Sedimentary structures and textures in sand injectites. Insights from dikes and sand blows of the Holocene fluvial sediments (Emilia, Italy)

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As discussed by Hurst et al. (2011), studies of sand injectites, including sand extrusions, are relatively scarce in the geological literature, although these phenomena were recognized in many geological settings (Quigley et al., 2013: Ross et al., 2014). A trench dug across dikes and sand blows formed as a consequence of the 2012 Emilia earthquake allowed a direct observation of liquefaction structures (Fontana et al., 2015, 2019). Sand dikes crosscut the fine-grained host sequence at high angles with a vertical extension of at least 5 m. The width of the fractures varied from a few cm to 30 cm. The injected sand showed complex sedimentary structures: the most common was a distinct banding, longitudinal to the dike length, or perpendicular to the dike margins. The bands oriented parallel to the dike were bounded by sharp contacts marked by thin clay veneers defined by differences in grain size and grain alignment. We observed both direct and inverse vertical grading from medium sand to mud. The fractures were rhythmically injected and filled of slurry sand and mud during the compression pulses end emptied by the rushing of the slurry back down deep into the fractures during the extension peak. The grain-size distribution along dikes and sand blows showed that some sorting occurred within injected dikes, probably due to pulse flows, and further segregation occurred as the material was extruded following the generated excess pore-water pressure. This may have caused the dispersion of the fine silt–clay content, producing highly sorted sand boils. The composition of sand dykes adds an important constraint in identifying the source layer. Regarding the possibility that selective mechanism due to flux variation may have influenced the sand composition, our data seem to indicate that no major variation was induced by injection phenomena.

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