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3D-Microfabric reconstruction of Neoproterozoic diamictites from the Valjean Hills, California (USA)

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Neoproterozoic rocks from the Kingston Peak Formation (KPF) in the Valjean Hills (USA) expose a succession of diamictites associated with major glacial events taking place during the Cryogenian, approximately 700 million years ago. Within any glacial period, diamictites are widespread and in addition, their mechanics of deposition are highly variable. Some are massive in appearance at outcrop or in hand specimen, and apparently lacking any information that allows their mode of emplacement to be elucidated. Yet the correct interpretation for deep time successions in this area is especially important, since it is debated whether the diamictites have a tectonically driven, gravitational (Mrofka & Kennedy, 2011) or direct (sub)glacial origin (Le Heron et al. 2016).

In this contribution we determine the origin of the diamictites based on its internal microfabric and associated microstructures. We base our method on the technique of Philips et al. (2011) for Quaternary sediments, by mapping the apparent longest axes of skeleton grains (ranging from fine-grained sand to fine-grained pebbles) in oriented thin sections and reconstructing their fabric in a 3D space, we could identify a bimodal signal in the orientation of the longest axes. Contrary to gravitational deposition, clasts in subglacial diamictites tend to align themselves to a stress field, induced by the movement of the glacier. Macroscopic observations (**Fig. 1A**), microtexture- and structures (**Fig. 1B**) as well as the reconstructed microfabric domains (**Fig. 1C**) suggests a subglacial origin. These circumstances suggest temperate glacial conditions with wet based ice sheets during the deposition of the KPF. Moreover, the quantitative data allow confident flow directions to be extracted from seemingly chaotic diamictites.

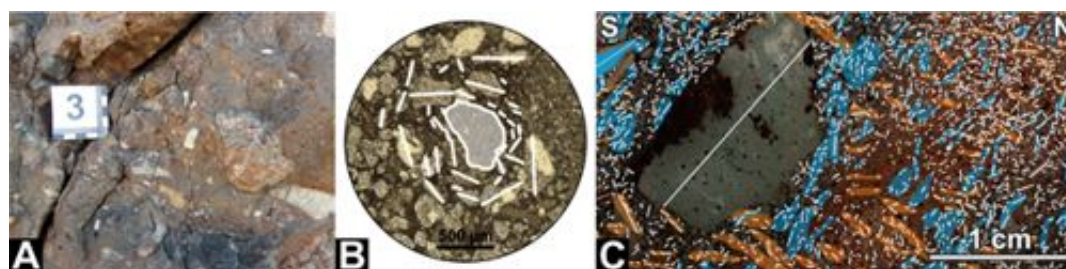


Figure 1: (A) Valjean Hills Diamictite (label is 5x5 cm), (B) Rotational structure around bigger skeleton grain, (C) traced long axes of clasts (white lines) and interpreted microfabric domains (blue, orange)

References:

Le Heron, D.P., Tofaif, S., Vandyk, T. & Ali, D.O. (2017): <https://doi.org/10.1130/G38460.1>

Mrofka, D., Kennedy, M., (2011): <https://doi.org/10.1144/M36.40>

Phillips, E. et al., (2011): <https://doi.org/10.1016/j.quascirev.2011.04.024>