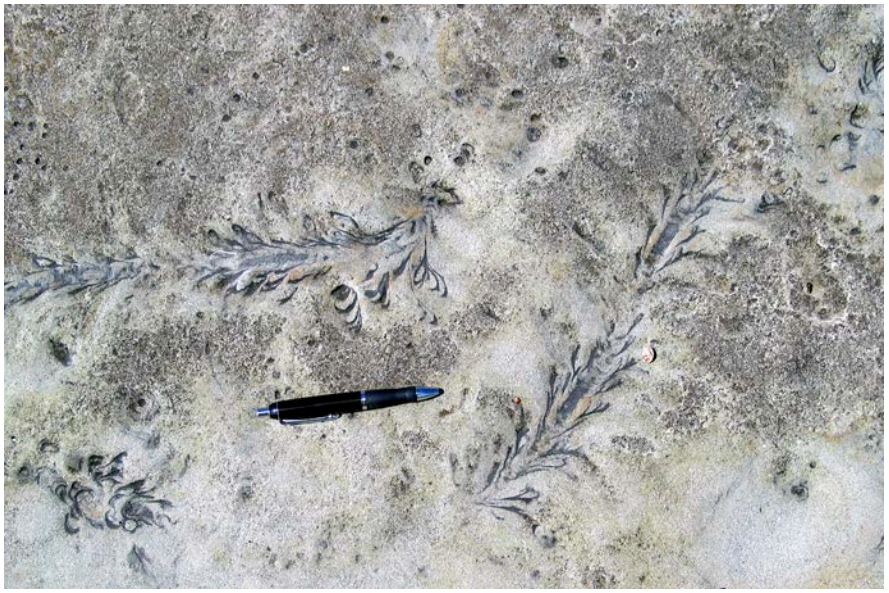
Hillichnus, a feathery, enigmatic trace fossil

Perhaps the most striking trace fossil at Point Lobos is a large complex form that has been named Hillichnus lobosensis. Herold first described the trace in 1934 as a fossil seaweed because of its resemblance to certain local kelp (such as feather boa kelp). Fossilized seaweed, however, should be carbonaceous and two-dimensional (like a pressed leaf). Although it does superficially resemble seaweed, the feature is three-dimensional, crosses bedding surfaces, and that the dark component is the mud, not carbon.

The trace has many manifestations, depending in large part on orientation of the surface on which it is exposed and the level of the section through the trace. which makes it particularly interesting, but hard to visualize in its entirety.



Hillichnus, as seen on bedding plane surfaces of Carmelo sandstones

Hillichnus exposed on three surfaces of either different composition or different lithologies A. muddy surface parallel to bedding. The trace is wide and has a central sand-filled core. B. Sloping sand surface with numerous Hillichnus traces. C. Surface perpendicular to a graded sandstone bed. Burrows in a graded bed demonstrate that the trace formed in the sediment below the sediment-water interface. It is difficult to reconcile the traces depicted in "C" with the feeding activity of a bivalve.

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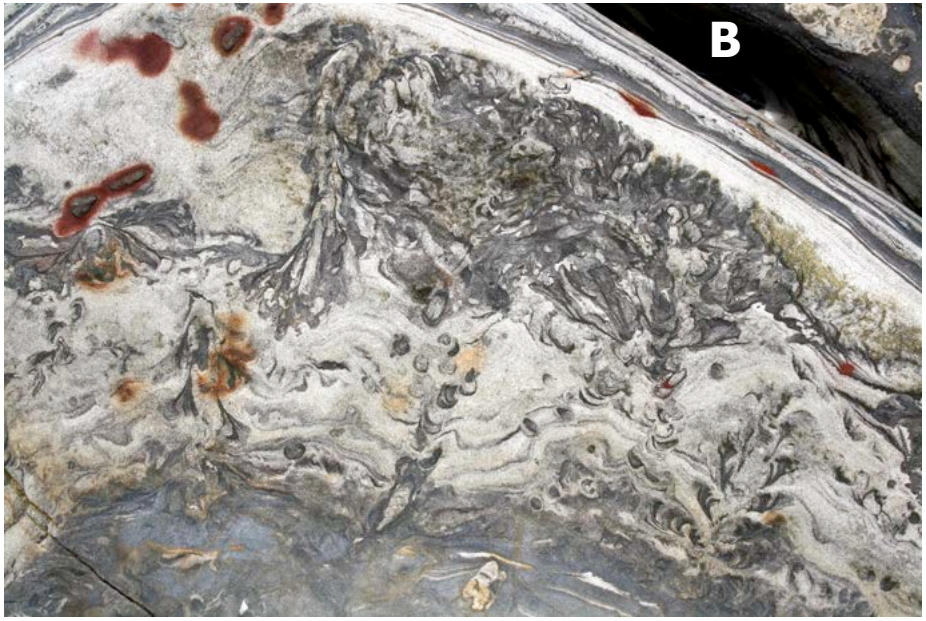
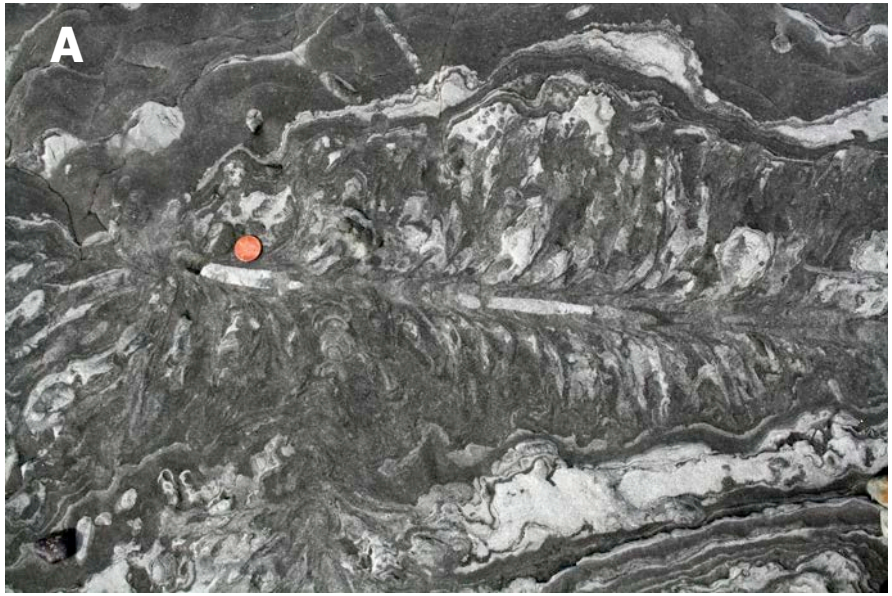
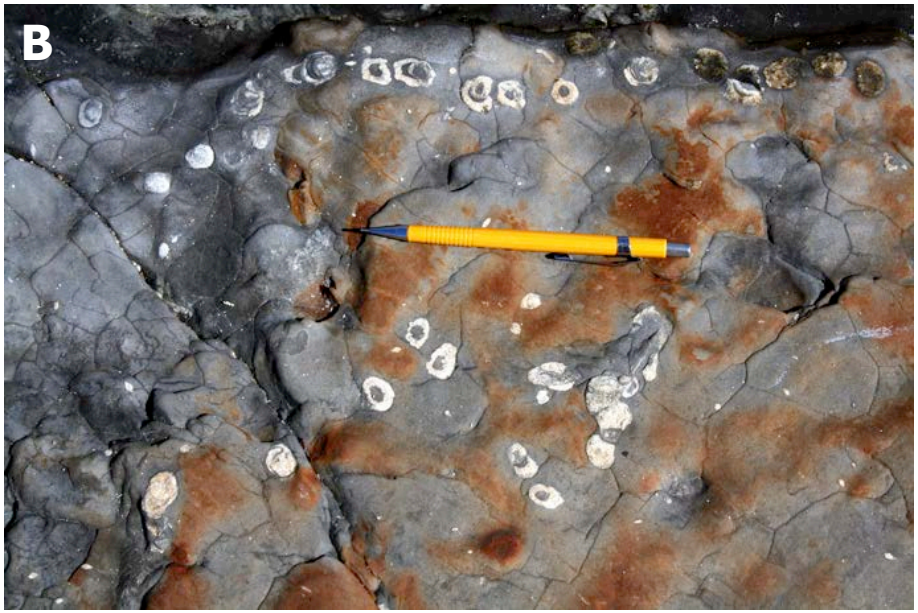




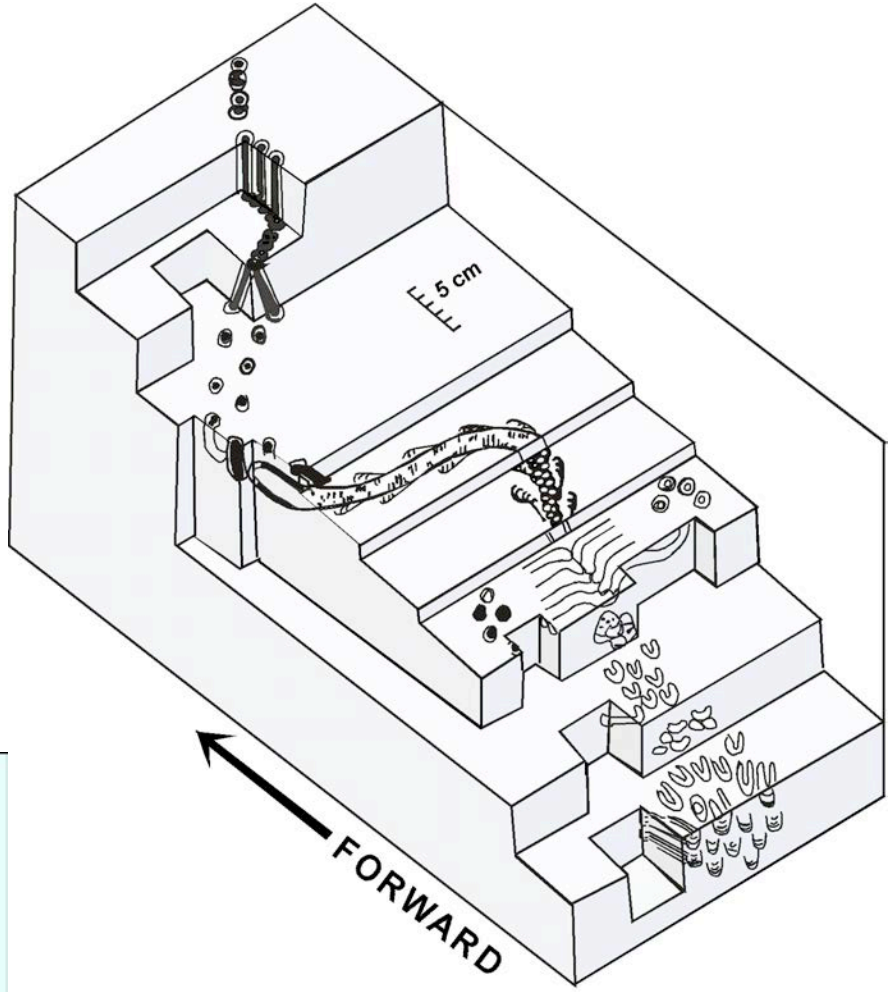
Other manifestations of Hillichnus in the Carmelo Fomation at Weston Beach A. Vertical section through sandstone above the trace. Some of the upward-extending mud "lines" may be paired or a represent a section through an upward extending tube cored with sane and lined with mud, perhaps similar to those in the center of figure "B" on the previous page.

B and C: Cross-sections through aligned (and apparently random) vertical tubes rimmed with sand and cored with mud. Tubes in "C" record movement to the right as are those in the uppe rorw in "B". These features have been considered part of the Hillichnus trace (HIll, 1981, Bromley et al., 2003), although a connection between the two is difficult to find.

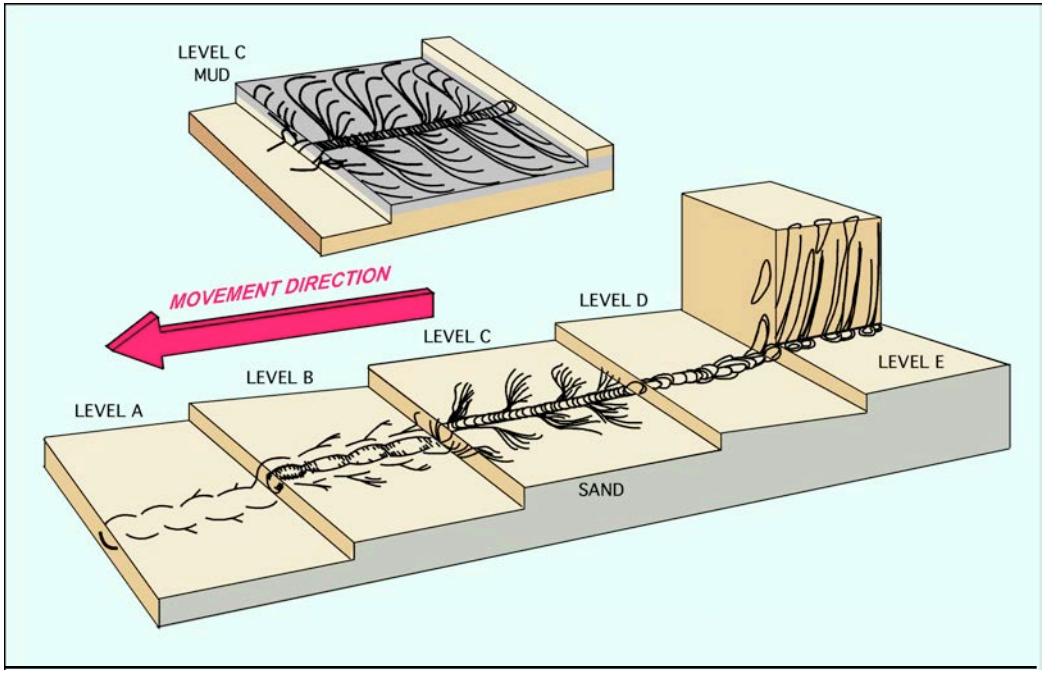


Hill (1981) provided the first attempt to reconstruct the trace. He pointed out that its numerous manifestations were not the result of different organisms, but were parts of a complex three-dimensional feeding pattern of a single organism

Bromley et al, (2003) named the trace "HIllichnus lobosensis", and suggested that if was produced by a substratal deposit-feeding bivalve. Their 3-dimensional model does not show the lower tier of traces depicted in the Hill model, and, in contrast to the Hill model, depicts movement of the trace-maker away from the direction in which the lateral "frills" or "feathers" open.



HIll's (1981) 3-dimensional reconstruction of the complex trace.



Three-dimensional model of the trace Hillichnus lobosensis by Bromley et al. (2003)

Multiple Hillichnus traces on a sandstone surface, Weston Beach. Trace above pen appears to be transiting in the direction pen is pointing.

Bromley et al. (2003) are probably correct in deducing that the structure was produced by the feeding of a subsurface animal. Hill arrived at the same conclusion in 1981; he believed the organism was feeding on organic matter contained in the mudstone layers. The trace locally disrupts the sand at the base of turbidite beds 6-10 inches thick. These beds almost certainly amassed their full thickness in one rapid depositional event. The disturbance of sand at their base indicates that the organism that formed them passed through after the entire bed accumulated.

Curiously, Hillichnus and Scolicia (the large passage ways through muddy sediment) seem to be mutually exclusive, never both occurring in the same set of strata. This may reflect a preference on the part of the organisms responsible for the traces for specific types of sea bed material. Scolicia seems not to occur where sand layers are thicker than about 2 inches and Hillichnus seems only to occur if such beds exist.

For all its prevalence at Point Lobos, Hillichnus is globally a very rare trace fossil. It has been reported from rocks of similar or slightly older ages at a few places along the central and northern California coast, including Point Reyes. A similar trace fossil, was described in a lower Cretaceous shallow marine sandstone in Argentina (Pazos and Fernandez, 2010). Although strikingly similar in one photograph, the Argentine example differs in a number of ways from the traces at Point Lobos, and it may represent the feeding trace of a totally different organism.

Summary

Trace fossils are a prominent feature in most of the finer sandstone and mudstone of the Carmelo Formation. They generally are absent in mudstone or fine-grained sandstone interbeds within a conglomeratic succession. The traces record a prolific fauna living on and beneath the floor of the ancient submarine canyon. For the most part, we have little idea of the identity, or even the nature, of the organisms that made the traces.

References

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