

3D-GPR STRATAL SLICING OF SEDIMENTARY STRUCTURES IN A CARBONATE CONTOURITE DEPOSIT - THE NEXT STEPS

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PROJECT OBJECTIVES

- Extract 3D sedimentary structures imaged in the 3D-GPR cube to refine the depositional model in the distal portion of the coarse-grained delta drift in the Maiella mountains.
- Refine the Geomodel used for stratal slicing by using a denser fault network and noise reduction in improved 3D-GPR migration.
- Ground-truth the Geomodel with drilling of short cores and outcrop.

PROJECT RATIONALE

The Madonna della Mazza quarry near Pretoro (Italy) is cut into the distal portion of the Upper Cretaceous Orfento Formation, which has been identified as coarse-grained delta drift (Eberli et al., 2019). In the proximal portion of the delta drift, outcrops expose successions containing sedimentary structures that are characteristic for three main depositional processes 1) high density turbidity current deposits, 2) transitions from subcritical to supercritical turbidity currents, and 3) hyperpycnal flows. In the distal portion, the outcrops are more uniform and in thick, massive grainstone beds but reworked clasts give evidence of erosive traction currents (Fig. 1). 3D-GPR data, however, reveal a more diverse spectrum of sedimentary structures that include migrating carbonate sand waves, small-scale mass transport complexes and fluid escape structures (Grasmueck and Eberli, 2021). These diverse structures indicate the evolution of the depositional processes from the proximal to the distal

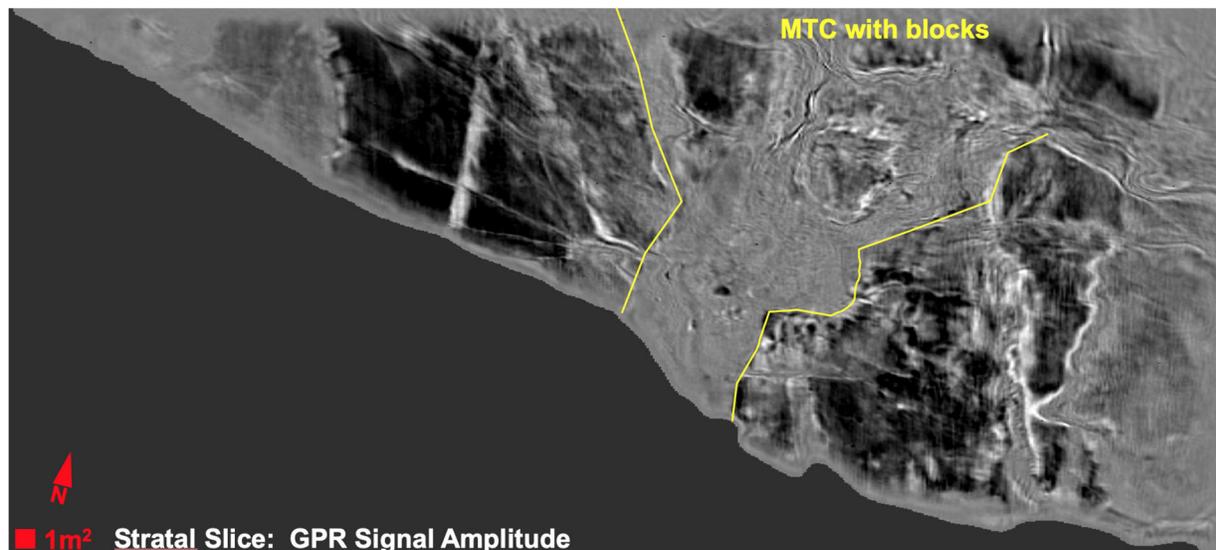


Figure 1: Stratal slice within the GPR cube of the Madonna della Mazza quarry displaying a small-scale mass transport complex with blocks floating in a grey grainstone matrix (modified from Grasmueck and Eberli, 2021).

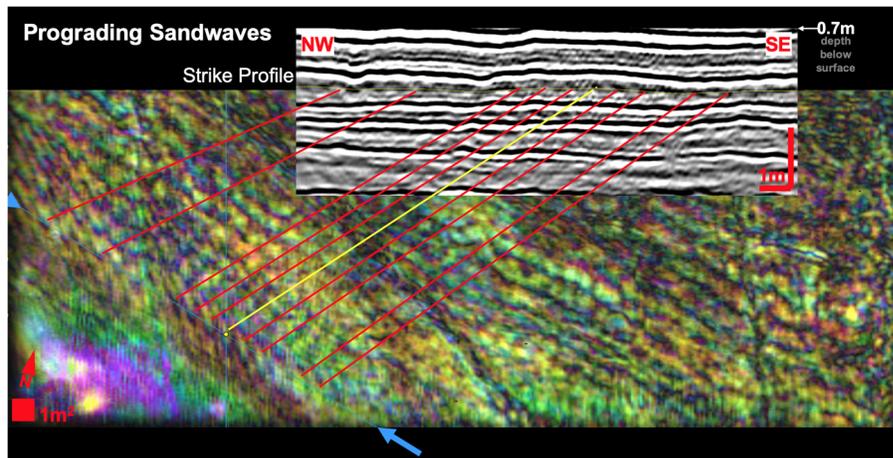


Figure 2: Stratal slice within the GPR cube of the Madonna della Mazza quarry in which spectral decomposition reveals the prograding sandwaves in the distal portion of the delta drift (modified from Grasmueck and Eberli, 2021).

portion of the carbonate contourite drift. Visualizing the sedimentary structures is paramount in deciphering these processes and their products.

APPROACH FOR VISUALIZATION AND INTERPRETATION OF SEDIMENTARY STRUCTURES

To visualize the strata, we use the 200 MHz 3D-GPR data that were acquired with a grid spacing of 0.1 m × 0.05 m over an area of 64.7 m × 27 m. Following data processing that included a 3D migration with a constant velocity of 0.09 m/ns, we constructed a Geomodel using Paleoscan, which resolves the individual horizons of the quarry succession (Grasmueck et al., 2021). The horizons can be populated with the original GPR signal amplitudes or any data derived attribute. So far, we have tested blended spectral decomposition attributes known from seismic imaging to enhance the visibility of subtle channels (Partyka et al., 1999) (Fig. 2).

The following steps are planned to further improve the visualization. 1) Do another migration of the data with noise reduction. And 2) refine the Geomodel with a denser fault network. In addition, we plan to incorporate other GPR volumes from the quarry. To improve the interpretation of the observed features in the GPR data we will revisit the outcrop and drill short cores into areas that are interesting on the GPR data. Other quarries and outcrops in the area will be visited for outcrop analogs.

SIGNIFICANCE

This study visualizes, for the first time, sedimentary structures in the rock record in three dimensions. This third dimension offers a better quantification of the sedimentary product from the flow processes in this carbonate contourite drift.

REFERENCES

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