

# RUDISTS LIVING ON THE MAIELLA DELTA DRIFT

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## KEY POINTS

- 3D GPR stratal slicing leads to the discovery of previously overlooked solitary rudist fossils in living position in the distal portion of the Maiella Delta Drift.
- Upper Cretaceous rudists are elongate filter feeders that thrive in deep water mobile sediments.
- Rudists may be “index” fossils for Maiella Delta drift and produce part of the sediment in the drift.

## PROJECT RATIONALE

Carbonate delta drift deposits of the upper Cretaceous Orfento Formation in the Maiella mountains (Italy) mainly consist of bioclastic debris shed from the shallow water carbonate platform and redeposited by an ocean current that passes through a narrow channel into the adjacent basin. The channel constriction produces a high energy flow environment that transports the sediment well below the photic zone. Changing current patterns and velocity partly cannibalize the underlying deposits, producing large, reworked clasts. As a consequence of such a dynamic and dark environment the in-situ benthic fossil content is sparse. In the outcrops of the Madonna della Mazza quarry no age diagnostic fossils had been observed yet. Stratal slicing of a full-resolution 3D GPR data set acquired

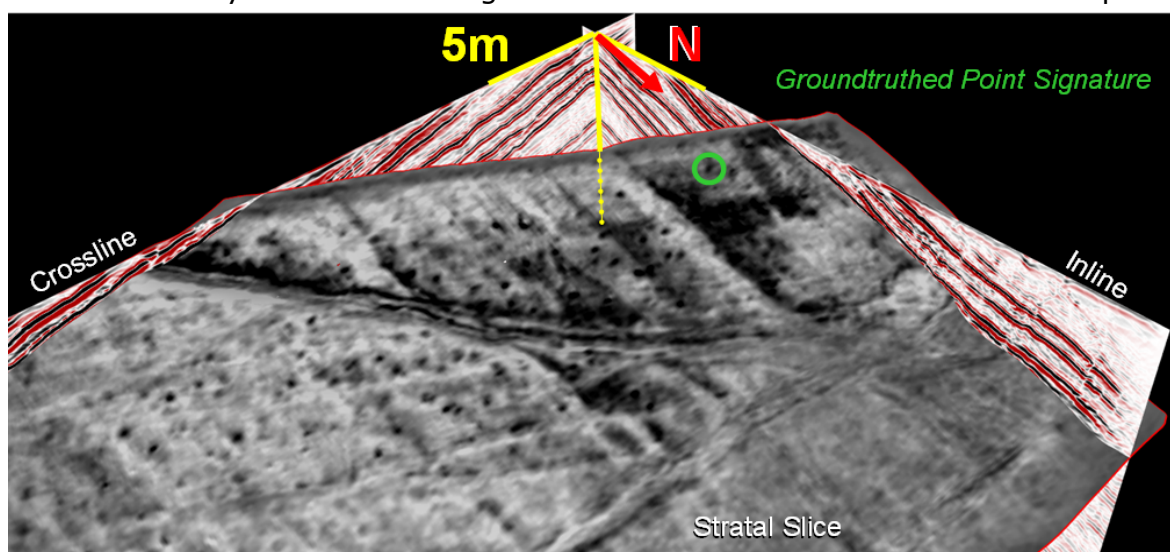


*Figure 1: Stratal slice through an interval in the Madonna dell Mazza quarry in the distal portion of the Maiella Delta Drift. Over 200 small dots are visible over an area of 400m<sup>2</sup>. Their origin has been resolved by excavation on the quarry floor.*

on the quarry floor revealed the internal sedimentary structures of prograding beds, channels and lithoclast beds. Stratal slices of one stratigraphic interval contain more than 200 dots over an area of 400 m<sup>2</sup>. The dot signatures consist

of small depressions with diameters of around 0.5 m and subtle vertical displacements over a depth range of 0.5-1 m (Fig. 1). In accordance with the dynamic depositional environment, we initially interpreted these unusual sedimentary structures either as water-escape structures (Grasmueck et al., 2021) or fish burrows (Grasmueck et al., 2024). However, none of these features were exposed in the outcrop.

## **METHOD AND RESULTS**

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For ground-truth, we excavated an 0.5x1.0m area centered on one of the shallowest GPR dot signatures to a depth of 0.5m. We found a well preserved rudist fossil of about 10 cm length embedded at the interface between two homogenous bioclastic grainstone beds. (Fig. 2).



*Figure 2: Left: The excavated hole on the quarry floor to one of the shallowest of dots imaged on a GPR stratal slice revealed that the dot signature was produced by a rudist of about 10 cm length (right).*

After this unexpected discovery and knowing what to look for, we also found four elongate rudists in the exposed quarry walls which apparently never had been noticed before (Fig. 3). All five rudists are confined to the same stratigraphic interval and four are in vertical living position. This also confirms the result of the 3D GPR dataset where all 200 dot signatures appear in the same stratigraphic layer, with just a handful similar signatures in the layers above and below.

## **SIGNIFICANCE**

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Commonly rudists are assumed: 1) to be shallow water reef builders during the Cretaceous and 2) rudist bivalves competitively displaced corals from reef frameworks. Gili et al. (1995) dispute the assertion that rudist commonly developed as reefs, and also reject the hypothesis of competitive displacement. They state that most rudists did not have any symbiotic algae and therefore did not rely on light. Being typical bivalves, they were pure filter feeders. Rudists also thrived in mobile sediment environments with nutrient-rich water. Especially the elongate types of the upper Cretaceous which had to keep growing upwards in order not to get buried can be solitary.

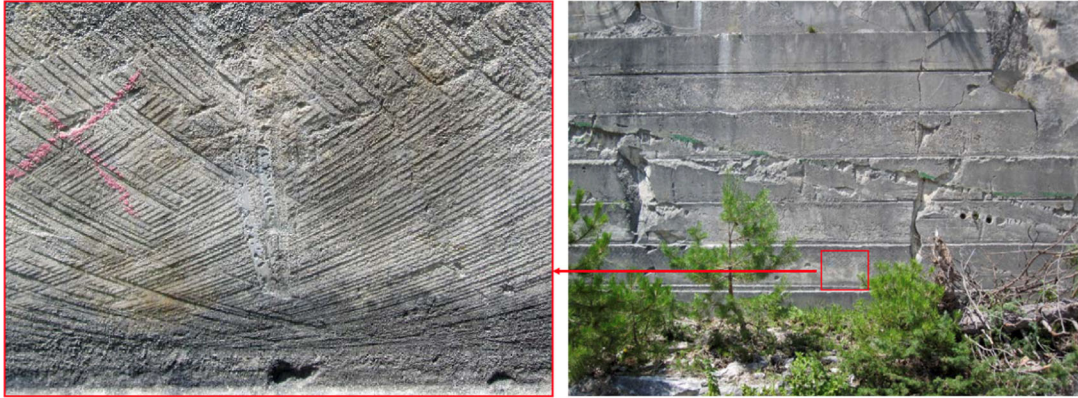


*Figure 3: Left: A rudist of about 20 cm height in living position exposed in the quarry wall. A total of 5 rudists were found in the same interval where the GPR stratal slice dots occur in the subsurface. Saw blade marks and weathering make them hard to detect.*

Therefore, late Cretaceous rudists must have found a niche to thrive in the dynamic depositional environment of the Maiella Delta Drift. Rudist in living position have been reported from other parts of the Orfento Formation, which is encompassing the Maiella Delta Drift (Narbon, pers. commun.). Thus, conditions for rudist growth might have occurred at several places on the drift, likely at

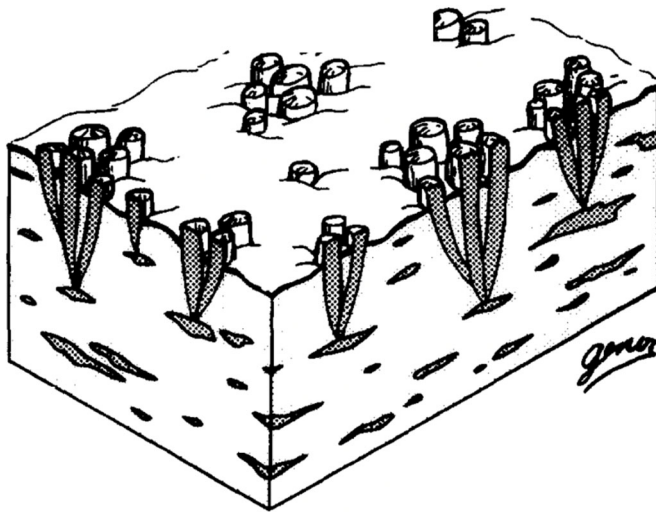


*Figure 4: Cartoon of growth fabric of constratal fabric where congregation of organisms is embedded in sediment. In this case the rudist elevators. (after Gili et al., 1995). This growth fabric is envisioned to have existed in the grainstone facies of the Maiella Delta Drift, making the rudist part of drift ecology.*

different times as currents shifted across the grainstone wedge. Gili et al. (1995) illustrate the living environments of elevator rudists. Such a scenario exists on the delta drift but shifting currents have moved the ideal environment around. In any case, rudists would be colonizing the drift and produce the part of the rudist debris that is so abundant within the delta drift. The next steps involve the determination of the species and investigate other outcrops of the Orfento formation outside of the Madonna della Mazza Quarry for their rudist content.

## REFERENCES

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