ASSESSING LITHOCLAST DISTRIBUTION IN GRAINSTONE DRIFT DEPOSITS

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PROJECT OBJECTIVES

- Re-process and analyze all Madonna della Mazza 3D GPR cubes data with Pondview.
- Assess lithoclasts, their textures and distribution inside the different grainstone units based on outcrop and GPR data.
- Relate clast distribution to flow processes for a refined model for their formation within drift deposits

PROJECT RATIONALE

One of the sedimentologic characteristics of the Maiella carbonate drift delta is the continuous reworking of the bioclastic strata. Lithoclasts from reworking or "cannibalization" are subsequently transported and deposited as intraclasts in grainstone beds (Fig. 1). In outcrop these lithoclasts are reminiscent of rip up clasts in hyperconcentrated flows or sandy debrites. Yet, the arrangement in the bed and the lateral arrangement do not fit precisely to the facies that is generally related to these sedimentary processes. Assuming that bottom currents are responsible for these reworking and transportation, the observed lithoclasts laden grainstone beds could be the product of a sort of hyperpycnal hyperconcentrated flow. In the Madonna della Mazza quarry that is situated in the distal portion of the delta drift, such beds are exposed and imaged with 3D Ground Penetrating Radar, which offers a unique opportunity to examine the clast arrangement in three dimensions and potentially interpret the flow conditions of these beds and the distribution of sediment in delta drifts in general.

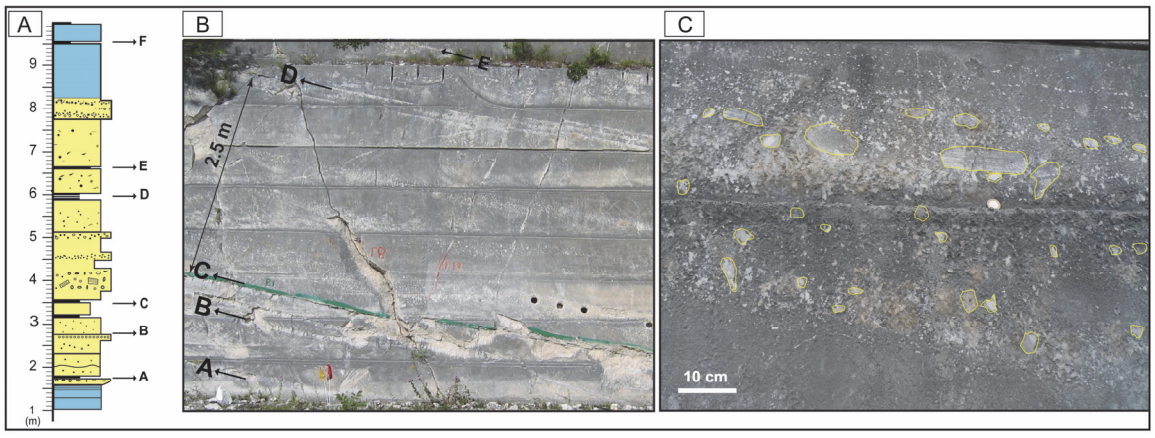

Figure 1: A) Lithologic section at the Madonna della Mazza quarry. Yellow portions are grainstone beds with lithoclasts; blue are massive grainstone beds. B) Photograph of the quarry wall with streaks of lithoclasts (white dots) between horizon A and D. C) Close-up of a lithoclasts (outlined with yellow lines) within the grainstone bed. Note that the base of the bed displays no erosional downcut.

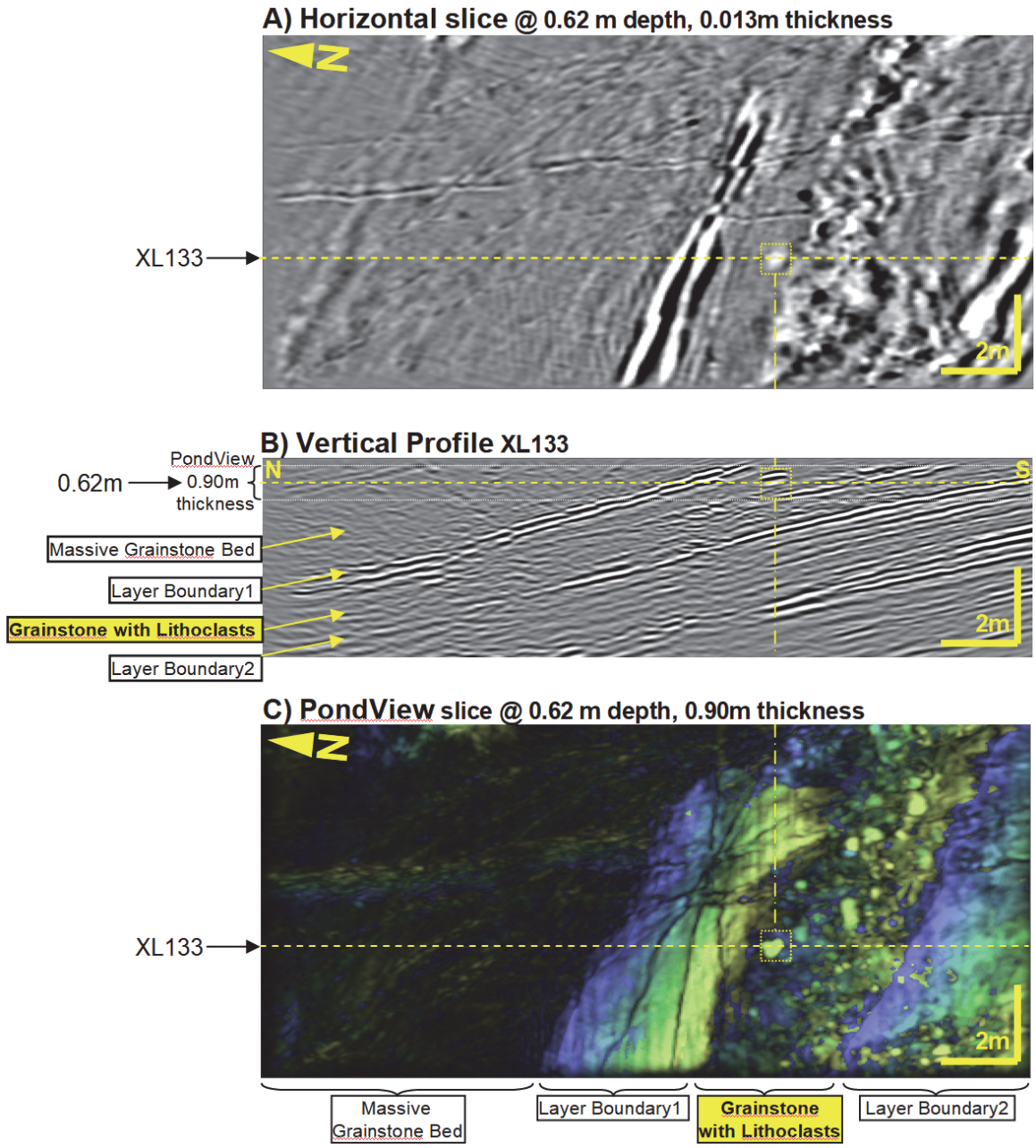

Figure 2: A) Single sample thin horizontal 3D GPR slice extracted at a depth of 0.62 m below the floor of the Madonna della Mazza quarry. Yellow square marks the response of a prominent lithoclast B) Vertical Profile XL133 crossing the marked lithoclast. The lithoclast is located in a North dipping grainstone layer. The profile is plotted without vertical exaggeration. C) PondView covering the same area as shown in A) but incorporating data over a 0.9m thick interval centered at 0.62 m depth. The lithoclast distribution is now clearly visible. Yellow shades are located shallower than green and blue shades. Colors are similar to objects submerged in a clear pond illuminated by the sun from above. The NE dipping layer interfaces contain fracture patterns. The massive grainstone in the northern half or the area only shows low amplitude curved signatures of deformation bands and contains no lithoclasts.

APPROACH

Most 3D Seismic and GPR data interpretation focuses on interfaces separating beds. To assess the lithoclast distribution in grainstones, the layer content between the bounding interfaces have to be visualized and interpreted. Preliminary tests on a 400 m2 3D GPR survey acquired in the center of the Madonna della Mazza quarry, show how thin horizontal slices and vertical profiles (Fig. 2A and 2B) do not give an interpretable view of the lithoclast distribution. However, our recently developed PondView application (Grasmueck and Viggiano, 2018) gives a clear map view of the lithoclasts inside the grainstone bed (Fig. 2C). The yellow-green-blue color coding shows the relative depth and vertical distribution of lithoclasts within the imaged slice thickness. At the same time Pondview also precisely shows fracture discontinuities and dipping bed interfaces.

SCOPE OF WORK

The next steps to further investigate the lithoclast distribution in the grainstone drift deposits of the Madonna della Mazza quarry are:

- Use horizon flattening to remove dip and to visualize lithoclast distribution of entire grainstone beds.
- Process and visualize the Madonna della Mazza 3D GPR data collection covering 2300 m2 quarry floor.
- Compare Pondview results with other geobody visualization approaches available in commercial 3D interpretation software.
- Integrate lithoclast distribution results obtained from 3D GPR data with Outcrop observations and refine the flow process model for drift deposits containing lithoclasts.

SIGNIFICANCE AND EXPECTED RESULTS

The sedimentary processes and the related genetic facies or difficult to interpret in the drift delta as the flow mechanisms are poorly understood. These beds are likely the result of a complicated transformation from bedload to suspended flow and/or supercritical flow. Because this study will produce a 3D clast distribution within a bed it potentially helps decipher the flow processes in such beds.

REFERENCES

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