

Aspidella terranovica Billings 1872

Mawsonites spriggi Glaessner and Wade 1966

Arkarua adami Gehling 1987

Eoandromeda octobrachiata Tang et al. 2008

APPENDIX 2: Further images related to the Long Mynd

A2.1 Images from Ashes Hollow Quarry

Fig. A2.1. General view of Ashes Hollow quarry, northern section with disc-rich beds in the foreground; southern section to back right (see Fig. A2.3). Upper Burway Formation, Stretton Group, Longmyndian Supergroup.

Fig. A2.2. "Longmyndian *Medusinites*" on bed sole (arrowed). Northern section of Ashes Hollow quarry. Scale bar: 1 cm.

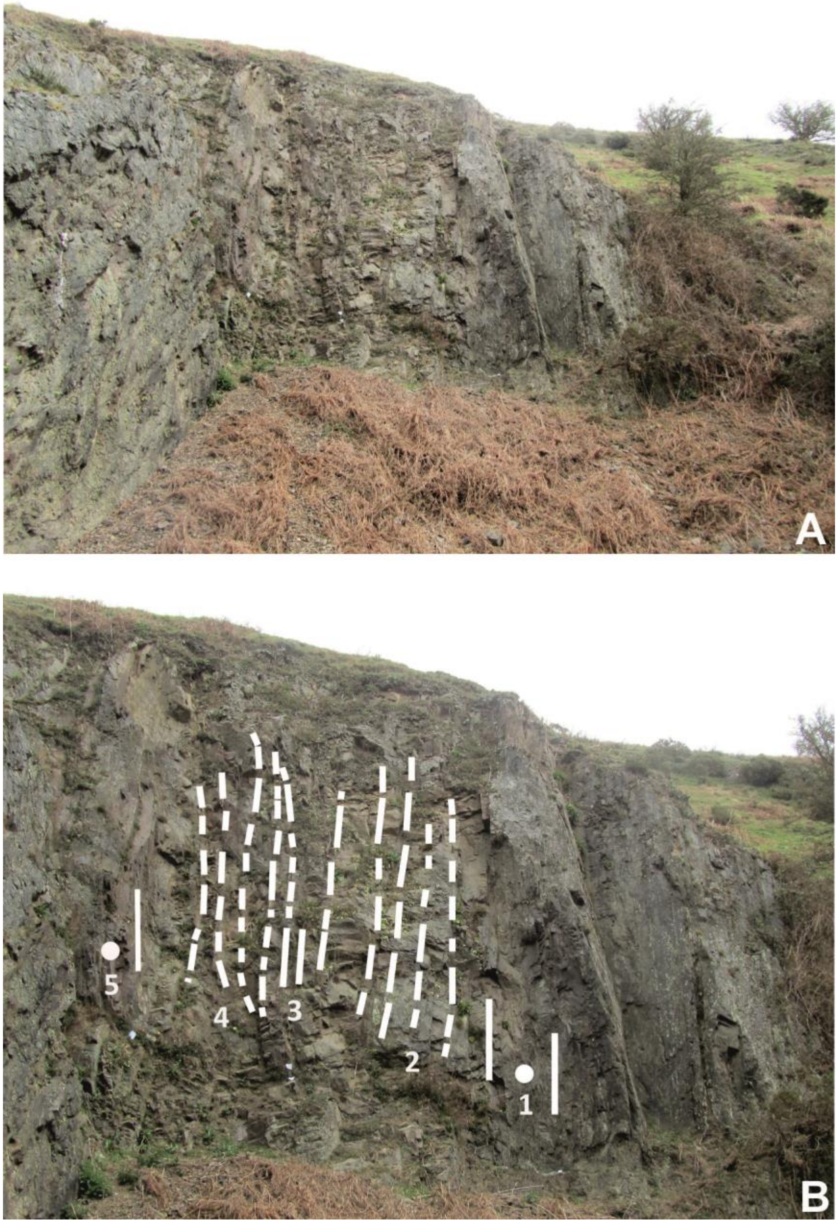


Fig. A2.3. A: Southern part of Ashes Hollow quarry. **B:** Annotated photo showing the two disc-rich beds (labelled 1, 5), cross-stratified beds (2, 4), and a narrow mudstone bed without discoidal impressions (3). A normal fault parallel to the cliff face with a throw of ~ 3 m results in the upper disc-rich bed (5) cropping out again in the northern part of the quarry (Fig. A2.1).

Fig. A2.4. Close-up of siltstone and fine sandstone laminae in first disc-rich beds (labelled 1 in Fig. A2.3), with "Longmyndian *Medusinites*" on bed sole arrowed.

A2.2 Further images of sediment disturbance and sediment injection features, upper Burway Formation, Long Mynd

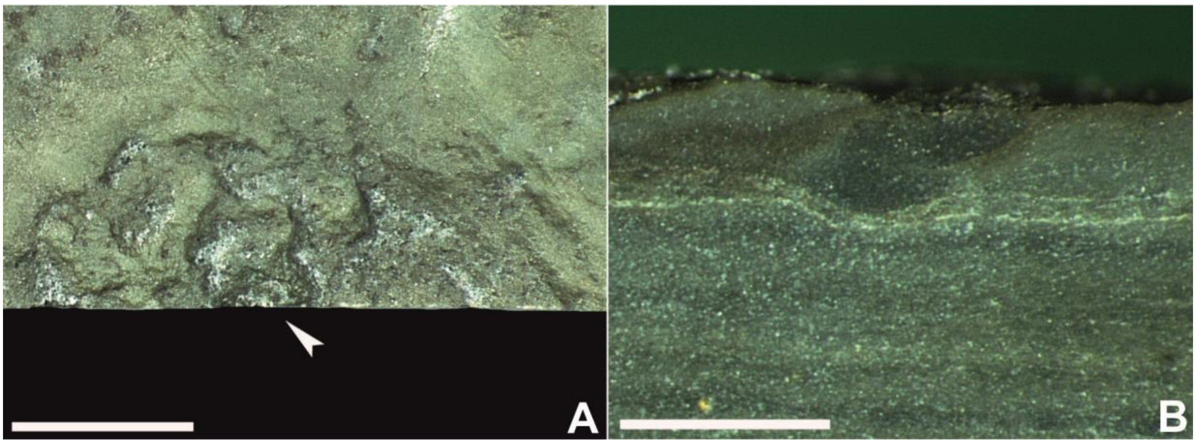


Fig. A2.5. Small sand volcano and associated features. **A:** Complex crater, centre arrowed, on top of bed. **B:** Preserved feeder column visible in cross-section. Note that the escape feature occurs just above a white matground. L-AH/18. Scale bars: 1 mm.

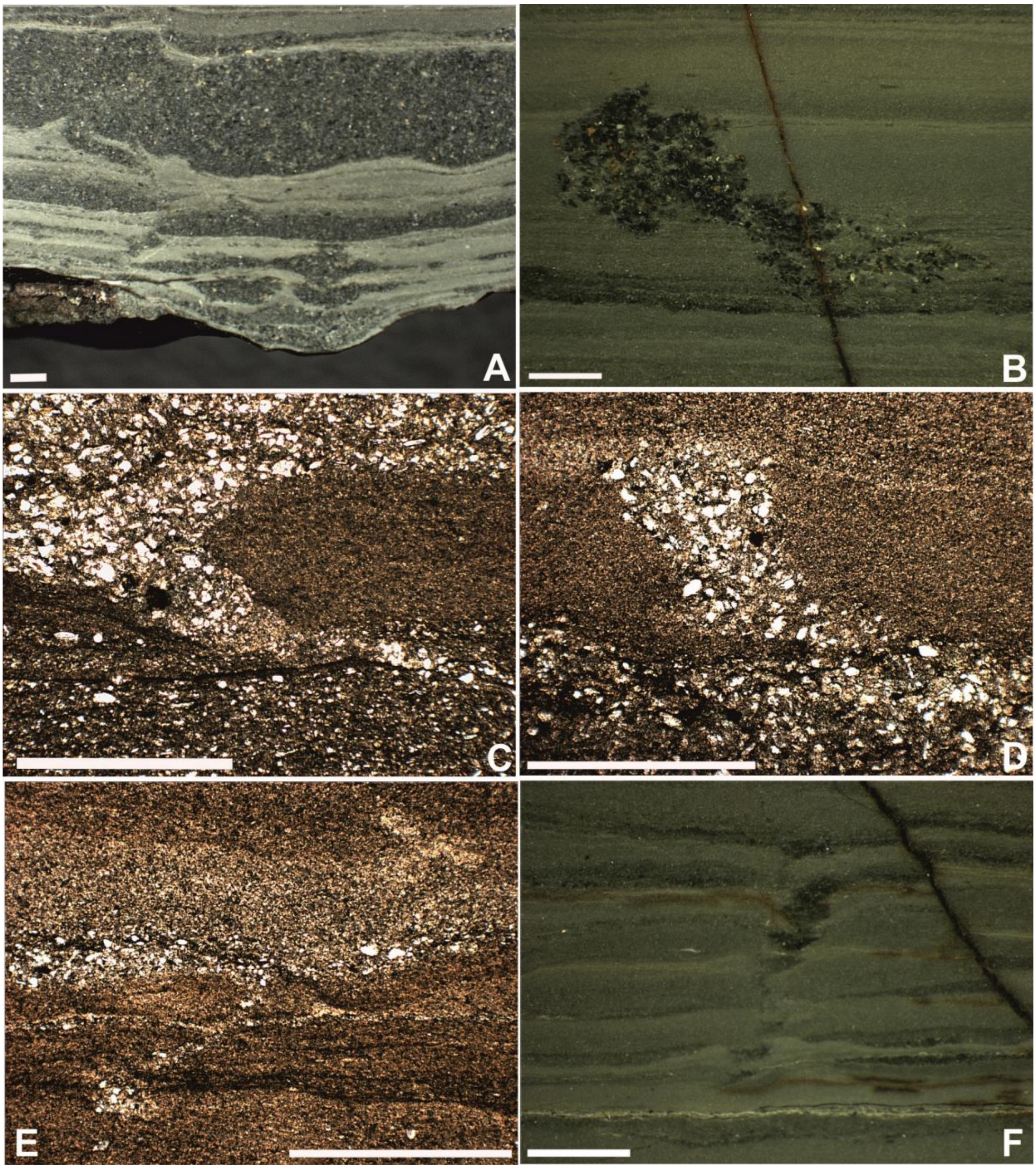
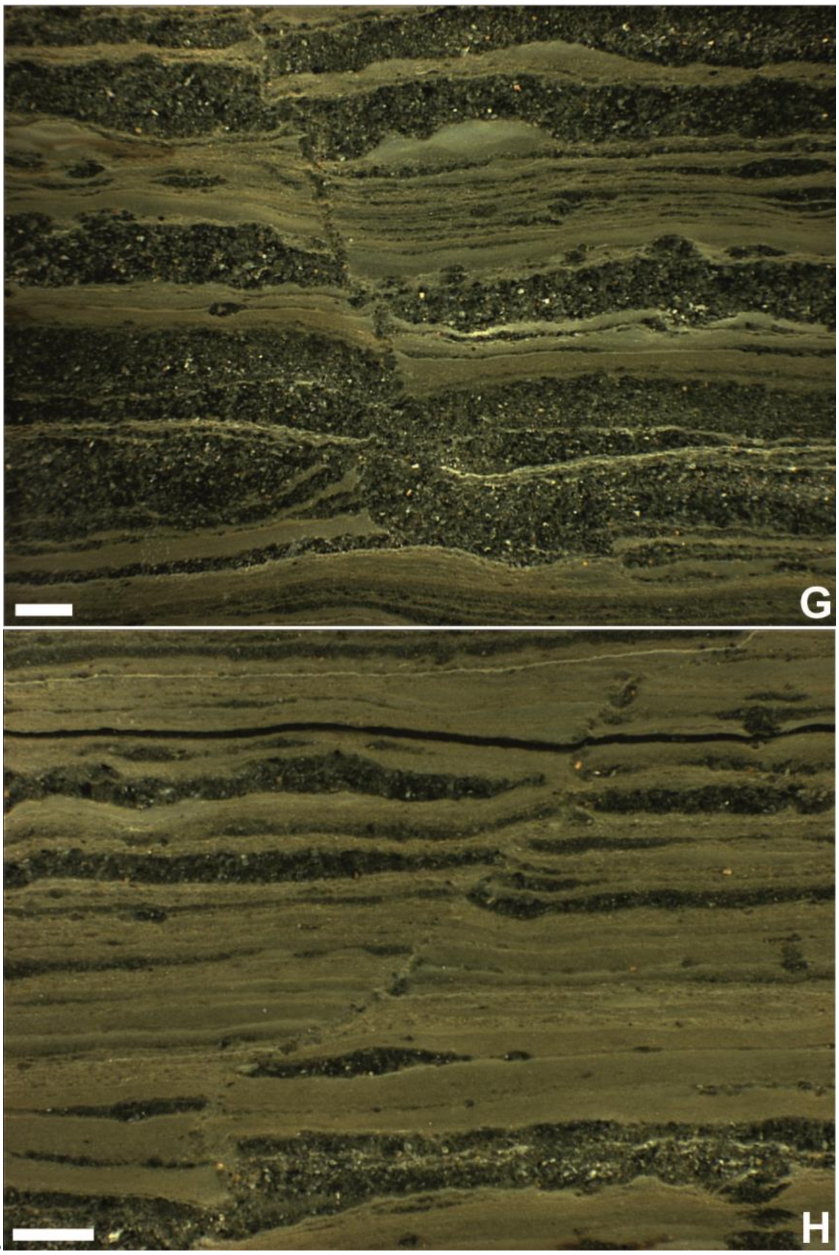


Fig. A2.6. **Figure continues overleaf ►**



A.

Fig. A2.6. Features resulting from fluid escape and loading, upper Burway Formation at Ashes Hollow(C–E, thin sections). **A:** Broader context of a "Longmyndian *Medusinites*" specimen on bed sole, showing paths of rising sand slurry. OUMNH Á.2543. **B:** Region of mixed, disturbed sediment. **C, D:** Cone-shaped sandstone structures linked by narrow extensions to lower sandstone bed. **E:** Narrow column of sandy sediment. C–E, L-AH/1c. **F:** Spiralling, widening column of sand slurry. By weaving in and out of the plane of section, such features can occasionally resemble the separate menisci of a trace fossil (cf. Chapter 5, Section 5.5.2). The widening path is however a typical sign of fluid escape. .B, F, OUMNH Á.2542. **G:** Lower part of the long vertical disturbance shown in Fig 2.3C. Note the tight zig-zag path of the narrow disturbance in places. This pattern may be partly due to compression, but may also reflect the original path taken by the fluid. (Note the Longmyndian *Intrites* structure just above centre, see Section 2.4.) **H:** Another narrow vertical disturbance. Had it not been for the context of widespread fluid escape, this feature could easily have been mistaken for a trace fossil. There is some widening of the path at the top, again resembling menisci. G, H, L-AH/12. Scale bars: 1 mm.

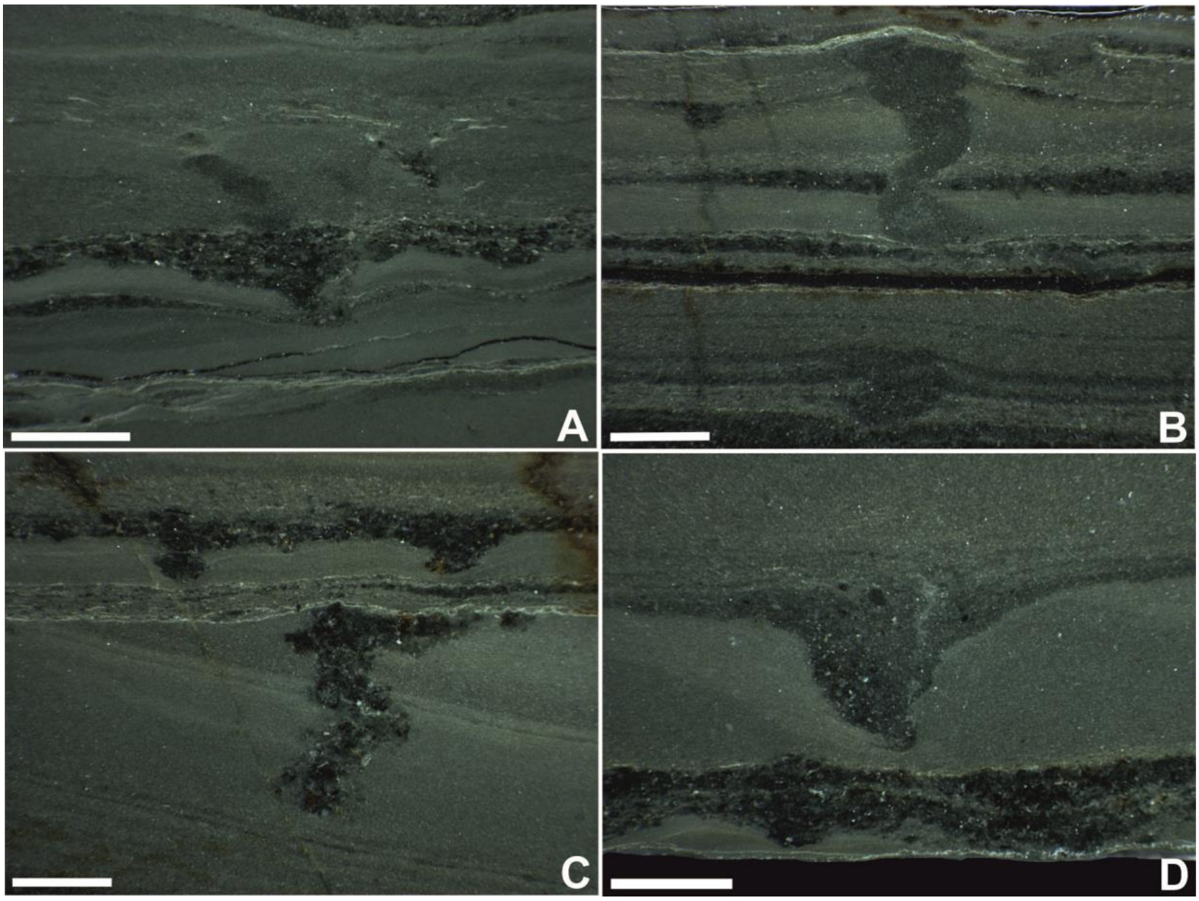
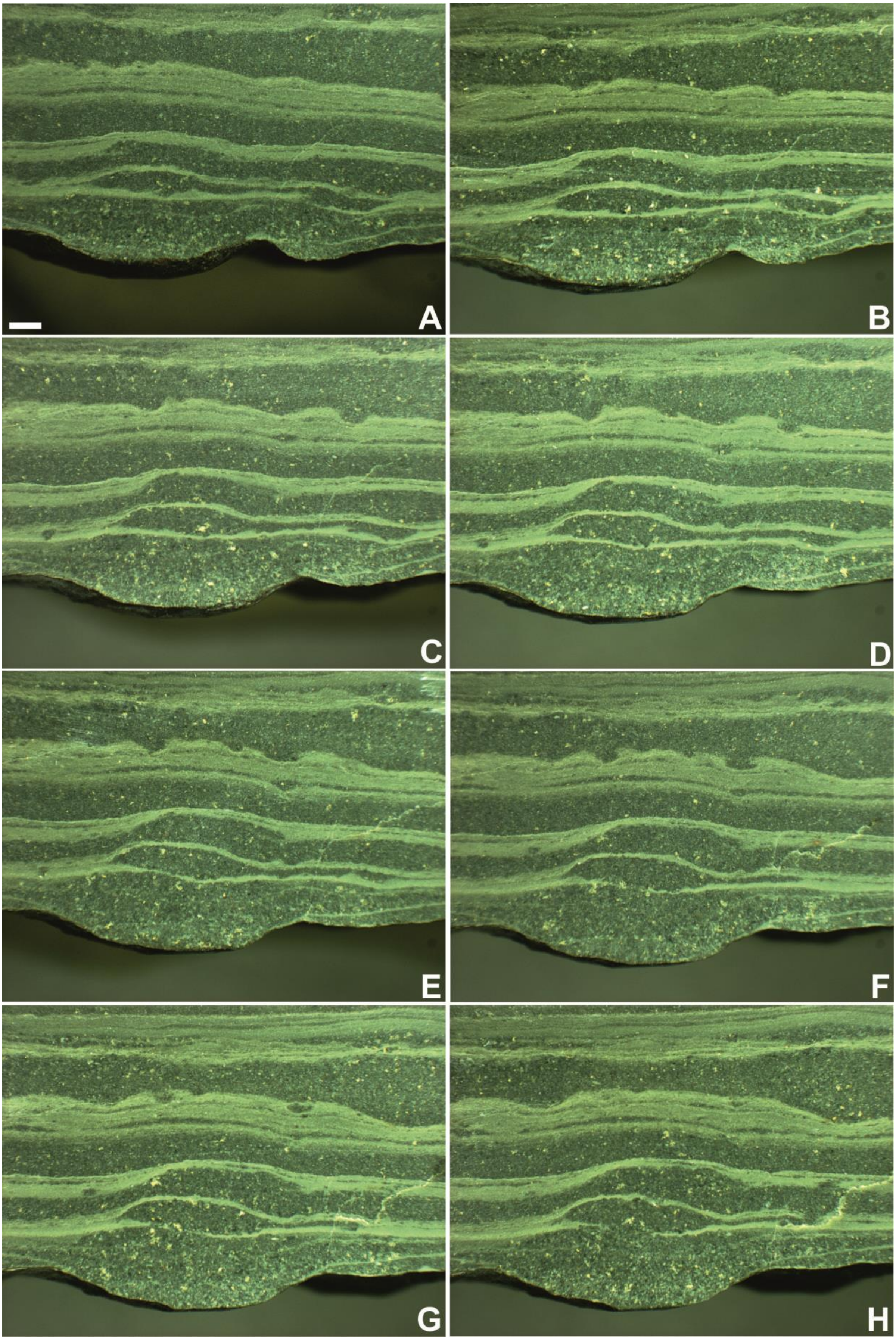


Fig. A2.7. Further examples of fluid escape and loading. These examples indicate the consistency of fluid-filled mud in which the fluid escape occurred in the upper Burway Formation. **A:** A "Longmyndian *Medusinites*" feature in cross-section showing both downward and upward extensions of sandstone. **B:** Vertical, twisting fluid escape column, arising just above a white matground and constrained by a mat layer above, which has domed upward from the force of the rising fluid below. A small fluid rise, with branches extending horizontally into sandstone laminae, can be seen at the bottom of the picture. **C:** Another irregular rising fluid escape structure entraining dark sandstone. The fluid is trapped below a white matground, and has spread horizontally below the mat layer. Note the cross-stratification of the laminae in the lower half of the picture. These laminae are cut through by the vertically aligned fluid escape feature, which has formed after the horizontal overlying laminae, including the constraining mat, have been deposited. The origin of the structure is out of the plane of section. The inferred role of mat sealing in driving such fluid escape is supported by this image. Two cone-shaped structures are seen above. **D:** Loading of sandstone into the soft mud below also plays a key role in the formation of the distinctive features seen in cross-section in the upper Burway Formation rocks, such as this typical cone-shaped form. The migration of fluid entraining sand grains along a meandering thin column from the lower sandstone level to the upper results in a wide cone as the excess weight sinks into the mud below. Note the indications of bleeding of dark sandy sediment from the sides of the cone into the surrounding green muddy sediment. OUMNH Á.2542. Scale bars: 1 mm.

Fig. A2.8. A–U: Sequential serial grinding images through a "Longmyndian *Medusinites*".



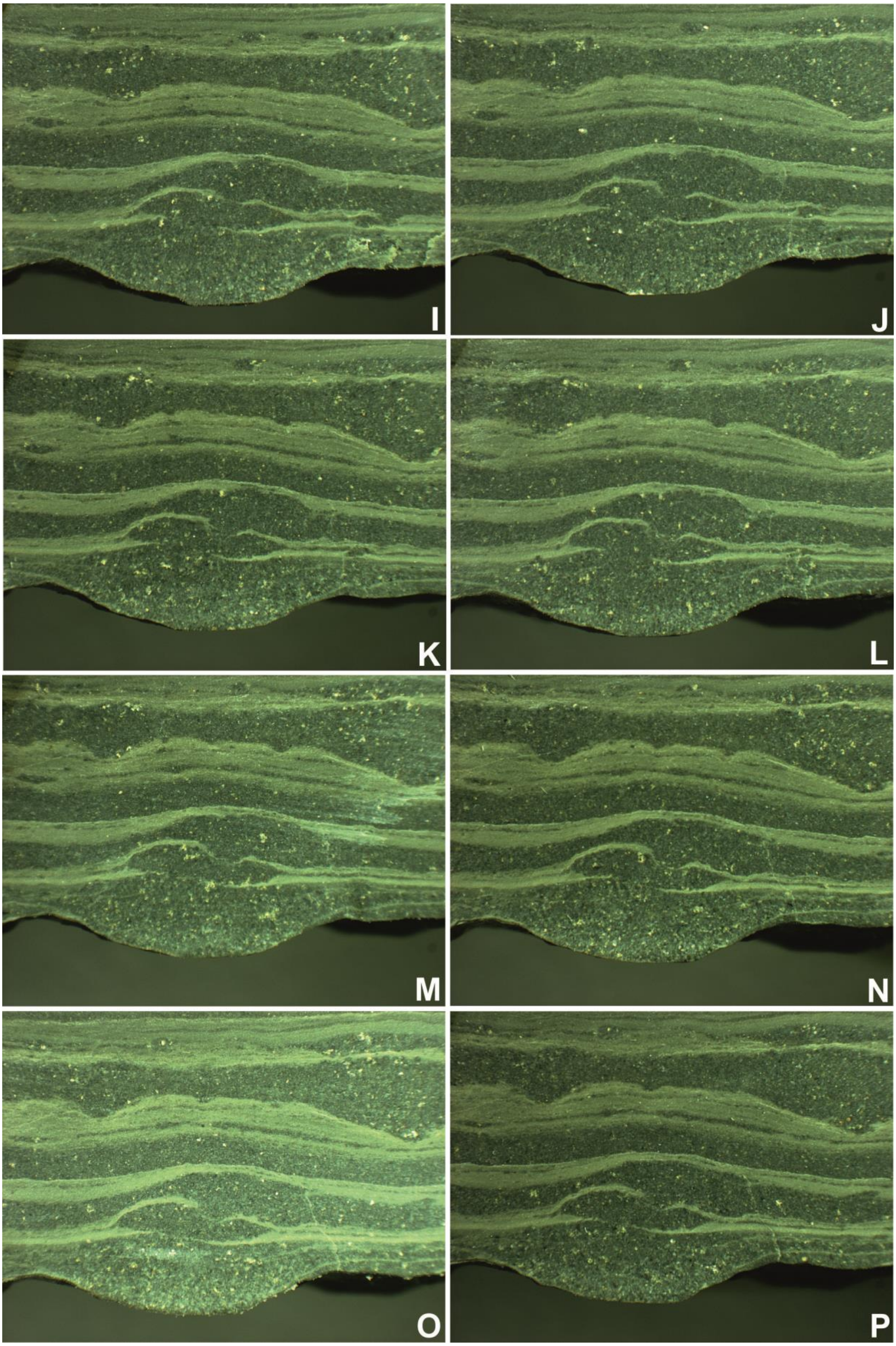


Fig. A2.8 (cont.) **Figure continues overleaf ►**

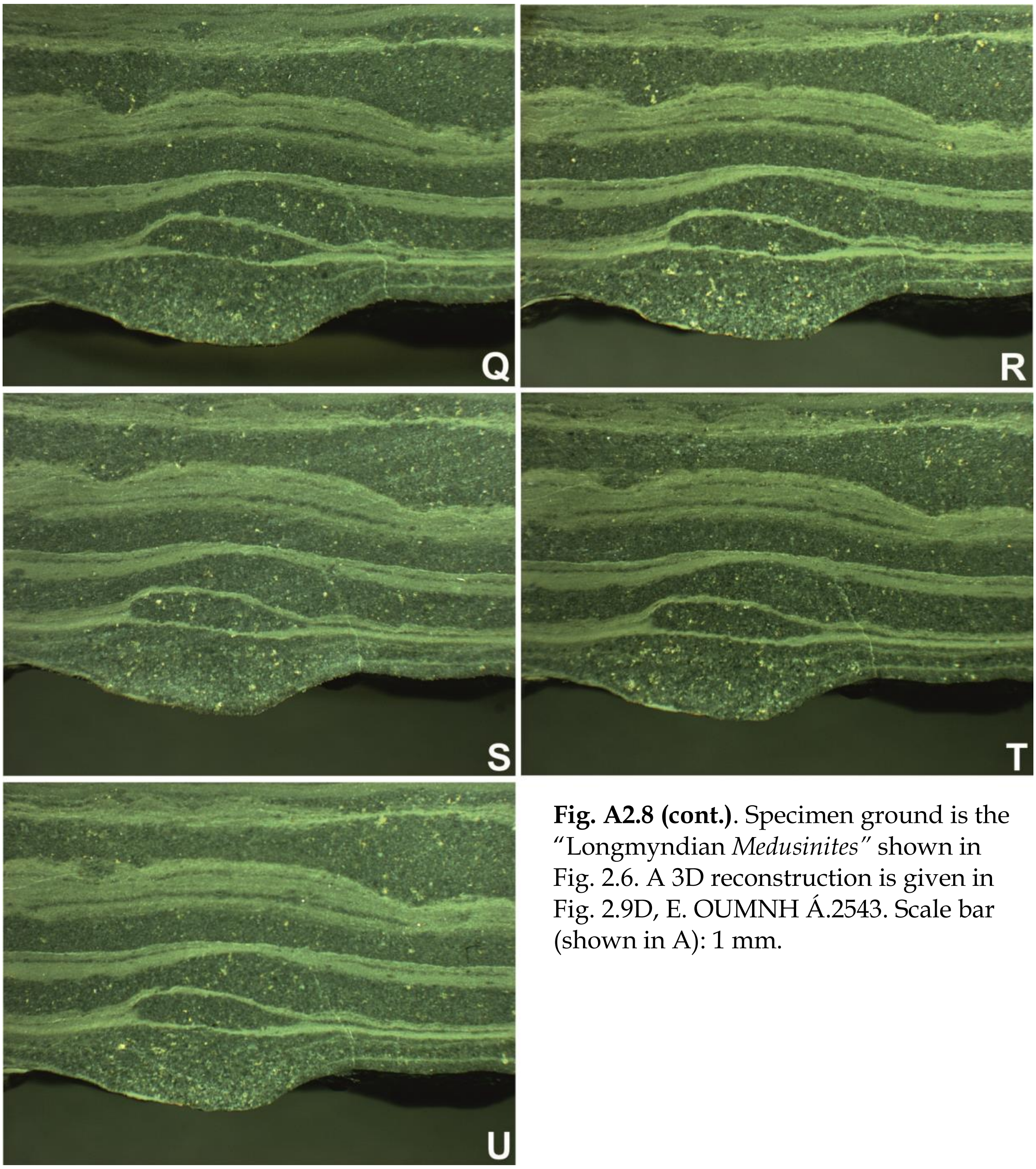


Fig. A2.8 (cont.). Specimen ground is the "Longmyndian *Medusinites*" shown in Fig. 2.6. A 3D reconstruction is given in Fig. 2.9D, E. OUMNH Á.2543. Scale bar (shown in A): 1 mm.

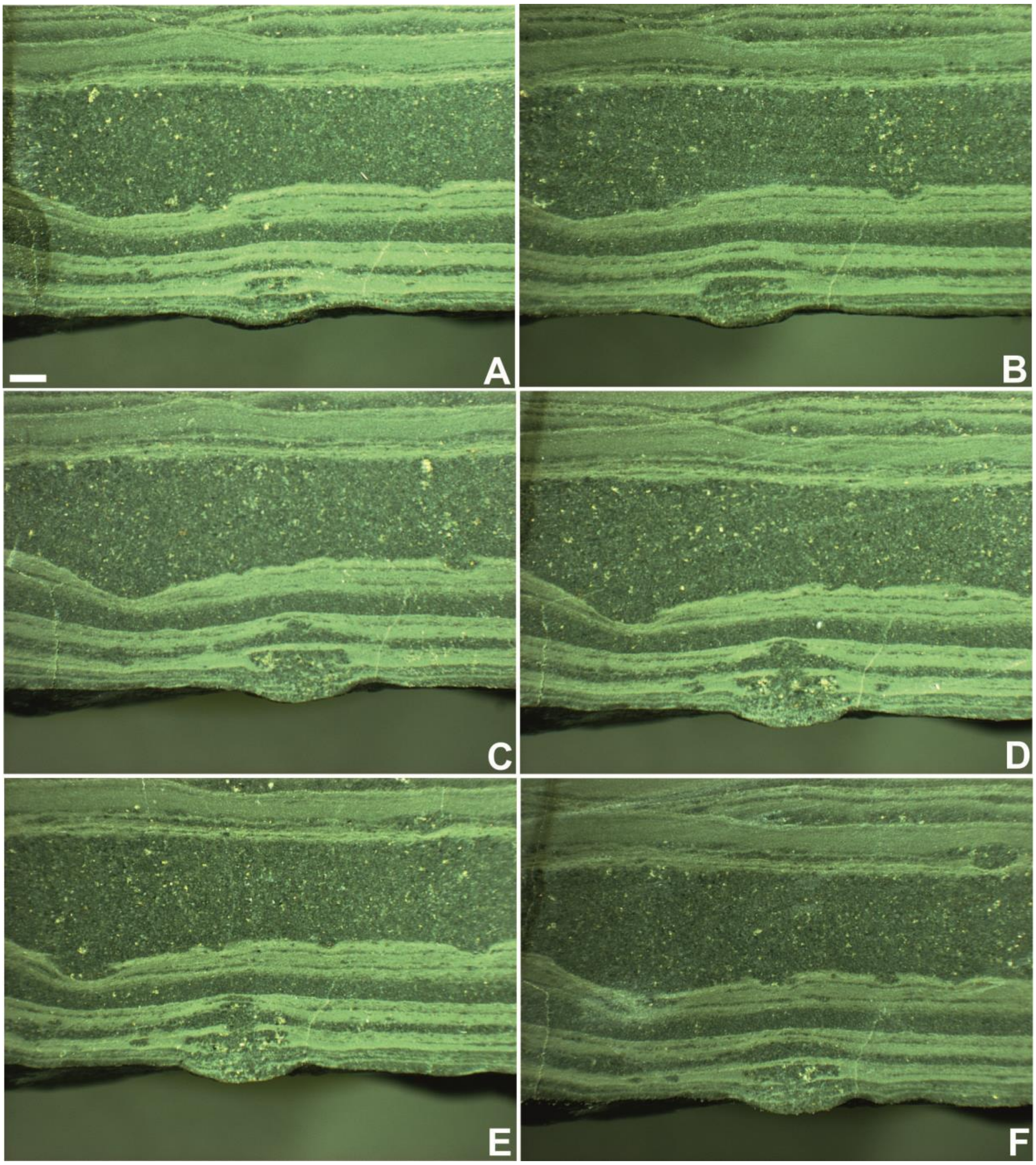


Fig. A2.9. **A–F:** Grinding sequence through a small "Longmyndian *Medusinites*". Note also disruptions of the top of the green mudstone lamina at centre of picture. A 3D reconstruction through the central portion of this feature is given in Fig. 2.9B. OUMNH Á.2543. Scale bar (shown in A): 1 mm.

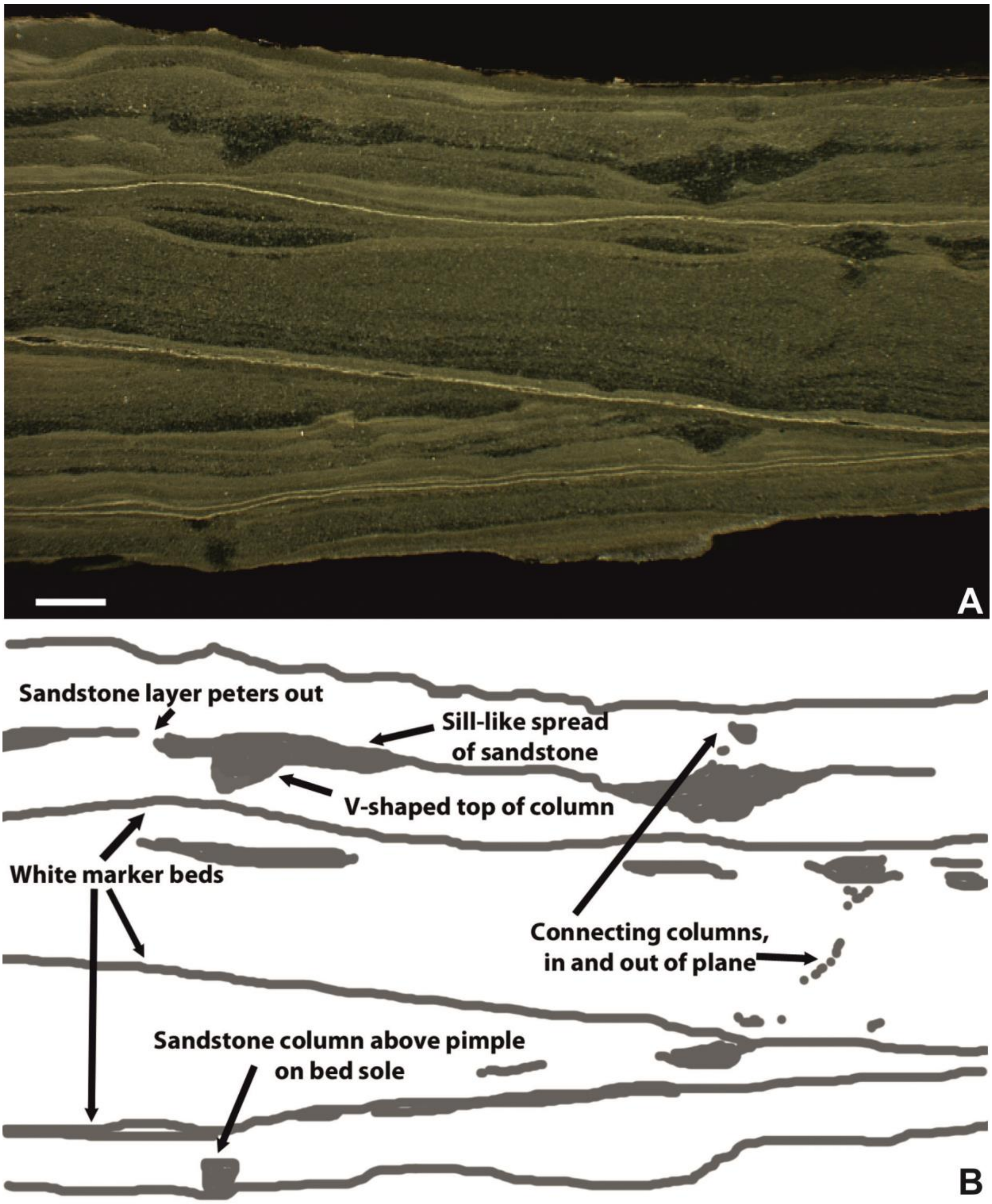


Fig. A2.10. A: Portion of polished vertical cross-section from upper Burway Formation at Ashes Hollow, showing various features interpreted here as part of a regime of fluid escape at millimetre and sub-millimetre scales. L-AH/Y. Scale bar: 1 mm. **B:** Annotated diagram highlighting features seen in A above. Sandstone columns take paths that wander in and out of the plane of section.

A2.3 Further images of fragmented microbial mat layer

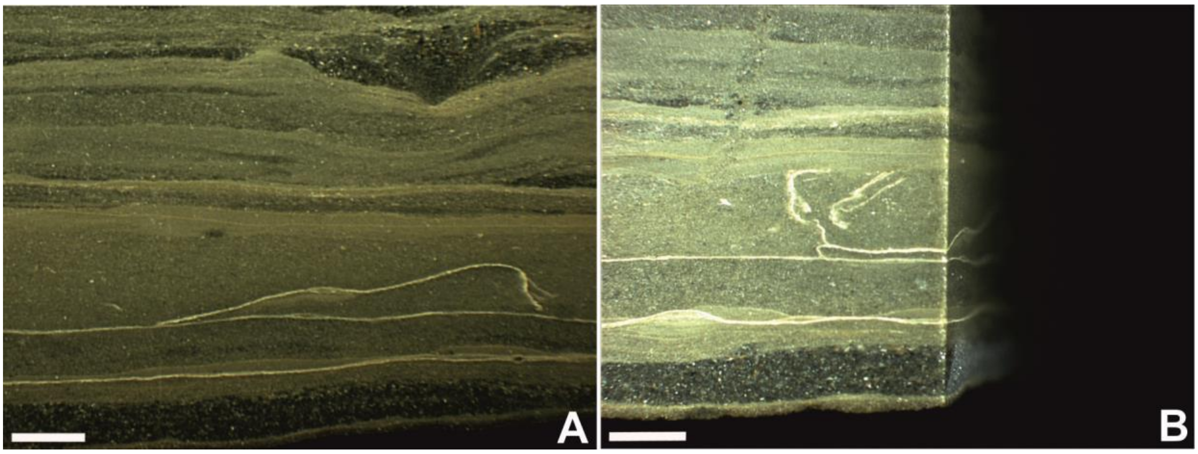


Fig. A2.11. A: Wider view of the fragment of a white marker bed that has diverged and broken, as shown in Fig. 2.12. **B:** A cross-section cut orthogonally to the face shown in A shows the continuation and then disruption of the same white marker bed, indicating that the white layer is a thin lamina that has become fragmented. RCL-AH/7. Scale bars: 1 mm.

A2.4 Spot spectra associated with carbonate filaments and Ti-rich bands in thin sections through upper Burway Formation laminae

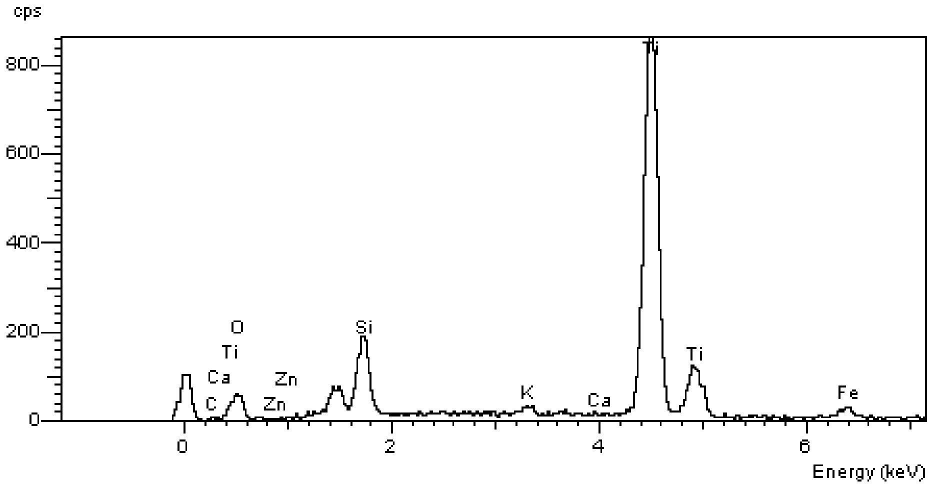


Fig. A2.12. Spot spectrum of titanium grain, probably rutile, in titanium-rich band.

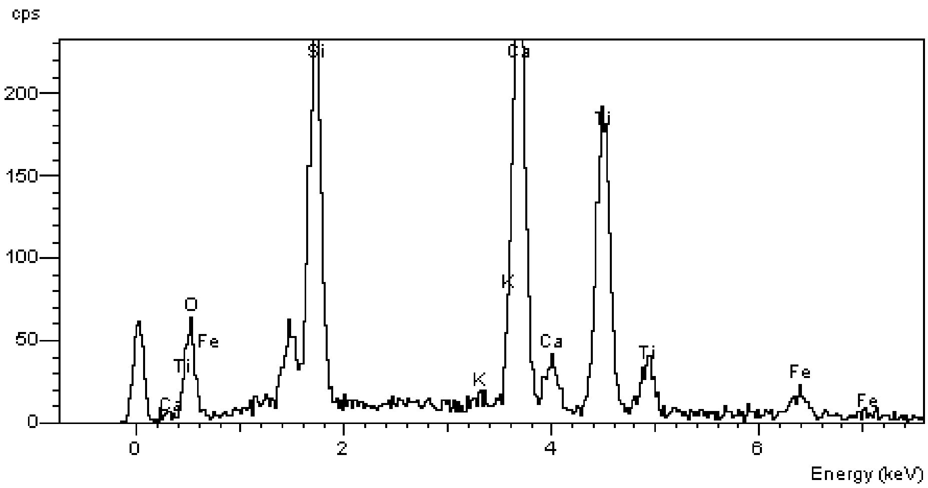


Fig. A2.13. Spot spectrum of microbial filament, showing high calcium and titanium signals.

A2.5 Another look at Salter's Longmyndian specimens

With the interpretations given in Chapter 2 in mind, John Salter's figured disc-bearing specimens from Ashes Hollow (Salter, 1856, 1857; Bland, 1984), previously discussed by McIlroy et al. (2005), Callow and Brasier (2009), and Callow et al. (2011), were re-examined, by kind permission of the British Geological Survey Collections, Keyworth, UK.

John Salter (1820-1869) was a leading palaeontologist of the Victorian period (Secord, 1985), and his figured specimens from the Long Mynd show exquisite preservation of detail. They include his putative arthropod, "Palaeopyge" (BGS GSM 10657; see Callow et al., 2011), but this discussion will concentrate on several specimens containing discs, Arumberia, and microbial textures: BGS GSM 49150, 49151, 49160, and 49163. The first two specimens were collected from "the west side of Yearling Hill, on the brook that flows down to the "Ashes"" (Salter, 1857). This feature is now known as Yearlet Hill, and forms the northern side of Ashes Hollow valley (Cope, 2000; Wilson, 2000; McIlroy et al., 2005; Callow et al., 2011). The specimens BGS GSM 49160 and 49163 were labelled by Salter as from "Carding Mill". BGS GSM 49160 appears from its pale and greenish lithology to be from the lower Green Synalds Member, while 49163 is from the overlying Red Synalds Member (see McIlroy et al., 2005). These specimens are discussed in turn below.

BGS GSM 49150 has raised mounds of varying size on a bed sole (Fig. A2.14). Salter described the mounds as casts of paired openings of U-shaped worm burrows, and named them *Arenicolites sparsus* (Salter, 1857). As pointed out by Callow et al. (2011), there is no evident pairing of the mounds. Callow et al. compared the mounds to "Beltanelliformis minutae". However, the mounds vary considerably in size and may rather be considered a mixture of "Longmyndian *Medusinites*" lacking a central boss, and "B. minutae" (pimples). At least one example (arrowed) appears to be an irregular lobed "Longmyndian *Medusinites*" with a relatively wide central boss. Following the interpretation given in Chapter 2, these mounds can now be explained as loading structures resulting from clastic injections, with spread of the injected sand slurry and resultant loading.

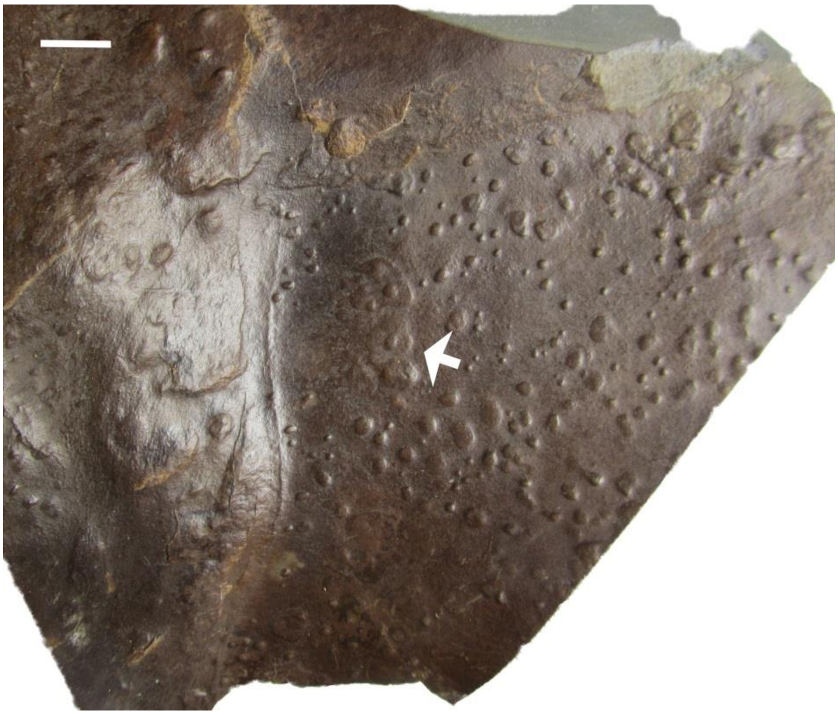


Fig. A2.14. Salter's specimen BGS GSM 49150, from the upper Burway Formation. These discs are here interpreted as fluid injection structures formerly known as "Longmyndian *Medusinites*". An irregular lobed form is arrowed. Scale bar: 1 cm. All images of Salter specimens in this section, BGS © NERC.

BGS GSM 49151 has patches of small, sharply defined pits and other areas containing large shallow depressions (Fig. A2.15). Salter considered the small pits to be juvenile *Arenicolites sparsus*, and the large depressions to be rainprints (Salter, 1857). It is noticeable that the two regions barely overlap. Previously interpreted as a bed sole (Callow et al., 2011), it seems more likely, given examples of similar pits and depressions in the field, that the markings occur on the top of a bedding plane. The small pits are likely to be the counterparts of the pimples on sole surfaces resulting from loading at an injection site ("B. minutae"; see Section 2.2), though they could be the result of bubble bursts (see Lyell, 1851). The rimless depressions form a network-like structure, and are likely to be of microbial origin (cf. Allwood et al., 2006, fig. 1f).

Under a binocular microscope, the specimen surface reveals copious positive casts of microbial strands and filaments (Fig. A2.16), as previously noted by Callow and

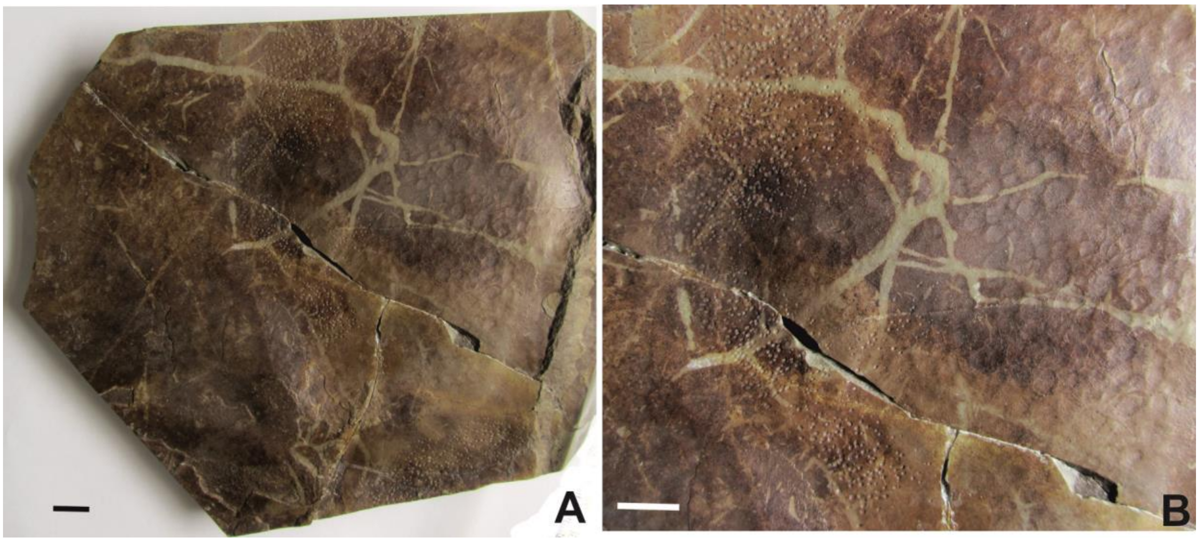


Fig. A2.15. A: Salter's specimen BGS GSM 49151. **B:** Close up showing patches of small pits and areas of connected shallow, rimless depressions forming a network. Scale bars: 1 cm.

Brasier (2009). Close examination indicates that these strands vary in thickness. The small filaments are ~74 µm in diameter, consistent with the size of the largest type of filament observed in the microbial mats (Fig. A2.16; Section 2.3). Others reach diameters of >185 µm, cross-cut each other, and branch, in one case dividing into a number of fine threads (Fig. A2.17A). Parallel strands can be seen branching off at T-junctions (Fig. A2.17B), as well as a probable H-junction, showing fusion of branches (Fig. A2.17C).

The relative age of these microfossils with respect to the two types of discoidal markings may be deduced from the evidence. Some threads lie across the shallow depressions, suggesting later growth (Fig. A2.17B), while threads stop at the edges

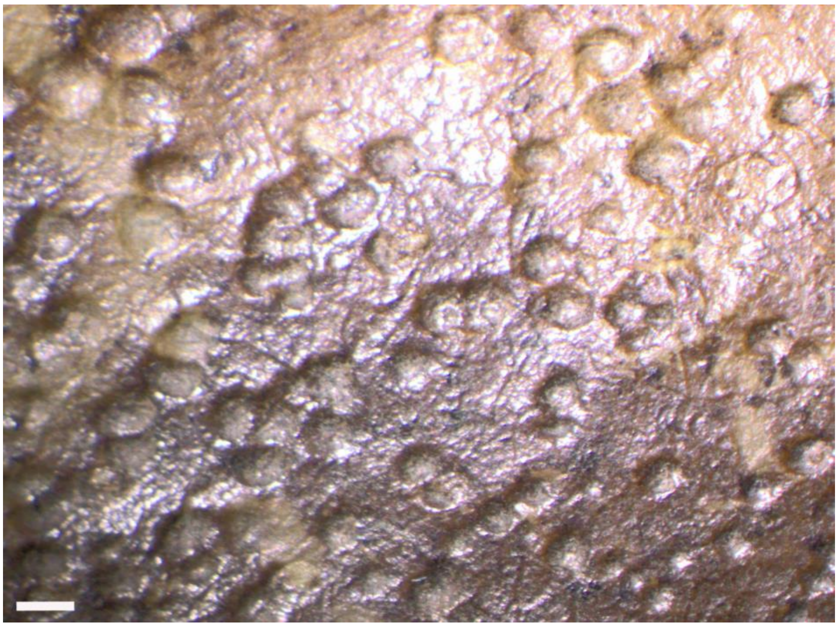


Fig. A2.16. Close up of BGS GSM 49151, showing the surface with small pits covered by microbial filaments. The pits break the filaments, showing that they postdate them. Scale bar: 1 mm.

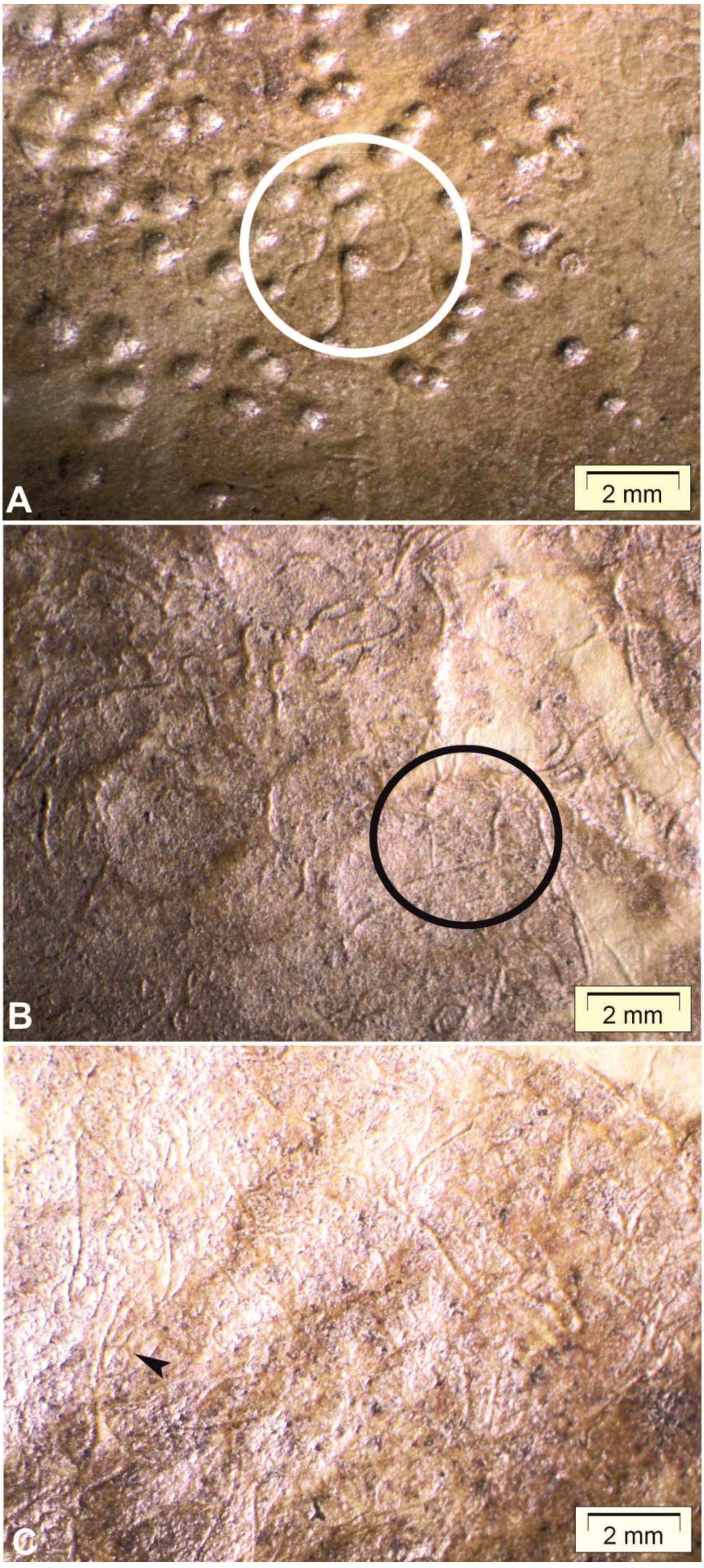


Fig. A2.17

◄ **Fig. A2.17.** Details of microbial strands covering BGS GSM 49151. **A:** Branch of ~17 µm diameter divides into finer (~ 12.5 µm) branches, one of which divides into a number of very fine (~ 4 µm) branches (circled area). The pits appear to break the strands. **B:** Strands of varying width, crossing and branching. Note thickening in some branches. Circled area shows T-branching. Note that the strands overlie the ridges of the network. **C:** T-branching and a possible example of H-junction (black arrow).

of the sharp pits (Fig. A2.17A). A possible order of formation may therefore be as follows: shallow depressions formed first, and then were partly covered by microbial mat before the formation of the small pits. This would be consistent with the shallow depressions being of microbial origin, and the pits resulting from fluid escape post-burial. Preservation as positive casts indicates that the microbial cover was approximately contemporaneous with the deposition of these sediments, rather than a later overgrowth of the rock (Callow and Brasier, 2009).

The size of the larger branching strands suggests they may have been algae or fungi. Filamentous algae cannot however have increases as well as decreases in thickness along branches. The variable thickness, together with the branching patterns of these microbial strands, particularly the T- and H-junctions, are strongly indicative of a fungal affinity, the thick strands being possible rhizomorphs. Callow and Brasier (2009) proposed the possibility of fungal hyphae for the fine, Y-branching white filaments they observed in the Burway Formation rocks. The further evidence presented here, alongside that obtained from thin sections and microscopic study of surfaces of ground hand specimens (Section 2.3), support a fungal affinity for these *c.* 560-Ma fossils. Fungi are thought to have evolved deep in the Neoproterozoic, although early fossil evidence is uncertain (see e.g. Taylor et al., 2014).

BGS GSM 49160, labelled as from Carding Mill, is the most intriguing of Salter's specimens (Fig. A2.18). From Salter's description (Salter, 1856), and similar examples observed in the field, the specimen appears to come from the Green Synalds Member, the greenish sandstones making up the lower part of the Synalds Formation (McIlroy et al., 2005). Described as *Arenicola didyma*, later revised to *Arenicolites didymus* (Salter, 1856, 1857), Salter considered these markings, like *A. sparsus*, to be traces left by the U-shaped tube of a marine worm. They have subsequently been described as a form of *Rusophycus* resting trace (*R. didymus*, Häntzschel, 1975), but there are no scratch marks or related *Cruziana* in these sediments (Callow et al., 2011). Salter identified two types of paired holes on this

Fig. A2.18. Salter specimen BGS GSM 49160, showing surface texture and paired pits (example arrowed). Scale bar: 1 cm.

top surface: one type "strongly impressed", and the other "faint, as if subsequently effaced", and noted that the paired markings were parallel and all aligned in the same direction on the specimen.

Re-examination of Salter's specimen by Callow et al. (2011) confirmed true pairing of the pits in this case, and their consistent alignment. They also noted that the supposedly effaced, faint pairs are in fact part of a texture that covers the surface with the same orientation as the larger paired pits. The same texture has been observed in other Ediacaran successions (Callow et al., 2011). Field observations in rocks in Carding Mill Valley show that in some cases the paired markings can merge to extend several millimetres (Fig. A2.19), although most are just 1-2 mm in length.

Fig. A2.19. Elongated paired pits, which may be merged pits in a row (white arrow), together with typical paired pits (black arrow) and microbial texture, upper bedding surface, Synalds Formation, Carding Mill Valley, the Long Mynd. Scale bar: 1 cm.

Under the microscope, it is evident that the depressions occur on a surface thickly covered with branching microbial strands and filaments (Fig. A2.20). Such a texture and its (presumably current-influenced) directionality must invariably constrain and influence any surface markings. One possible explanation for the enigmatic paired depressions comes from the observation that "Longmyndian *Intrites*", now understood as a microbially induced structure (see Section 2.4), frequently appears as short, parallel raised ridges on the surface as well as pairs of arcs and incomplete circles (Fig. A2.21; see also Fig. 2.25).

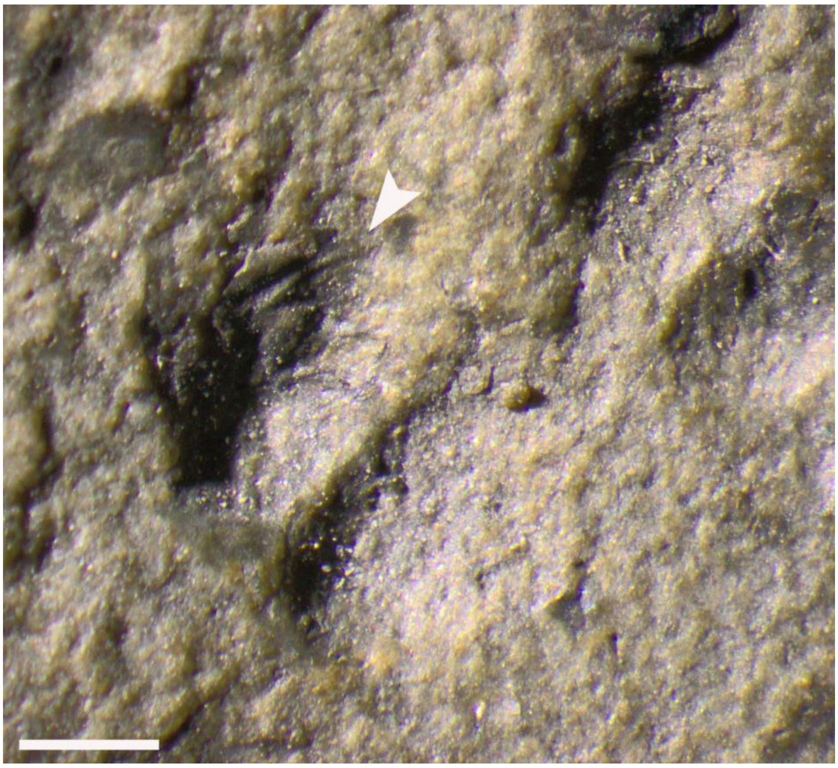


Fig. A2.20. Close-up of Salter specimen BGS GSM 49160, showing double pits and microbial filaments (arrowed). Note the close similarity with the positive Longmyndian *Intrites* on bed sole in Fig. 2.25B and Fig. A2.21. Scale bar: 1 mm.

Fig. A2.21. Close up of Longmyndian *Intrites* appearing as parallel ridges on sole surface (detail of same hand specimen as Fig. 2.27C, RCL-AH/5; this is not a Salter specimen). Scale bar: 1 mm.

A. didymus may be counterpart pits of such parallel-ridged Longmyndian *Intrites*, impressed on the adjoining, similarly microbially textured surface. Longmyndian *Intrites* ridges are observed to be approximately aligned (see Fig. 2.25). Discovery of part and counterpart specimens, showing Longmyndian *Intrites* on the sole of the overlying surface, and *A. didymus*-like paired pits below would confirm such a hypothesis.

BGS GSM 49163, labelled by Salter (1856) as "Marks of _____?" contains large rimless depressions and broadly parallel Arumberia-like structures which occasionally show small-angle branching (Fig. A2.22). Salter regarded these markings as abiogenic, suggesting that the threads were "mineral structures" and the oval depressions likely to result from gas bubbles or weathered-out concretions. This specimen was discussed by Bland alongside other examples of Arumberia (Bland, 1984). He regarded the threads as organic, the impression of "a colony of

Fig. A2.22. Salter's specimen BGS GSM 49163, with Arumberia-like ridges and rimless depressions. Scale bar: 1 cm.

flexible thin-walled tubular elements", and the discs sometimes found with the threads as associated with "flexible-walled spheroids" forming a resting stage of the organism.

Arumberia is observed on surfaces of much of the Stretton Group in the Long Mynd, in keeping with its appearance in shallow to fluvial environments (Bland, 1984). Arguing that Arumberia is a form of MISS, McIlroy and Walter (1997) suggested that Bland's "spheroids" were volcanic lapilli, and McIlroy et al. (2005) suggested that the association of Arumberia with the discs is coincidental.

The rimless depressions on GSM 49163 are shallow and may be the result of gas bubble bursts, as originally described by Salter. Some appear to have merged (Fig. A2.23). The lack of a raised rim or deepening of one side in the depressions argues against raindrop prints (cf. Lyell, 1851; see also Cloud, 1960). The edges are too clear cut for the discs to be caused by a drop of the surface due to loading below (see discussion of shallow, rimless depressions in Section 2.2). The merged examples make Bland's "flexible-walled spheroids" unlikely. Other organic explanations such as microbial colonies would be consistent with merging impressions, but there is no call to invoke them when a simpler physical explanation such as bubble bursts is

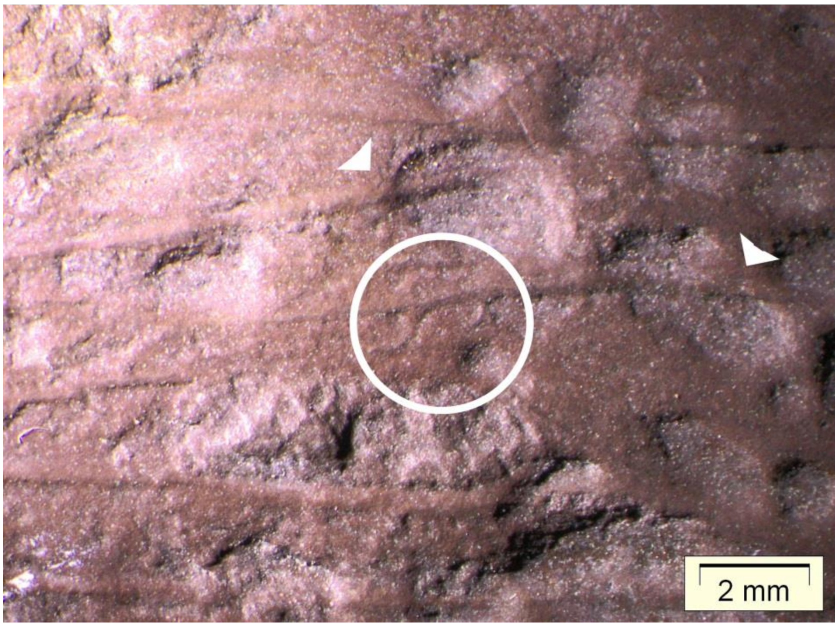


Fig. A2.23. Detail of Salter's specimen BGS GSM 49163. Note merged discs to right of picture, and Arumberia-like strands overlying the discs (arrows). Within circled area, two branches can be seen coming off a strand almost orthogonally, inconsistent with Arumberia branching.

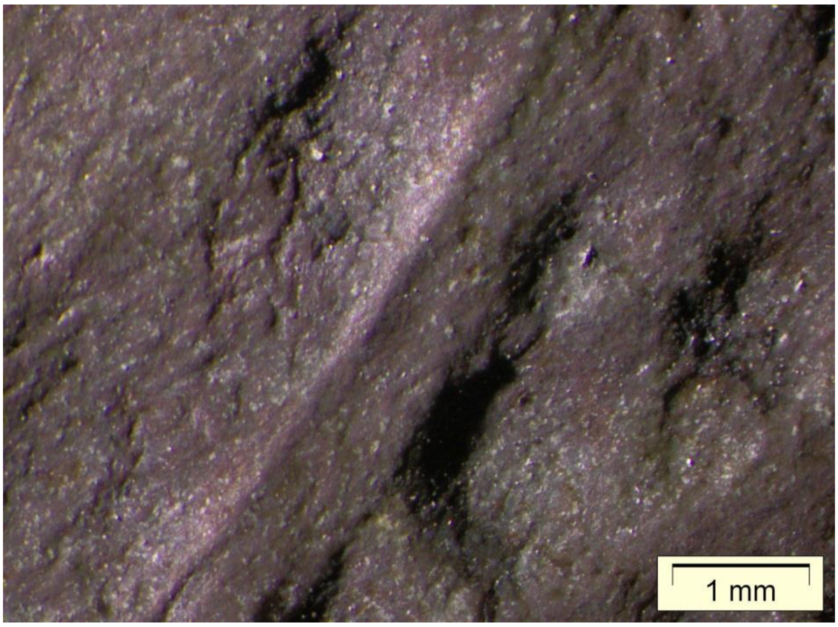


Fig. A2.24. Detail of Salter's specimen BGS GSM 49163, showing a strand in close up, and indications of microbial texture on the bed surface.

sufficient to explain the evidence. The weathering of lapilli cannot be ruled out but there is no indication of scouring in the even shapes of the discs, and clusters of lapilli of this size are not apparent in the field.

The threads are uniform in width, occasionally bifurcating, and in several places on the specimen can be seen to lie across discs (Figs A2.22, A2.23). There is one instance of two small branches separating from a thread almost orthogonally, as T-junctions, rather than the usual low-angle bifurcation (Fig. A2.23). The surface of the specimen again shows indications of microbial texture (Fig. A2.24).

If the Arumberia-like threads are examples of MISS, they might be expected to have formed while the surface was flat, prior to the formation of the depressions.

Fig. A2.25. Typical Arumberia ridges (to left), with discs on a lower bed, upper Synalds Formation, Carding Mill Valley, the Long Mynd. These discs show slight rims and commonly merge, but do not show a deepening to one side, suggesting they are more likely to be gas bubble bursts than raindrop prints. Scale bar: 1 cm.

Examples of Arumberia are sometimes seen near discs (Fig. A2.25), but the discs are usually on an underlying bed, not directly below the ridges. The Salter specimen is unusual in this respect. Moreover, the depressions on the specimen show no distortion of shape around the threads, which might be expected whether they formed biogenically or abiogenically. It appears more likely that the threads in this case draped over an already disc-marked surface. This, together with the examples of unusual branching, suggests that at least in this specimen the "Arumberia" may be a fossil, most probably algal or fungal filaments. Other examples of ridges and grooves observed in the Stretton Group conform to typical Arumberia as a form of MISS (Fig. A2.25).

Salter's specimens from the Long Mynd show exceptional preservation of detail, and the model of mat-driven small-scale fluid escape described in Chapter 2, together with the investigation of Longmyndian *Intrites*, has allowed a re-interpretation of some of the structures described by Salter as pseudofossils. Further, the study of microbial mats and microfossils in section and on ground surfaces, combined with new detailed observations of microbial casts on the surfaces of Salter specimens, has enabled further insights into the Longmyndian microfossils, building on those of Callow and Brasier (2009).

APPENDIX 3: Further images of holdfast discs

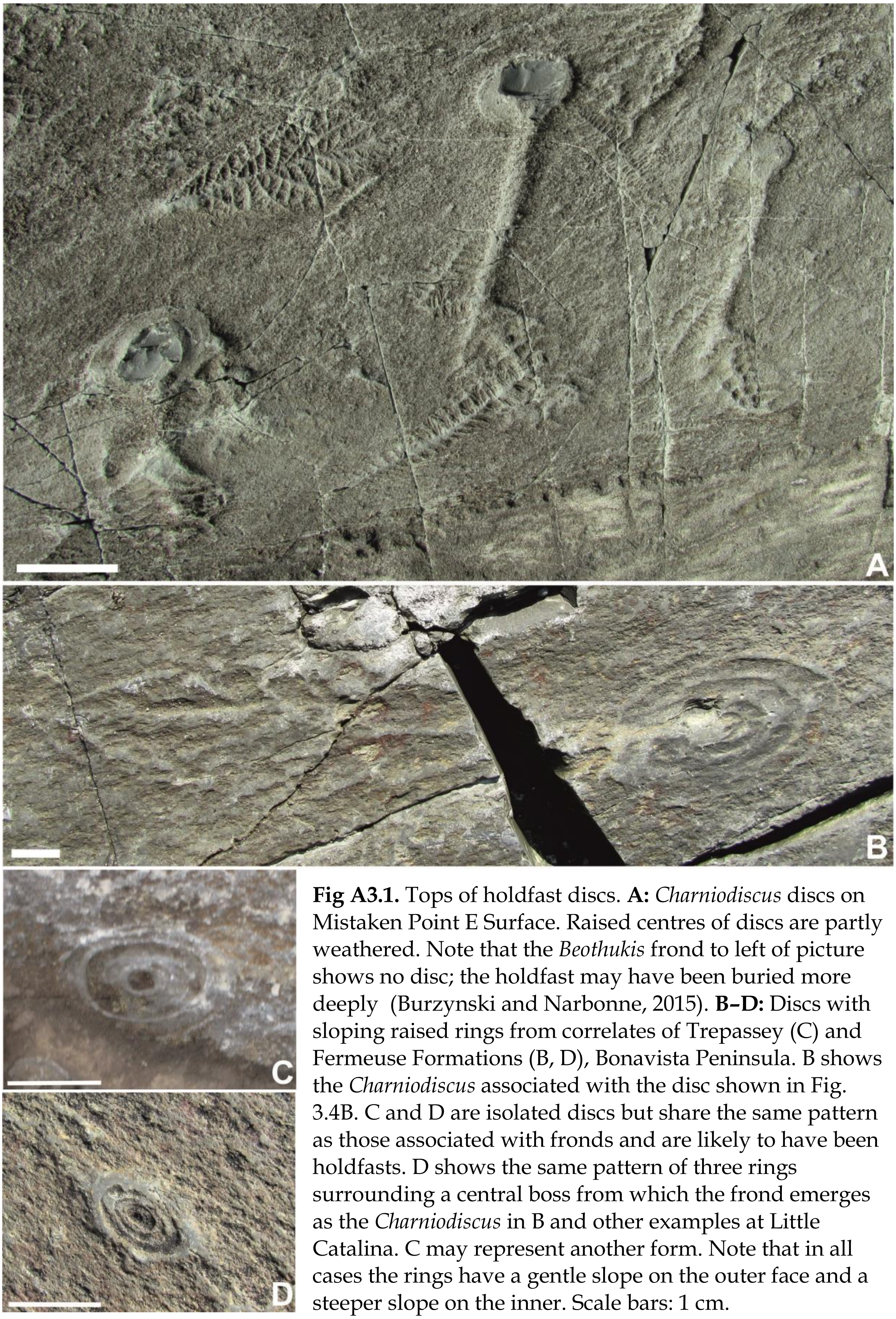


Fig A3.1. Tops of holdfast discs. **A:** *Charniodiscus* discs on Mistaken Point E Surface. Raised centres of discs are partly weathered. Note that the *Beothukis* frond to left of picture shows no disc; the holdfast may have been buried more deeply (Burzynski and Narbonne, 2015). **B–D:** Discs with sloping raised rings from correlates of Trepassey (C) and Fermeuse Formations (B, D), Bonavista Peninsula. B shows the *Charniodiscus* associated with the disc shown in Fig. 3.4B. C and D are isolated discs but share the same pattern as those associated with fronds and are likely to have been holdfasts. D shows the same pattern of three rings surrounding a central boss from which the frond emerges as the *Charniodiscus* in B and other examples at Little Catalina. C may represent another form. Note that in all cases the rings have a gentle slope on the outer face and a steeper slope on the inner. Scale bars: 1 cm.

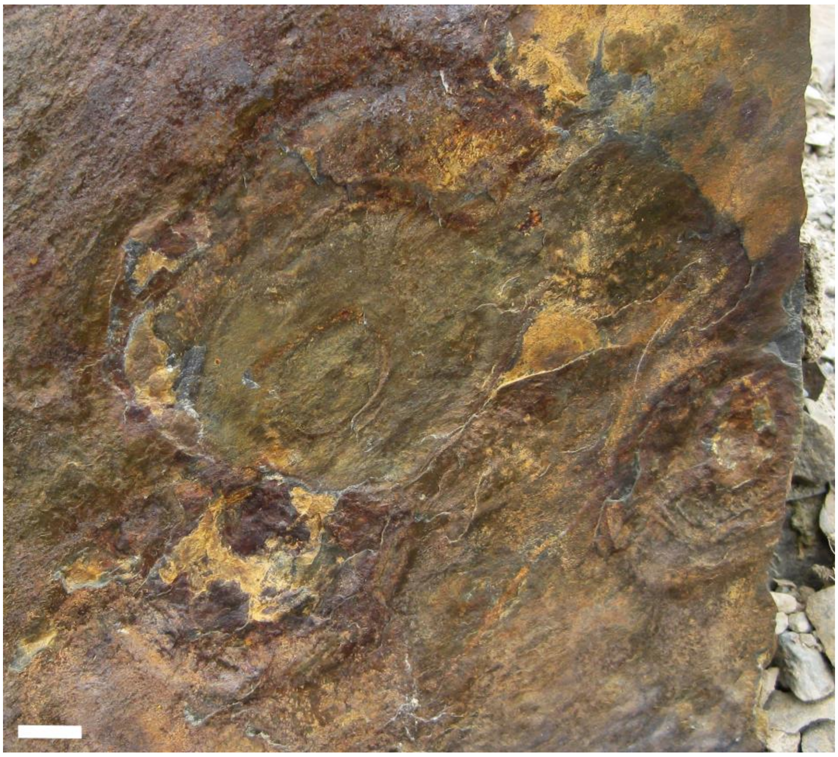


Fig. A3.2. Group of large discs on top of bed, Fermeuse Formation, Avalon Peninsula. These are interpreted as the collapsed tops of holdfast discs. Note the presence of several discrete rings. Scale bar: 1 cm.

Fig. A3.3. Group of presumed holdfast discs on bed sole, from Fermeuse Formation, Avalon Peninsula. These are from the same specimen as Fig. 3.12, and are interpreted here as the undersides of holdfast discs, showing a distinct central boss. FR-H/18. Scale bar: 1 cm.

APPENDIX 4: Further images related to *Hiemalora*

A4.1 Main *Hiemalora* fossil sites studied, Bonavista Peninsula

Fig. A4.1. A: Murphy's Cove main fossil study site, looking towards east. Blue arrows indicate main fossil surfaces with *Hiemalora* and *Charniodiscus* specimens. **B:** Close up of fossil bed and surroundings shown by right-hand blue arrow in A, with rucksack and walking stick for scale. Fossil bed with many *Hiemalora* specimens marked with red arrow. **C:** Murphy's Cove locality looking towards west. **D:** Seaward extension photographed in 2011, on emergence at low tide; the farthest portions have now partly collapsed into the sea. Some of the specimens illustrated and discussed in Chapter 4 were located here.

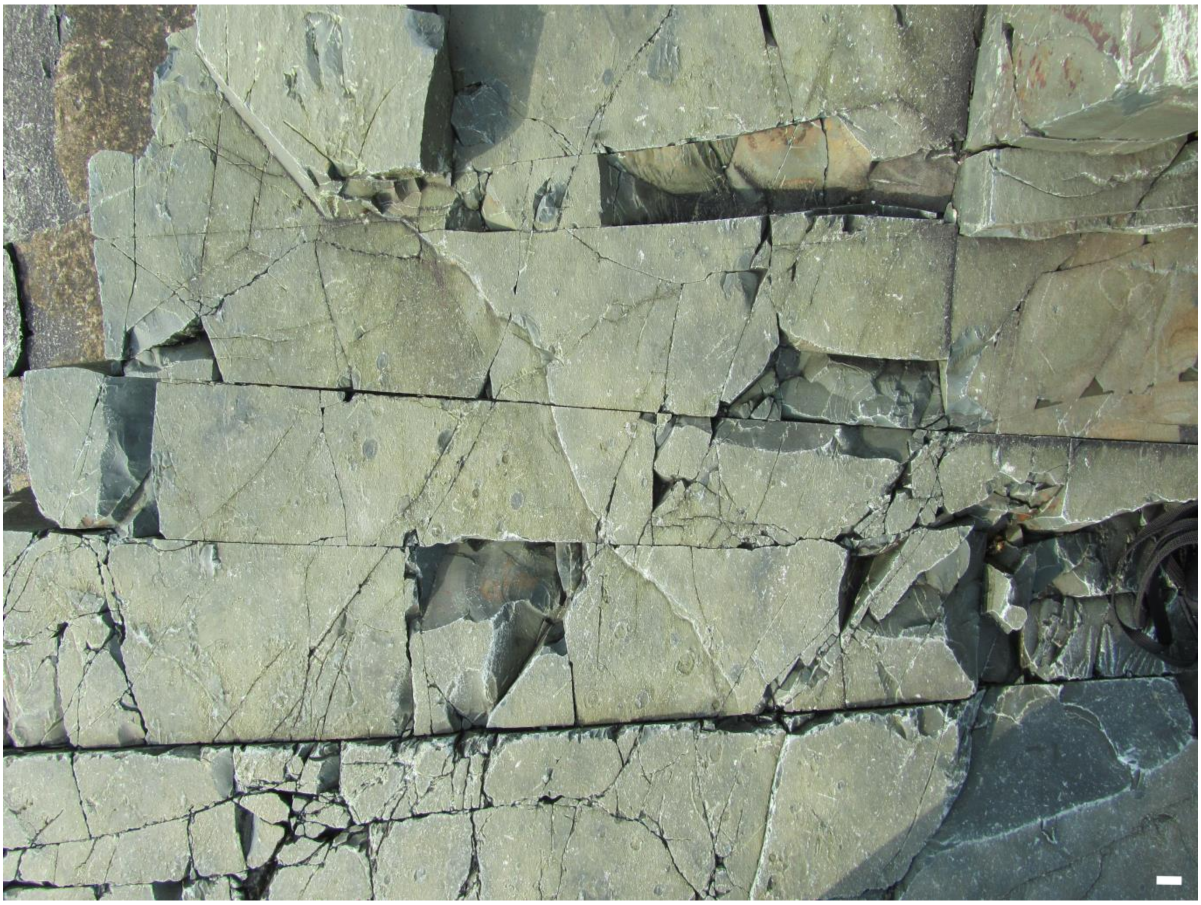


Fig. A4.2. Part of fossil bed marked with red arrow in Fig. A4.1B, with many *Hiemalora* specimens, most covered with a thin tuffaceous layer weathered grey. Occasional *Charniodiscus* discs identified by several raised rings also occur here. Scale bar: 1 cm.

Fig. A4.3. Little Catalina fossil study site. These low rock ledges close to the water's edge have several bedding planes with fossils preserved under ash. **A:** View looking north. Martin Brasier and Jack Matthews for scale. **B:** Close up of part of a fossil surface close to the water level and grey shale lithology of overlying beds to left, which weather to brown. These rocks of the lower Fermeuse Formation in the Bonavista Peninsula have been interpreted as thin- to medium-bedded turbidites (O'Brien et al., 2006; Mason et al., 2013). Scale bar: 1 cm.

A4.2 Further examples of *Hiemalora* from various localities

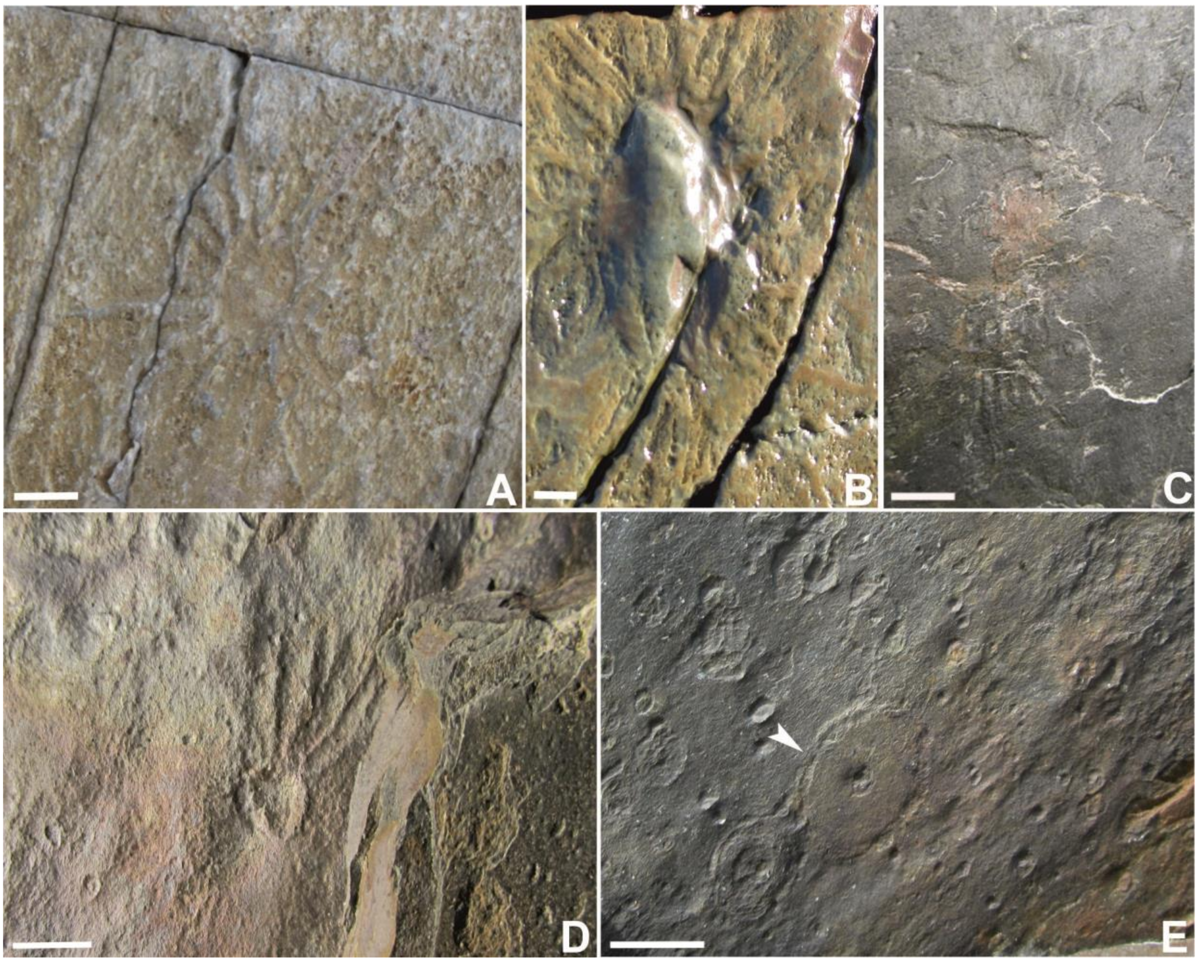


Fig. A4.4. A: *Hiemalora* specimen with disc preserved as simple, smooth negative and rays preserved positive. Trepassey Formation, Port Union, Bonavista Peninsula. **B:** *Hiemalora* preserved positive, with overlying sediment retained on disc. Mistaken Point Formation, Murphy's Cove, Bonavista Peninsula. **C:** *Hiemalora* specimen preserved as smooth positive disc with long positively preserved rays. Fermeuse Formation, Ferryland, Avalon Peninsula. **D:** Small probable *Hiemalora* specimen, preserved as smooth negative disc with rim and several positive rays, some branching, preserved on one side. Fermeuse Formation, Ferryland, Avalon Peninsula. FR-R/12. **E:** Probable *Hiemalora* (arrowed) with smooth, low-positive-relief disc and small central depression, and one or two faint rays towards top. Fermeuse Formation, Ferryland, Avalon Peninsula. Scale bars: A, C, E, 1 cm; B, D, 0.5 cm.

APPENDIX 5: Further images related to *Aspidella*

A5.1 Fermeuse Formation fossil localities and context

Fig. A5.1. Localities of study in Fermeuse Formation in Ferryland area, Avalon Peninsula, Newfoundland. **A:** Road cut in Ferryland. **B, C:** Two of the inlets a kilometre south of Ferryland making up what is known locally as "Silos Cove". **D:** Rocks extending beyond Ferryland harbour, looking north. **E:** Harbour rocks looking south. **F:** Central section of harbour rocks, the area in which the *Triforillonia* specimens described in Chapter 5 were found, and to which they seem to be almost entirely limited. Jack Matthews for scale.

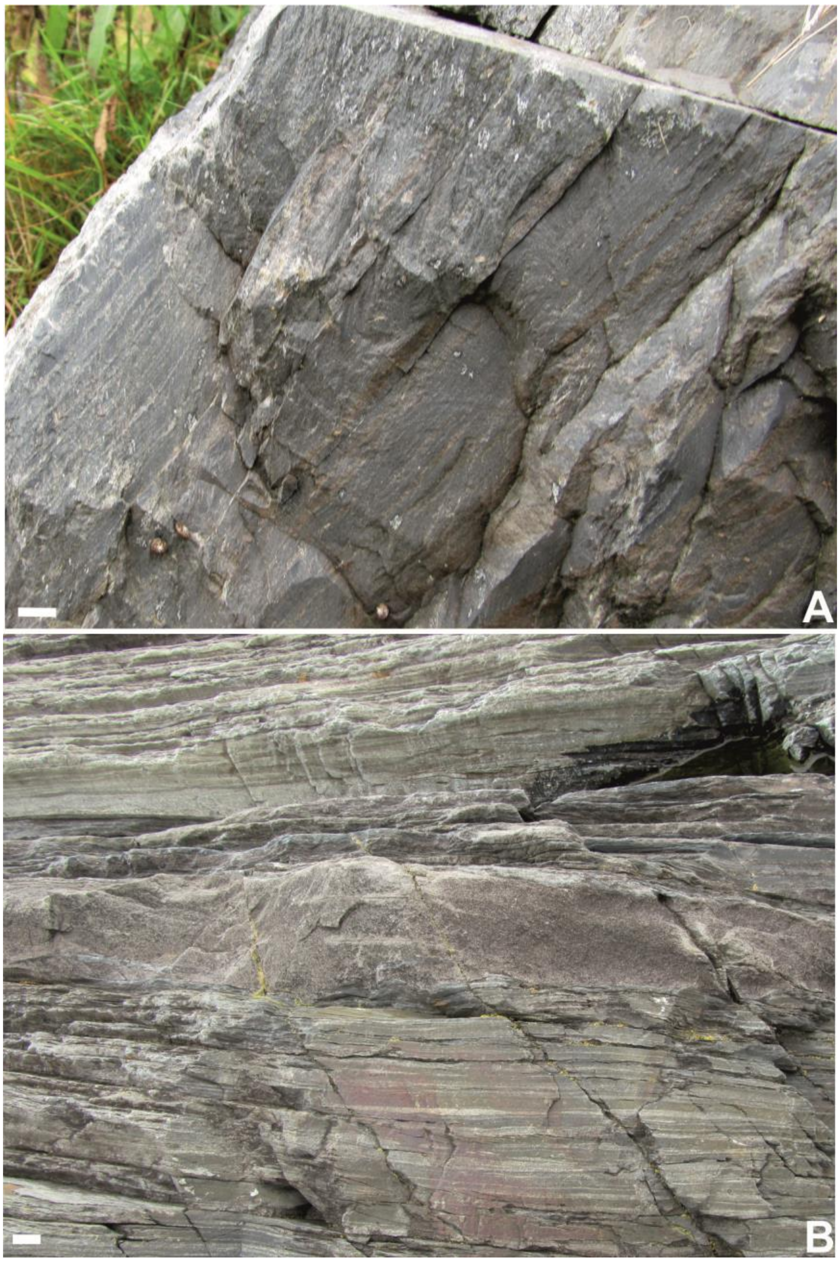


Fig. A5.2. Fossil-bearing thin-bedded to interlaminated silt and sand with some cross-bedding, upper Fermeuse Formation, at road cut (**A**) and one of the "Silos Cove" inlets (**B**). Sand beds several centimetres thick occur intermittently at this level (e.g. centre of B), and slumps and soft-sediment deformation are found even high up in the Fermeuse Formation. Scale bar: 1 cm.

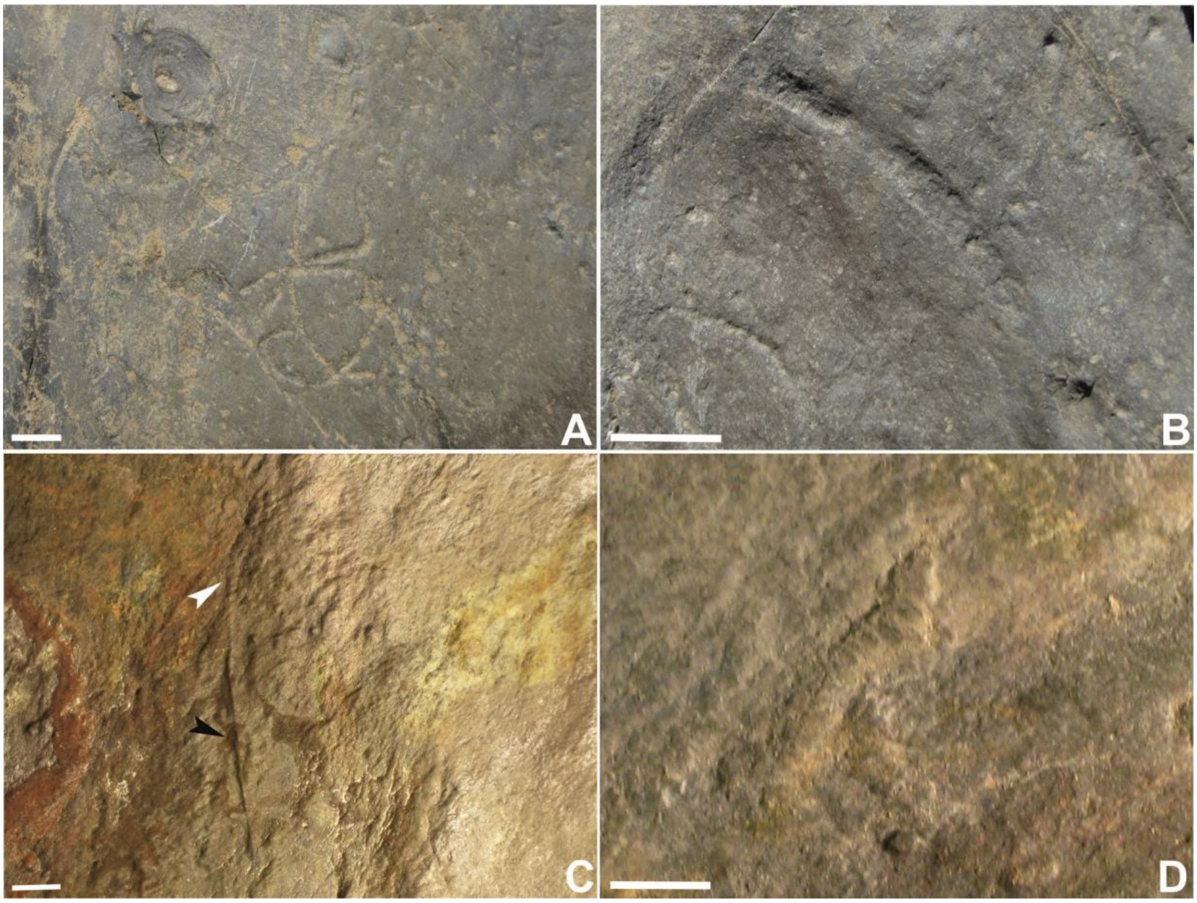


Fig. A5.3. Examples of other fossils found alongside discs in the upper Fermeuse Formation. **A:** Several curved impressions preserved negative on bed top which may be simple trails. They appear to cross-cut each other. **B:** Tube-like form preserved negative on bed top, with transverse ridges and a straight terminus. **C:** Thin, elongated trail-like impression (black arrow), preserved positive on bed sole, that widens slightly towards top and breaks up into small *Palaeopascichnus*-like chambers (white arrow). **D:** *Palaeopascichnus*, preserved positive on bed sole of same hand specimen as in C. C,D, FR-H/8. Scale bars: A, B, 1 cm; C, D, 0.5 mm.

A5.2 Further examples of *Ediacaria* and *Spriggia*, Fermeuse Formation

Fig. A5.4. Unusual group of discs on bed sole, some showing prominent bosses, others partially recessed and distorted. FR-R/7. Scale bar: 1 cm.

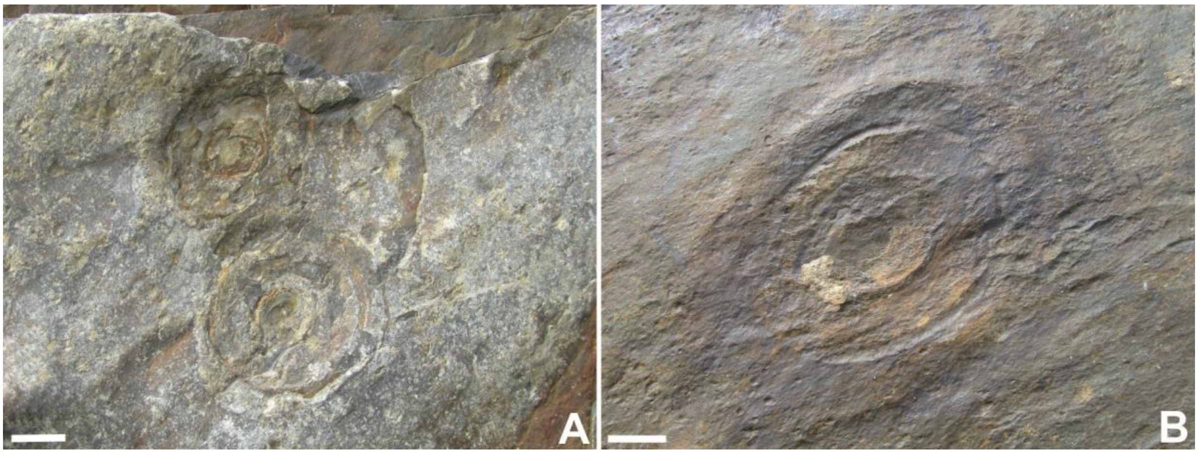


Fig. A5.5. Examples of *Spriggia* on bed tops, Fermeuse Formation, Ferryland locality. These flat discs typically exhibit 3 or 4 rings surrounding a central depression, similar to the morphology of *Charniodiscus* holdfasts preserved under ash observed in the Fermeuse and Trepassey Formations at Little Catalina and Upper Island Cove respectively (see Chapter 3). They are interpreted here as collapsed tops of holdfast discs. Note the slightly raised rim of the inner disc in B. Scale bars: 1 cm.

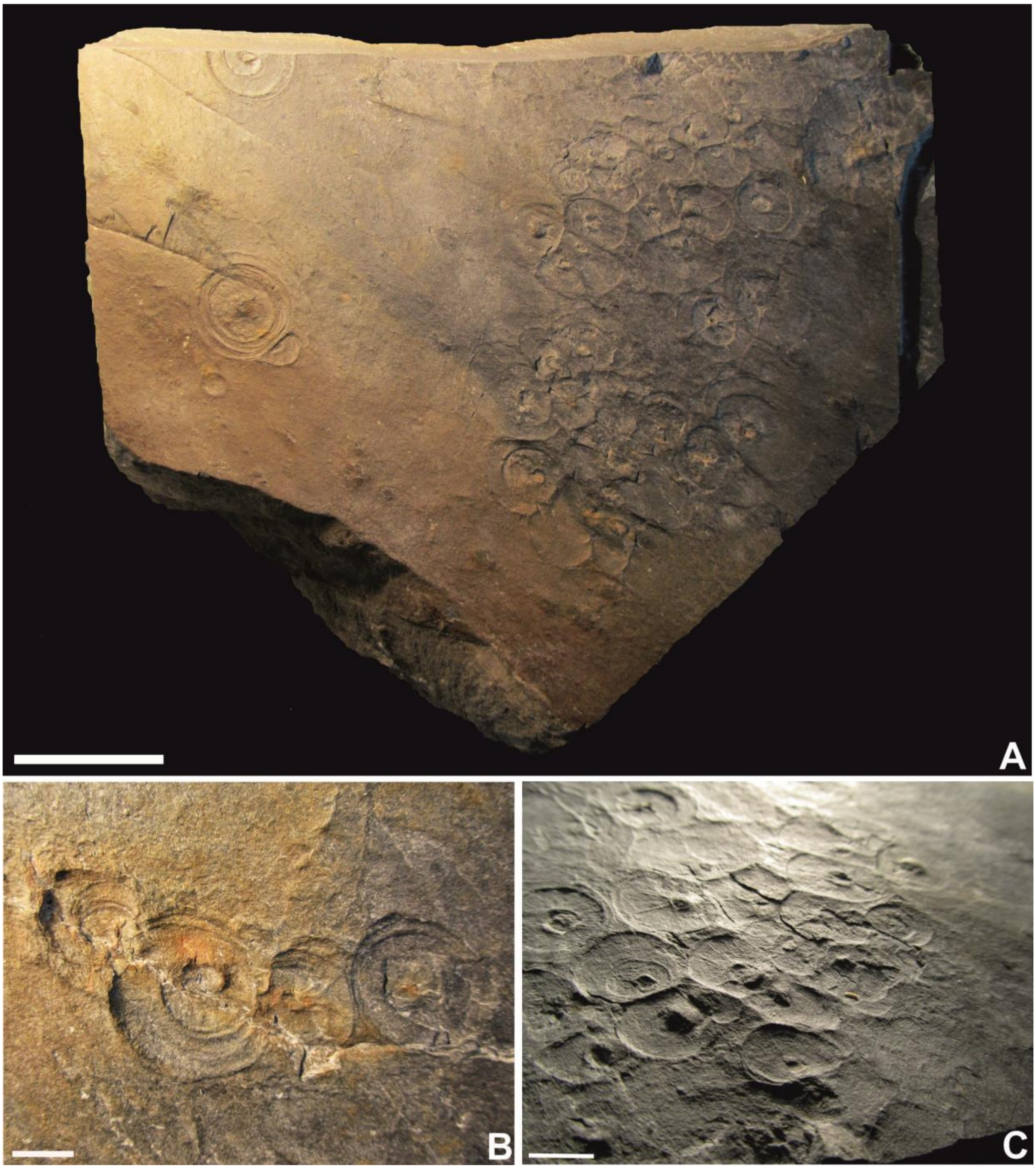


Fig. A5.6. One half of well-preserved part and counterpart block, broken in two fragments, preserving low-relief, annulated *Spriggia*-type discs, interpreted here as probable partially eroded tops of holdfast discs. Details from this specimen are shown in Figs 5.14C, 5.15B. **A:** View of major part of block, with discs preserved in negative epirelief. **B:** Group of four discs in contact, from small block contiguous with that shown in A. Boundaries do not appear to be distorted, but the discs may be imprinted from different laminae. **C:** Low-angle view of portion of the mass of discs on the right side of the large specimen in A, highlighting subtle radial ridges. FR-H/24. Scale bars: A, 5 cm; B, C, 1 cm.

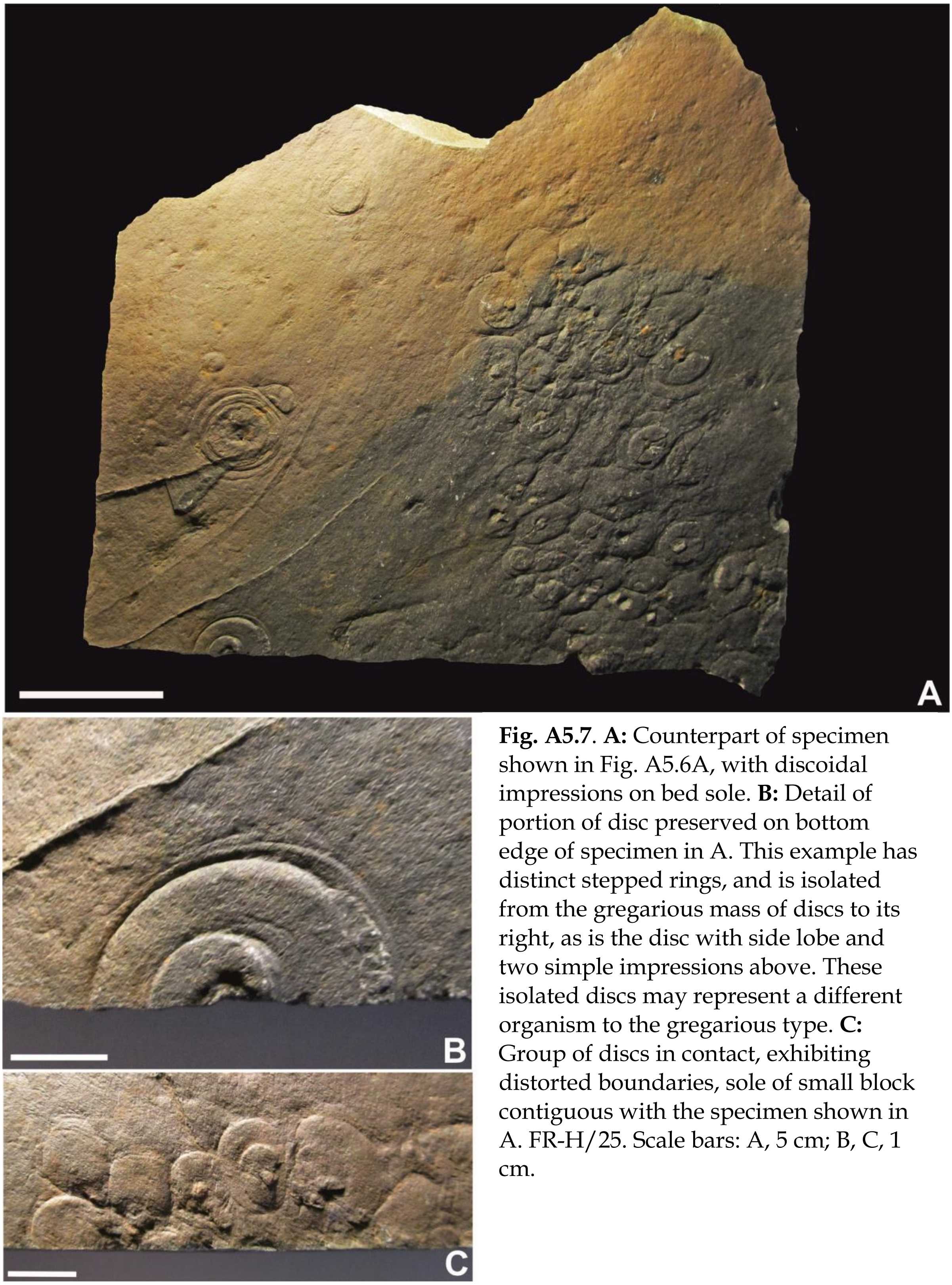


Fig. A5.7. **A:** Counterpart of specimen shown in Fig. A5.6A, with discoidal impressions on bed sole. **B:** Detail of portion of disc preserved on bottom edge of specimen in A. This example has distinct stepped rings, and is isolated from the gregarious mass of discs to its right, as is the disc with side lobe and two simple impressions above. These isolated discs may represent a different organism to the gregarious type. **C:** Group of discs in contact, exhibiting distorted boundaries, sole of small block contiguous with the specimen shown in A. FR-H/25. Scale bars: A, 5 cm; B, C, 1 cm.

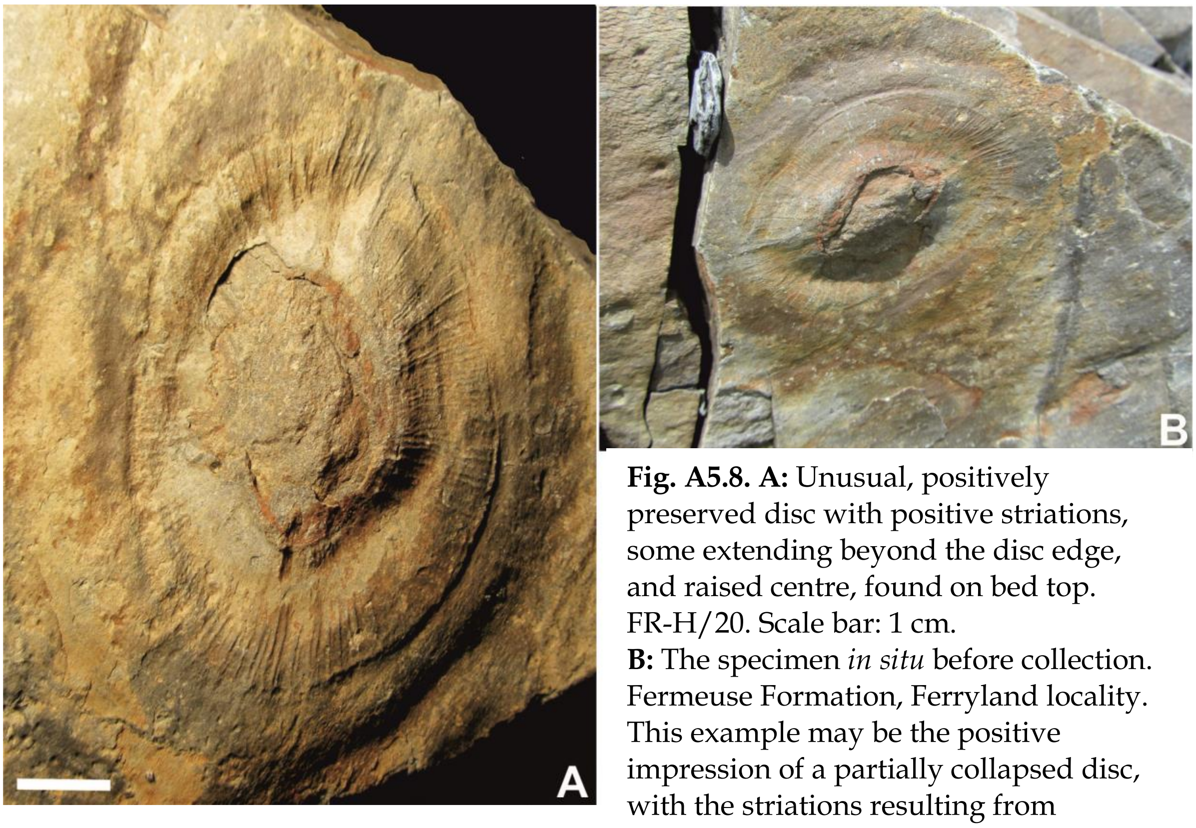


Fig. A5.8. A: Unusual, positively preserved disc with positive striations, some extending beyond the disc edge, and raised centre, found on bed top. FR-H/20. Scale bar: 1 cm.
B: The specimen *in situ* before collection. Fermeuse Formation, Ferryland locality. This example may be the positive impression of a partially collapsed disc, with the striations resulting from overgrowth by a microbial mat. The clear boundary argues against the possibility of a gas dome.

A5.3 The nature of *Aspidella terranovica* Billings

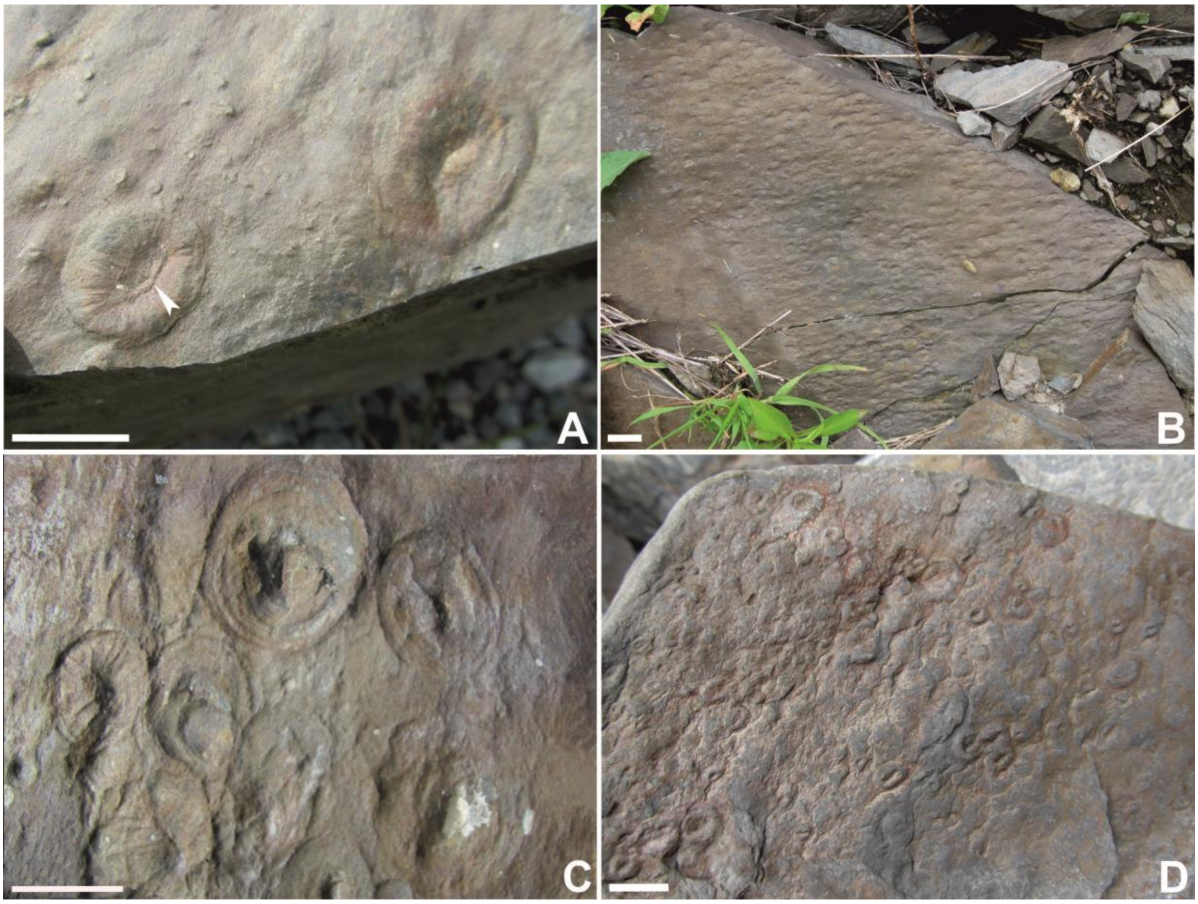


Fig. A5.9. Aspects of *Aspidella*. All specimens from Fermeuse Formation, Ferryland localities. **A:** Image taken in the field of specimen shown in Fig. 5.20, bed sole. A margin is clearly seen on the internal edge of the specimen to left (arrowed). **B:** Closely packed *Aspidella* discs, top surface. **C:** Well-preserved group of *Aspidella*, some distorted, within cleft in rock, preserved negative on top surface. **D:** *Aspidella* preserved positive on top surface. These merit further investigation. They may be impressions of the top of the *Aspidella*-making organism. If so, they suggest a simple organism with central opening, like a polyp, rather than a holdfast. Scale bars: 1 cm.

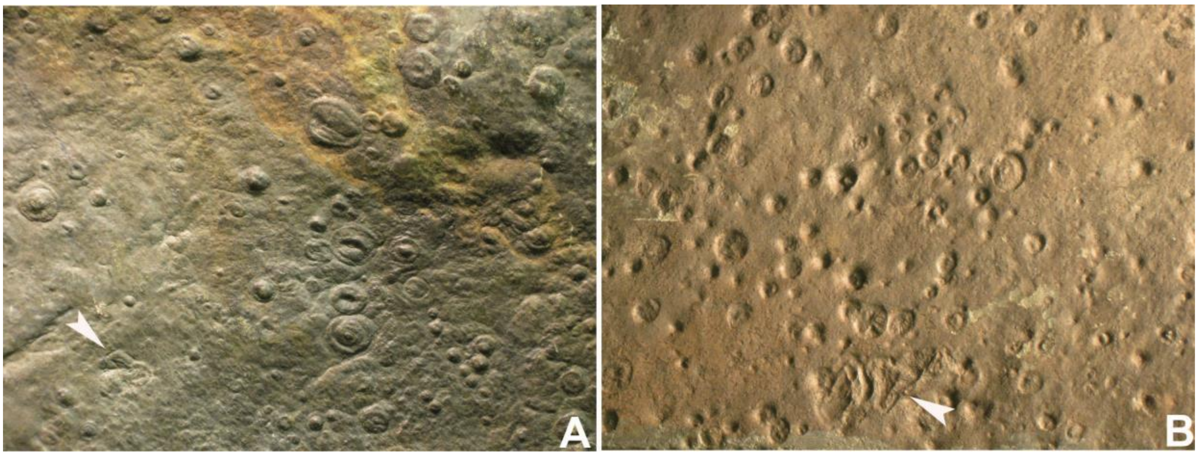


Fig. A5.10. **A, B**: Effect of an approximate retro-deformation, to make most discs close to circular, on the shape of *Triforillonia*. B is the same specimen as shown in Fig. 5.23, now with an artificial skew. Note that the approximately isosceles triangle shape of *Triforillonia* remains on retro-deformation, and that some *Aspidella* specimens remain elliptical. FR-H/14.

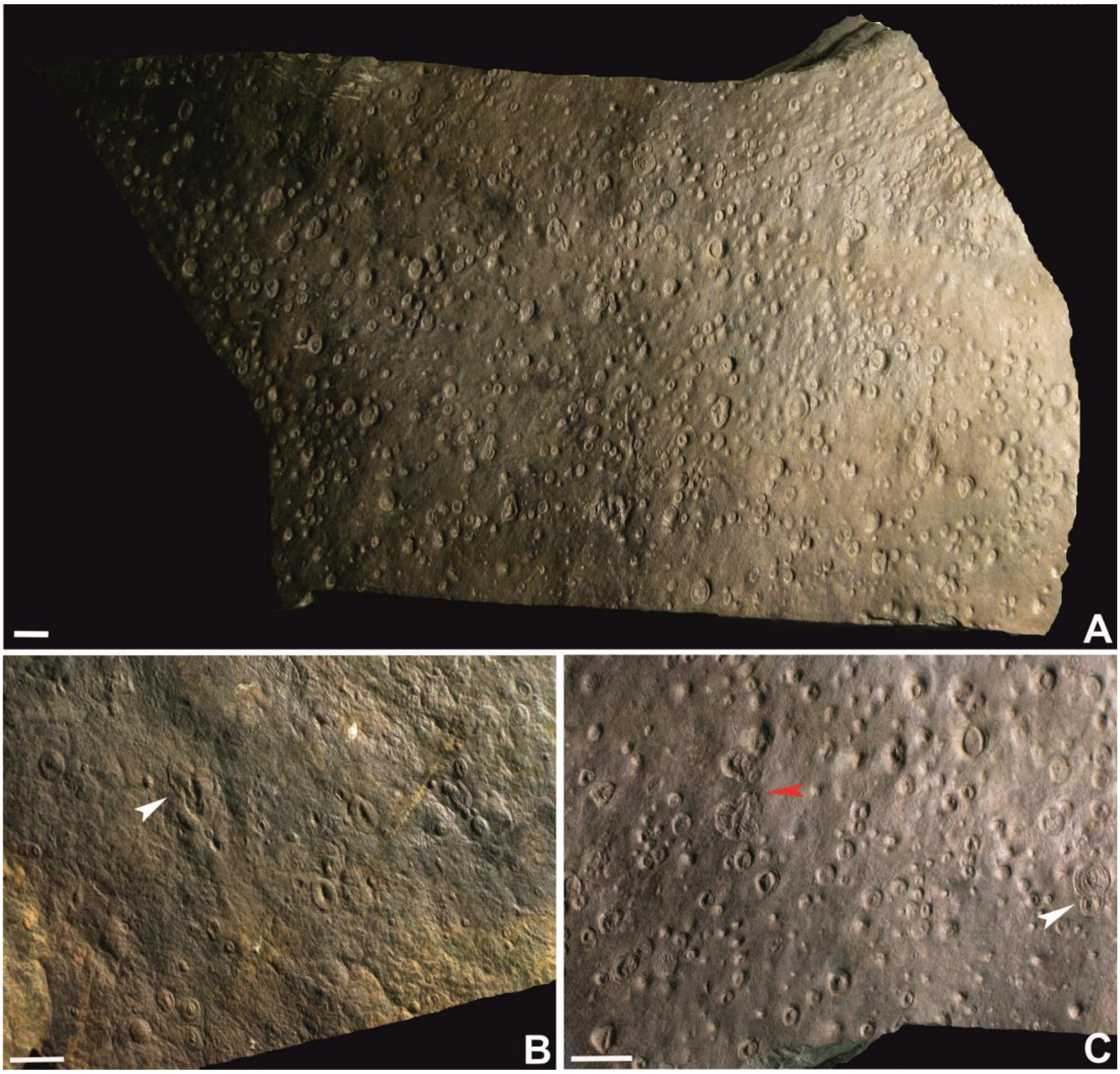


Fig. A5.11. *Aspidella*, *Triforillonia*, and distorted discs. **A:** Large specimen with many *Aspidella* and a variety of distorted discs preserved on top surface.**B:** *Triforillonia* with strong central furrow (arrowed), and several *Aspidella* with central furrows, on sole surface of same specimen. Discs with round bosses are seen to bottom left. **C:** Portion of top surface of same specimen, with heavily distorted discs (red arrow) and a large disc with a small disc in contact, sharing an external margin (white arrow). *Aspidella* with central ridge and rounded centres can be seen. FR-H/1. Scale bars: 1 cm.

A5.4 Evidence of locomotion associated with *Aspidella* – further images

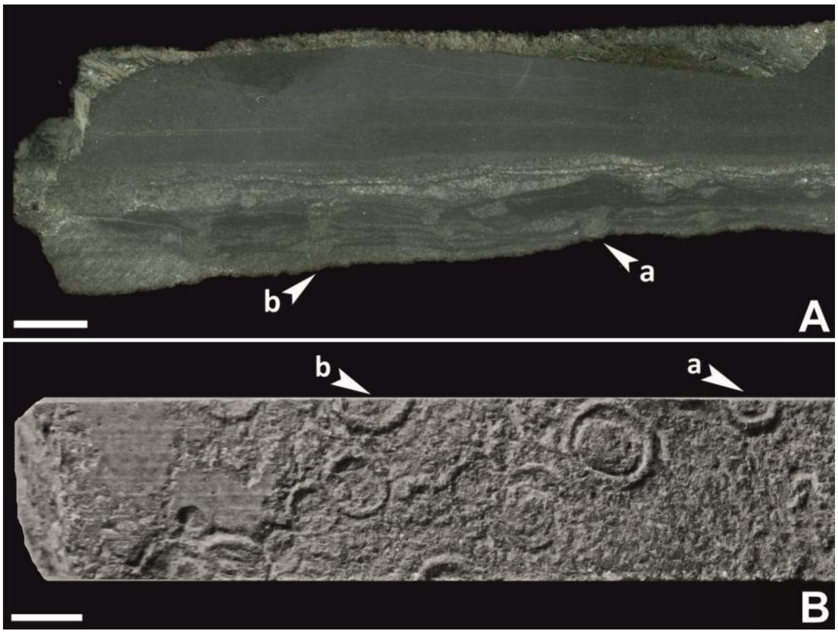


Fig. A5.12. Correlation of simple positive rings on bed sole with vertical stacked menisci in cross-section, interpreted here as equilibrium traces. **A:** Polished cross-section through hand specimen from Fermeuse Formation, Ferryland locality, with two examples of vertical structures labelled. **B:** Sole of specimen shown in A (and Fig. 5.37G), with directly correlating ring structures labelled. Note that these simple rings are quite different in morphology from the mounds produced on bed soles by sediment injection and loading in the upper Burway Formation, Longmyndian Supergroup, UK (Chapter 2). SC-3/1. Scale bars: 1 cm.

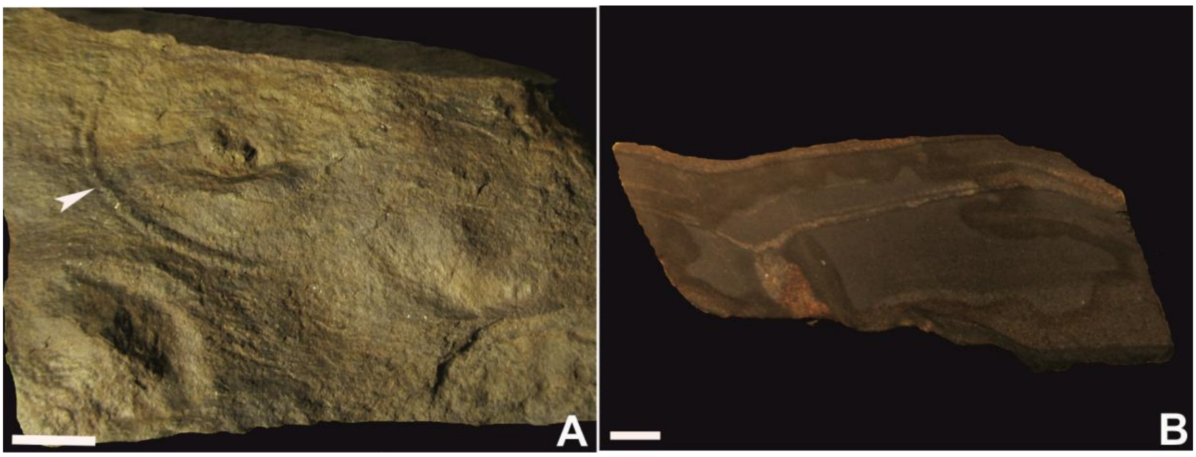


Fig. A5.13. For comparison, an example of a likely small fluid escape column (**B**) arising from the centre of an annulated flat disc with a thin raised rim and central boss on bed sole (**A**, arrowed). Note the continuity of the fluid escape column. It seems likely that the disc in A is biogenic, given the morphology of the disc – a *Spriggia*-like form – and the context of evidence for biogenicity of similar discs in the locality. The fluid escape may result from the migration of fluids post-mortem, although in this case no pyritization is evident. There is no evidence however that the vertical structure is a trace fossil. FR-J/7. Scale bars: 5 mm.

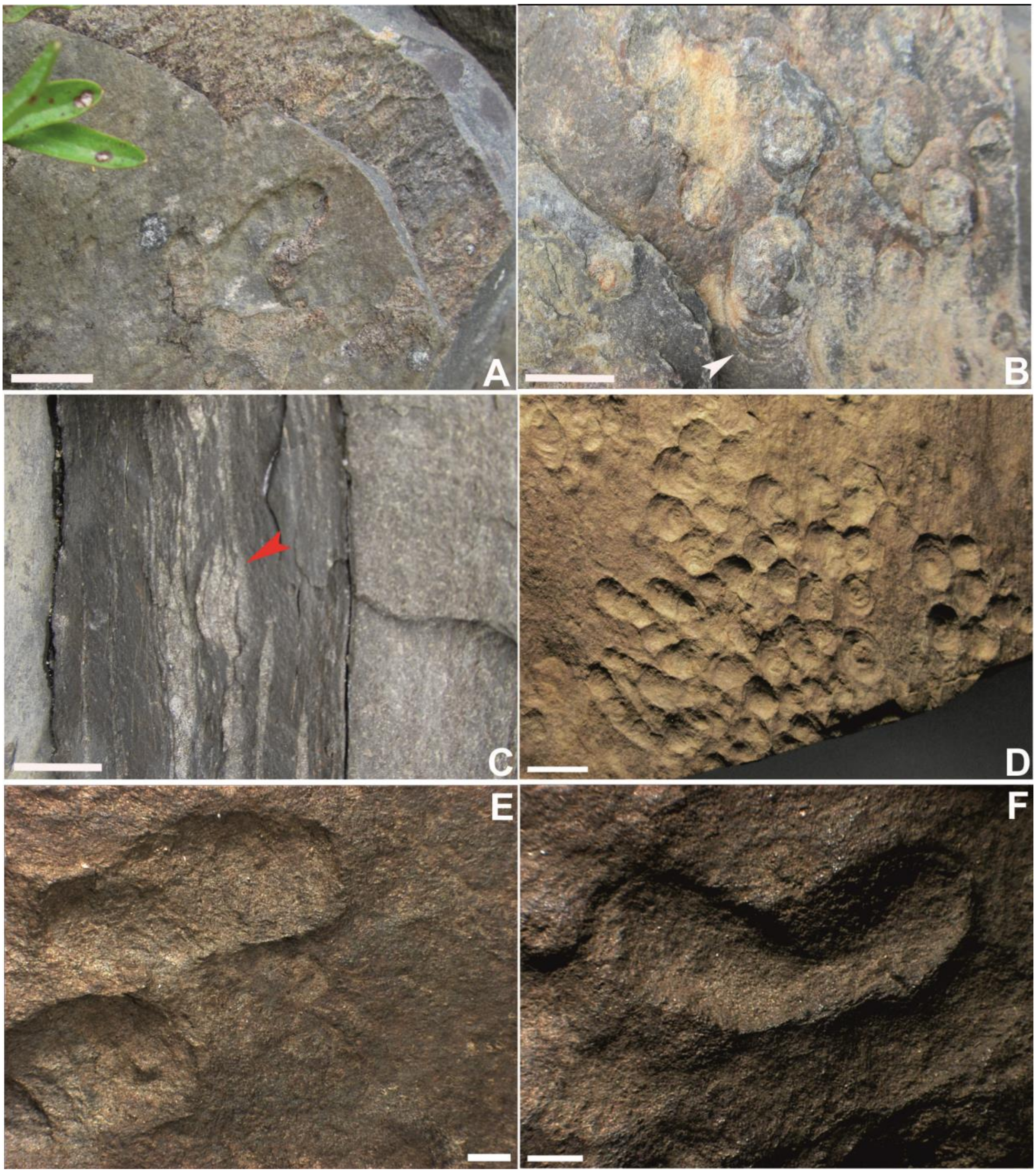


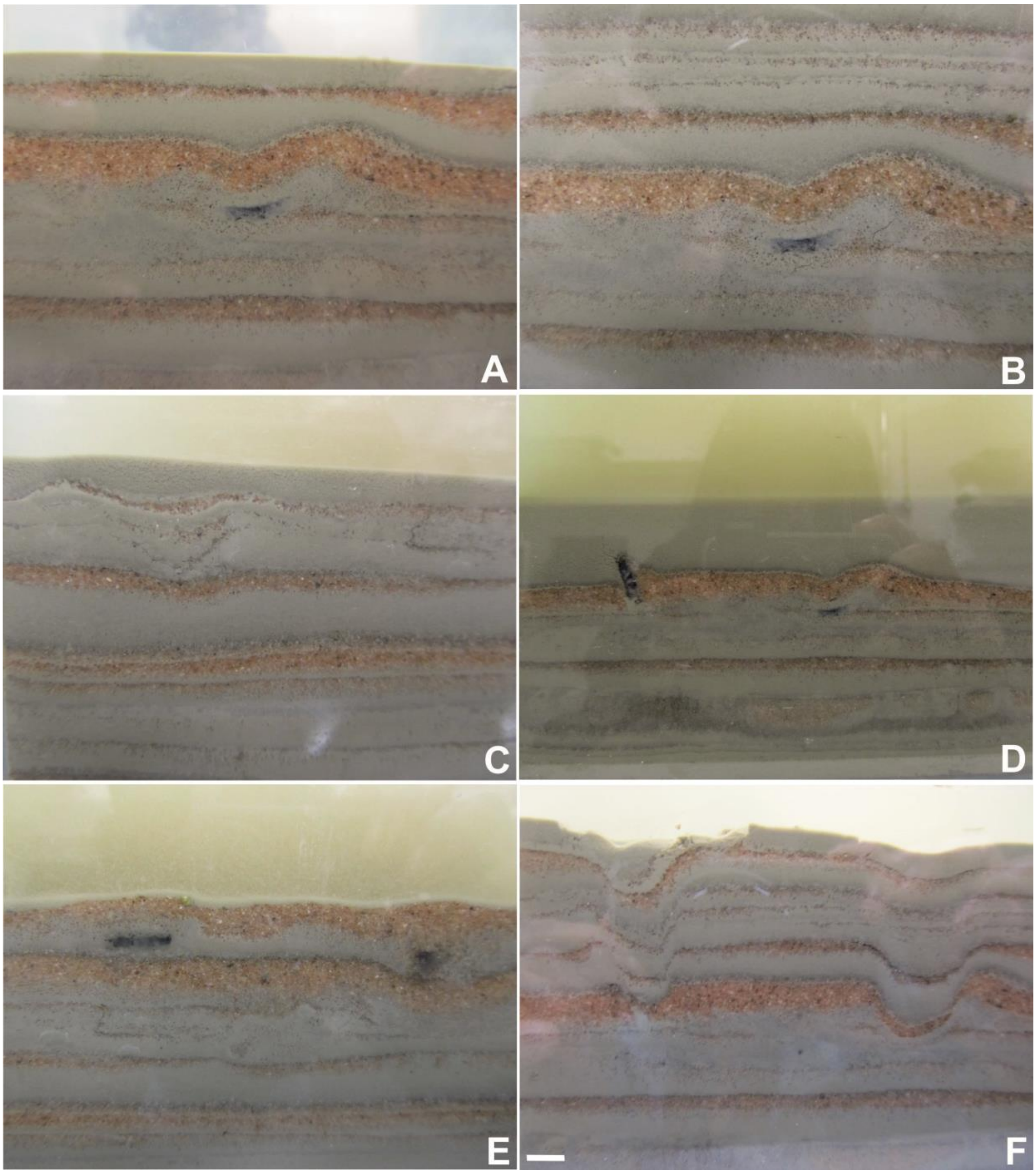
Fig. A5.14. Further examples suggesting movement of *Aspidella*, upper Fermeuse Formation, Ferryland localities. **A:** Small possible trace on top of bed. Internal crescent-shape ridges can be seen. **B:** Series of crescents next to disc on top of bed, suggesting movement rather than compression. The size, at ~0.5 cm, is within the typical range of *Aspidella*, although a small holdfast cannot be ruled out. This positive impression probably represents the top of the organism. **C:** Possible equilibration trace within almost vertically dipping strata. **D:** Several extended horizontal markings, lower left of picture, on disc-rich bed top, interpreted here as horizontal traces. Above these extended traces are several small possible traces indicating some vertical movement. **E, F:** Traces from the hand specimen shown in D, imaged under a binocular microscope. The slightly raised edges of the markings, suggesting movement through sediment, are apparent. Faint internal crescentic ridges can also be seen. D–F, FR-R/5. Scale bars: A–D, 1 cm; E, F, 1 mm.

A5.5 Details of experiments to test sedimentary structures produced by gravitational collapse into voids

Ten experiments were performed over two months in a water-filled 25-cm^3 tank, in which sand and clay laminae were built up over buried, commercial, light-oil-filled capsules (cod liver oil), to check the sedimentary pattern resulting from gravitational collapse into voids described by Buck and Goldring (2003). The clay was softened by soaking in brine for 2-3 weeks. After placing the capsule on a mud layer, laminae were built up by sprinkling sand and dropping the soft mud on the surface of the water in the tank. Salt was added to the water to encourage rapid settling of the mud (see Kindle, 1916). The mud layers settled over 1 or 2 days, so that several layers could rapidly be built up over a week.

The expectation was that the buried capsules would dissolve, resulting in the drop of the overlying sediment layer to fill the void. However, the buoyant capsules tended to rise up to the sediment-water interface unless pushed down into the surface, which produced a raised rim of sediment around the point of burial. Only about half the experiments provided useful results; in others the capsules broke quickly and/or worked themselves out of the sediment and were discarded. However, the successful experiments supported the Buck and Goldring (2003) description, and provided useful insights into the impact of burial and decay on overlying unconsolidated sedimentary layers. In one instance, a capsule which had not been firmly buried and had worked itself up to the surface vertically was not removed while further sediment layers were added. The capsule continued to work up to the sediment-water interface through each of several layers before breaking up completely. This proved to be a serendipitous natural experiment, as although lacking muscular movement, the capsule was nevertheless adjusting its vertical position effectively somewhat like an equilibrating organism maintaining its position at the sediment-water interface. The resulting sedimentary pattern was similar to an equilibration trace (Fig. A5.15D–F). Subsequently, several experiments were conducted using pieces of cane sugar, to avoid the problems resulting from buoyancy of the oil-filled capsules. The cane sugar pieces dissolved in position, and further confirmed the sedimentary pattern resulting from gravitational collapse.

Fig. A5.15. Results from gravitational collapse experiments. **A:** Example of capsule buried under several layers of sand and mud (the remains of the collapsed capsule can be seen as a black meniscus). **B:** The same capsule four days later, after the addition and settling of several more layers of sediment. Note that the overlying layers have rapidly become flat above the buried capsule. **C:** Another example of a sedimentary pattern from gravitational collapse, with a more pronounced dip, that shallows quickly over several layers. **D:** Two capsules buried near each other. The right hand capsule was more firmly buried and remained embedded, but the left-hand capsule was not effectively buried, and its buoyancy enabled it to work up vertically. It was left in this position. In this photo, a layer of mud has been added above, and is still settling. **E:** Same two capsules after 12 days, during which a further sand layer and thin mud layer have been added. The left-hand capsule appeared to have settled horizontally, but had not broken, while the right-hand capsule had broken and some upward seepage of the oil can be seen. The left-hand capsule subsequently worked its way up through the sediment. **F:** After a further 16 days and the addition of further sedimentary layers, the left-hand capsule continued to work its way up vertically to the sediment-water interface between sediment pulses, and finally broke up, leaving a thin sub-vertical trail of dark oil within the topmost mud layer. In the process, a series of similarly dipping sedimentary layers was produced. By contrast, the collapsed capsule on the right resulted in the usual gradually shallowing dip of consecutive overlying layers. This is the structure imaged in Fig. 5.37F. Scale bar (shown in F): 1 cm. (Other photos are close to but not exactly at the same scale.) ►


A
B
C
D
E
F

APPENDIX 6: Catalogue of Long Mynd specimens

Collection permitted for scientific study. All specimens to be housed in the Oxford University Museum of Natural History (OUMNH nos) following completion of research.

Ashes Hollow quarry

Specimen no.	Other nos	S/M/L	Sectioned?	Brief description
L-AH/1	OUMNH Á.2542 LMy – 1	L	y	Many small *Medusinites* and pimples. Cut into three, a-c. Each piece sectioned, shows range of sandstone forms in cross-section. Ground parallel to bedding to reveal filaments. Thin sectioned, transverse and longitudinal. Collected by Rich Callow.
L-AH/2	OUMNH Á.2543 LMy - 2	S	y	*Medusinites* on sole. Shallow depressions on top. Cut into 3 parts, a-c. Several Medusinites systematically ground. Also ground through depressions, vertically and parallel to bedding. Offcuts ground down to reveal rich mat layer of white filaments. Piece b thin sectioned longitudinally to reveal filaments, examined in optical microscope and SEM-EDX. Collected by Rich Callow.
L-AH/3		S	n	Small piece showing 'bobbly' microbial texture.
L-AH/4		S	y	*Intrites*. Ground.
L-AH/5		S	n	*Intrites* and *Medusinites*. –ves and occasional +ves. Lobed disc examples.
L-AH/6	OUMNH Á.2541	S	y	*Intrites* and *Medusinites* (-ves). Three further associated small pieces. Ground to examine counterparts.
L-AH/7		M	n	Fine piece, with *Medusinites*. Some *Intrites* on other face.
L-AH/8		S	n	*Intrites/Medusinites*.
L-AH/9		S	n	Good piece. *Intrites/Medusinites* both sides. –ve counterpart 4-lobed discs.
L-AH/10		S	y	*Medusinites*, good, one side. Good 4-lobed discs. Cut, ground, thin sectioned transverse. SEM-EDX. Bands of rutile found. Two offcuts of 10a ground parallel to bedding reveal microbial mat, finely preserved filaments.
L-AH/11		S	n	AH5'. Interesting sedimentary structures, blobs to elongated, in rows.

L-AH/12		M	y	Good piece with small +ve bulges on sole, *Medusinites* mounds with no central peak. Sectioned. Several long vertical disturbances. Ground through disturbances. Thin sectioned.
L-AH/13		S	y	*Intrites*. White filaments on surface. Ground parallel to bedding. Longitudinal thin sections showing filaments. Ground to show microbial mat layers. Thin sectioned longitudinally, reveals several types of filaments in two layers.
L-AH/14	OUMNH Á.2544	S	n	Good small piece showing distinct *Intrites* with central depression.
L-AH/15		S	n	Quite good *Intrites* on one face.
L-AH/16		S	n	*Intrites*.
L-AH/17		S	y	*Medusinites.* –ve counterparts. Ground.
L-AH/18		S	y	One distinct *Intrites* with high +ve relief and central depression, plus other fainter examples. Ground.
L-AH/19		S	n	Small, fine examples of *Medusinites*, +ve, and lobed discs.
L-AH/20		S	n	*Intrites*, several examples with strong +ve relief, but some weathering.
L-AH/21		L	n	Large, thick block for possible sectioning, showing 'bobbly' texture. Found by Alex.
L-AH/22a,b		M	n	Split slab (a,b). Shows sediment volcanoes on split surfaces. SO 43480 BNG 92952.
L-AH/Y		S	y	Small piece with *Medusinites*. Shows range of sandstone features in cross-section.
L-AH/Z		S	y	*Intrites* on sole. Sectioned, ground. One offcut ground parallel to bedding to reveal microbial mat layer.
RCL-AH/1		S	y	*Intrites* on sole. Among pieces collected by Rich Callow but left uncatalogued and unexamined. Choice pieces were selected for study of *Intrites* and labelled 'RCL-AH/…'. Sectioned, ground.
RCL-AH/2		S	y	*Intrites* on top surface. Sectioned.

RCL-AH/3		M	y	*Intrites* on top surface. Collected by Rich Callow. Sectioned and ground. Thin sectioned.
RCL-AH/4		S	y	*Intrites* on top surface. Sectioned. Rock split. Filaments, branching and twisted, on upper and lower parting surfaces, both ground parallel to bedding, and photographed in detail.
RCL-AH/5		M	y	*Intrites* on sole, many as parallel ridges. Sectioned, ground.
RCL-AH/6		S	n	Some *Intrites* on sole.
RCL-AH/7		M	y	*Intrites* on top surface and within block. Sectioned, ground. Variety of interesting sedimentary disruption and fluid escape features. Fragmented microbial mat layer.
RCL-AH/8		S	y	*Intrites* on sole, some tending towards wide parallel ridges. Ground.
RCL-AH/9		S	n	*Intrites* on top surface.
RCL-AH/10		S	y	*Intrites* on sole surface. Ground.
RCL-AH/11		S	y	Small sediment volcanoes on top surface. Unusual piece, exact provenance within quarry unknown. Sectioned, ground, thin sectioned. Internally, much disturbance; large quartz grains.

Batch Valley

Specimen no.	**Other nos**	**S/M/L**	**Sectioned?**	**Brief description**
L-BV/1		S	n	Interesting sedimentary texture, elongated broken ridges.
L-BV/2		S	n	Faint interesting texture, as if extended *Intrites* in rows. Filaments on surface.
L-BV/3		S	n	Smooth piece with small +ve bulges.
L-BV/4		S	n	Pattern of *Intrites*-like pits.

L-BV/5		S	n	Pattern of pits, in rows, some elongated.

Carding Mill Valley

Specimen no.	Other nos	S/M/L	Sectioned?	Brief description
L-CM/1	OUMNH Á.2540 L-CMV3-7	M	y	From CMV scree. Large -ve *Beltanelliformis* discs and small +ves on same surface. Sectioned. Collected on visit with Alex. Also labelled by Alex in his system.
L-CM/2	L-CMV3-8	M	n	From CMV scree. Large +ve bulges in systematic arrangement. Collected with Alex. Also labelled by Alex in his system.

APPENDIX 7: Catalogue of *Aspidella*-containing specimens, Fermeuse Formation, Ferryland localities, Avalon Peninsula, Newfoundland

All specimens are under the care of DMC at Memorial University, Newfoundland, and on loan to Oxford for research purposes. Following completion of research, they will be returned to Memorial University, and figured specimens placed in the museum, The Rooms, St John's, Newfoundland.

Ferryland Roadcut

Specimen no.	Other nos	Size S/M/L	Sectioned?	Brief description
FR-R/1	FR1	M	y	Small discs +ve relief. Sectioned into 5 pieces, (0)-(4). Small meniscus traces found within. Partially ground. SEM-EDX.
FR-R/2	FR2	M	y	Small discs -ve relief. Sectioned into 5 parts, (1)-(5).
FR-R/3	FR1-3	M	y	Many +ve 'pimples'. Sectioned into 3 pieces, (1)-(3).
FR-R/4a	FR4a	S	y	Small -ve discs. Sectioned into 3 parts, (1)-(3).
FR-R/4b	FR4b	S	y	Counterpart to FR4a. Small +ve discs. Sectioned into 4 parts, (1)-(4).
FR-R/5	FR DD1	M	n	Fine dense disc block showing cluster of distinct crescentic trails.
FR-R/6	FR DD2	M	n	Fine dense disc block. Shows several trails.
FR-R/7		M	n	Interesting thin block showing several medium discs with +ve relief and detail, close clusters. Useful for interactions.
FR-R/8		S	n	Number of small discs showing +ve relief and some detail.
FR-R/9		S	n	Number of small/medium discs showing rims and +ve relief.
FR-R/10		M	n	Part of dense disc area. Several possible short beginnings of crescentic trails.
FR-R/11		S	n	V small discs, +ve relief, showing central dip or invagination.
FR-R/12		M	n	Thick block with interesting disc showing several distinct rays extending off one side only, -ve relief. Also small disc with strong -ve relief rim and raised boss.

FR-R/13		L	n	Block perhaps from same dense disc area of roadcut, -ve relief. Showing several distinct crescentic trails. Also possible faint fine rays emanating from one side of a disc.
FR-R/14		L	n	Large block with a number of small discs, broken into two large pieces (a, b), one smaller (c), and several small pieces. -ve relief. Some discs showing central boss or ridge.
FR-R/15		L	n	V thick block, about 6 cm, with fine +ve hyporelief type *Aspidella* showing central dip and grooves, and a second *Aspidella* larger with less detail.
FR-R/16		L	n	Two clusters of large discs, some overlapping, on thick block, looks to be top surface. Sectioned, but no structures below.
FR-R/17	DD3, FRY1-1	M	y	Dense disc block sectioned into 3 parts, (1)-(3). One part thin sectioned.
FR-R/18	FR3	S	y	Small piece with small +ve relief discs. Sectioned into 4 pieces, labelled (0)-(3).
FR-R/19	FR	S	n	Triangular piece with some -ve discs. Not much here but could be sectioned.
FR-R/20	FRY1-2	L	n	Thick block with a number of discs, -ve relief, showing rims. Some +ves on sole.
FR-R/21		M	n	Thin slab, partly broken, with two large discs, *Ediacaria*, showing central boss and distinct rims.
FR-R/22		S	n	Thick slab with many small discs closely packed, almost in rows, *Chuaria*-like.
FR-R/23		L	n	Thick slab with several large discs overlapping. Weathered but some detail.
FR-R/24		M	n	Medium and small discs showing raised rims and central bosses, though weathered.
FR-R/25		M	n	Broken piece, assumed probably originating from roadcut. Small discs, one good small *Aspidella* epirelief with ridge. Linked to FR-R/26
FR-R/26		S	n	Small broken piece of same slab as FR-R/25. Small discs, one with boss, one with ridge, epirelief.

FR-R/27		M	n	Several small-medium discs showing distinct rims and bosses on uneven sole with several -ve epirelief discs on other face.
FR-R/28		S	n	Number of small pimple-like forms, one or two with central pits. Similar to Long Mynd examples.
FR-R/29		M	n	Portion of large disc on one face (rest on FR-R/30); small discs, -ve, together with tiny -ve pits on other face (probably top). Fits over/under FR-R/25 and links laterally to FR-R/30 and FR-R/31.
FR-R/30		S	n	Small broken piece of same slab as FR-R/29 and FR-R/31 and fits between them and over/under FR-R/25 and 26. Contains most of large disc (rest on FR-R/29).
FR-R/31		S	n	Portion of large disc, rest on FR-R/29, on one side, probable sole, with small discs on the other. Rests on FR-R/26, and links laterally with FR-R/29 and FR-R/30.
FR-R/32		S	n	Number of small discs in +ve relief, probably sole. Several showing round slightly protruding bosses in recessed portion; one with fold/invagination.
FR-R/33		M	y	Number of small discs in -ve relief, probable top of bed. Some showing central ridge, and some also faint radial ridges of *Aspidella* type.
FR-R/34		S	n	Small disc, -ve, showing apparent 'rays'.
FR-R/35		S	n	a,b. Part-counterpart Billings *Aspidella*.
FR-R/36		M	n	Many small bumps with *Aspidella*.
FR-R/37		L	n	Large thin surface fresh off roadcut, +ve hyporelief. Many discs, some slightly distorted.

Ferryland, harbour rocks

Specimen no.	Other nos	Size S/M/L	Sectioned?	Brief description
FR-H/1	2A JM/AL	L	n	Large block full of small discs, *Triforillonia*. Part of find of freshly fallen slabs in central harbour rocks.
FR-H/2	2A JM/AL	L	n	Another portion of same block as FR-H/1. Discs and *Triforillonia*. Central harbour rocks.
FR-H/3	2D JM/AL	L	n	Discs and *Triforillonia*. Central harbour rocks.

FR-H/4	2F JM/AL	M	n	Discs and *Triforillonia*. Central harbour rocks.
FR-H/5	2E JM/AL	S	n	Discs and *Triforillonia*. Central harbour rocks.
FR-H/6		S	n	Discs and *Triforillonia*. Central harbour rocks.
FR-H/7	1.2C JM/AL	L	n	Large 3D disc +ve relief plus smaller discs, on reverse -ve relief fine type specimen of *Aspidella*.
FR-H/8	1.1B JM/AL	L	n	Fine +ve relief discs, type *Aspidella* and *Triforillonia*. Counterpart of FR-H/7.
FR-H/9	3	L	n	Fine +ve relief discs and *Palaeopascichnus*. Clusters of 3D discs.
FR-H/10	3B JM/AL	L	y	Large block with 3D +ve relief discs. Sectioned, some parts ground.
FR-H/11	2C JM/AL	L	n	Discs and *Triforillonia*. Central harbour rocks.
FR-H/12	2G JM/AL	L	n	Particularly rich in discs, *Triforillonia*. Central harbour rocks.
FR-H/13	1A JM/AL	L	y	Some +ve relief small-medium discs. Central harbour rocks. Sectioned. Pyritic cement indicating fluid escape from medium disc.
FR-H/14	2B JM/AL	L	n	Discs and *Triforillonia*. Central harbour rocks.
FR-H/15	PE JM/AL	L	n	Many small +ve discs and some *Palaeopascichnus.*
FR-H/16		M	n	Discs. Central harbour rocks.
FR-H/17		L	n	Thick slab with -ve relief medium discs with fine rims and central depressions.
FR-H/18		L	n	Thick slab with +ve relief medium discs showing interesting detail and arrangement, some in close clusters. Rings and central bosses.
FR-H/19		S	n	Close small-medium discs -ve relief showing ring detail.
FR-H/20		L	n	Large disc showing strong +ve relief and fine ray detail all around, stretching beyond apparent edge of disc.
FR-H/21		L	y	Several medium-large discs showing some detail, though weathered block. Small discs on other face. Sectioned and thin sectioned to examine microbial mat layers within. Fine example of menisci with pyritic cement above, within block.
FR-H/22	P.1.A JM/AL	L	n	Thin slab broken into 4 pieces (a-d). -ve relief *Palaeopascichnus* and some discs.
FR-H/23	P.2.C JM/AL	L	n	Portion of thin slab, with some discs and poor *Palaeopascichnus*, -ve relief.

FR-H/24		L	n	Large part a, smaller adjoining section b. -ve epirelief part of striking part-and-counterpart (FR-H/25) showing individual disc with apparent small disc budding off; disc split between a and b showing 2 distinct stepped rings; and clusters of discs squeezed together with distorted edges. (b) contains small +ve mound with faint rays - a small *Hiemalora*. *Palaeopascichnus* on (a).
FR-H/25		L	n	One of two counterpart blocks to FR-H/24, +ve hyporelief medium-small discs. Single disc with small distorted growth to side, possible budding; half of high relief stepped disc; and large patch of interacting, distorted discs with distinct bosses, sometimes recessed. Small -ve *Palaeopascichnus*. Very fine block.
FR-H/26		L	n	Second of two counterpart blocks to FR-H/24, fitting adjacent to FR-H/25. Medium-small discs in +ve hyporelief, with distinct bosses. Other half of single stepped disc; set of four touching discs, two groups of interacting discs. V small *Palaeopascichnus*, 1mm and less, +ve. Fine block.
FR-H/27		S	n	Thin block from N end of harbour rocks, with one whole med disc and three partial of same size, one showing small 'budding-like' distorted small disc to side.
FR-H/28		L	n	Central harbour rocks where *Triforillonia* specimens were found. Many small discs on main surface (sole, +ve hyporelief), with some *Palaeopascichnus*. Medium discs with some relief on portion of visible bed above (sole of). One broken portion to side.

“Silos Cove”, inlets 1-3

Specimen no.	Other nos	S/M/L	Sectioned?	Brief description
SC-3/1	SC1	M	y	Number of small discs -ve showing +ve rim, circular, no other detail. Sectioned into 6 parts, (1)-(6). Thin sectioned. Important specimen, shows vertical traces.
SC-3/2		M	y	Interesting flat piece showing a number of small discs with strong +ve rims, and one ringed disc. Top layer has split off showing bulges beneath. Labelled (a) and (b). Sectioned, ground.
SC-3/3		M	y	Thick medium slab with small discs quite weathered and -ve *Palaeopascichnus*. Edge sectioned (b,c) partially through large disc.
SC-3/4	SC	S	n	Small piece showing a few strongly +ve small discs.
SC-3/5		M	n	Thin slab with many small discs, +ve relief. V small 'trails' which may be tiny examples of *Palaeopaschichnus*.
SC-3/6		S	n	Small piece with +ve discs, weathered.
SC-3/7	SILOS	M	n	Thin slab in two pieces, many small +ve pimples and some -ve discs, possible *Palaeopascichnus*. Probably Silos 3, but uncertain.
SC-2/1		L	n	Large disc, +ve, showing some detail. Over 2 cm thick slab, suitable for sectioning.
SC-2/2		L	n	Very thick block, 6 cm, with small +ve discs.
SC-2/3		S	n	Two medium discs showing rings, and small discs on other face.
SC-2/4		S	n	A number of smallish –ve discs showing some relief, and several small +ve relief discs on sole. Possible small –ve relief trail.
SC-2/5		S	n	Medium-small slab with small pimples and several discs with distinct rims. Some depressions on same face.
SC-2/6		M	n	Number of positive pimples and bumps, and one small *Triforillonia*-like form.

SC-1/1		M	n	Several +ve small-medium discs on thick slab.
SC-1/2		M	n	Several small-medium discs, +ve, showing rim, central boss, and one with central invagination on same slab.
SC-1/3		M	n	Two large discs showing features of compression of soft body.
SC-1/4		L	n	Very fine slab with a number of large discs, including several doubles and three possibly interacting.
SC-1/5		S	n	Medium-large disc showing compression folds, and one smaller +ve disc.
SC-1/6		L	n	Double disc and fine -ve *Yelovichnus* on one side, many small discs on the other, including start of a possible trail from a disc.
SC-1/7		S	n	A few small discs, weathered, on small face; some interesting subtle marks on larger face.
SC-1/8		M	y	Thin slab with small discs on one face, some showing a little detail, and several +ve relief ringed discs, *Palaeopascichnus* and possibly related +ve markings on the other. Sectioned.
SC-1/9		S	n	Small discs in -ve epirelief, one showing distinct raised ridges from central point.

Ferryland, Art and Lana Jordan's Yard, with permission from the Jordans

Specimen no.	**Other nos**	**S/M/L**	**Sectioned?**	**Brief description**
FR-J/1		M	y	Two +ve hyporelief *Ediacaria* with strong relief, one particularly fine, showing raised central boss. Over 3 cm thick block showing sand and shale layers. Counterpart in situ behind Art Jordan's well. Donated by Art Jordan. Sectioned. Flat *Spriggia*-like disc on same surface has fluid escape feature.
FR-J/2		S	y	Three clear small 1 cm discs and several faint ones. Central disc in group of 3 shows some detail as radial lines and central boss. Sectioned.

FR-J/3		M	y	A number of small discs showing 3D detail and invagination. Hyporelief type *Aspidella*.
FR-J/4		S	y	A number of small discs -ve with +ve central boss. Sectioned.
FR-J/5		S	y	Half of large disc sliced through. Slight +ve relief with central round depression. Sectioned. Shows interesting meniscus structures within block.
FR-J/6		S	y	Several small discs +ve, two connected, on sole. No detail. Simple negatives on top surface. Sectioned. Small fluid escape feature.
FR-J/7		S	y	One medium disc, 2 cm, with rings and central boss.
FR-J/8		M	n	Several med +ve discs with recessed and protruding central bosses, and some small bumps. From side of Lana's driveway.
FR-J/9		S	n	Small Billings *Aspidella* +ve hyporelief showing markings. From side of Lana's driveway.

Ferryland, rocks below "Kavanagh's" diner

Specimen no.	Other nos	S/M/L	Sectioned?	Brief description
FR-K/1		L	y	Group of small-medium discs, -ve epirelief, showing a number of compression rings, and centres infilled with coarse sand from above. Cut into three (1,2,3) through several discs. (2) and (3) contain *Hiemalora*.

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