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Anatomy of an Exhumed Debrite and Impact on Stratal Architecture

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Submarine debrites generate complicated patterns of seabed relief which influence subsequent flow behaviour and depositional patterns. However, recognizing this interaction in subsurface data is challenging in seismic and well data. To bridge this resolution gap, large-scale outcrop analogues can be used. The early post-rift Middle Jurassic succession of the Los Molles Formation is well-exposed along a 10 km long and downdip-orientated W-E outcrop belt located the western Central Neuquén Basin, Argentina. We document the sedimentology and architecture of a 50 m thick and 10 km long mud-rich debrite with a correlation panel including 27 sedimentary logs constrained with marker beds. Our study documents the clast content (size, shape, lithology), the geometry of the basal-shear zone and upper surface of the debrite, and the distribution and sedimentology of foundered sandstones overlying the debrite. The sandstone deposits are characterized by deformed basal contacts indicative of foundering into the debrite, which developed as a result of density instabilities and uneven loading between the denser sand over the unconsolidated and fluid-saturated muddy debrite. The foundered sandstones (0.5-4.5 m thick) are composed of two divisions: i) a basal division of thick-bedded, structureless argillaceous sandstone with abundant cobble-size mudstone clasts and ii) an upper-division of banded sandstone. The juxtaposition of these two facies suggests that turbidity currents flowing over the top of the debrite underwent a transformation to laminar and transitional flow behaviour. However, the post-depositional foundering of sands and their resultant geometry and spatial distribution should not be misinterpreted as the result of confinement induced by a static rugose upper surface. We present recognition criteria for interpreting syn-sedimentary foundering processes: 1) Thickness changes associated with growth strata; 2) progressive rotation of laminae or banding in sandstones; 3) Deformed mudstone clasts in the sandstones, derived from the underlying debrite and sandstone detached load structures within the underlying debrite. While none are diagnostic, the combination

of these features suggests foundering processes. These characteristics can be useful in the understanding post-depositional processes above debrites, and prediction of the reservoir and seal complexity in carbon capture and storage (CCS) projects, aquifers and hydrocarbon exploration.