Size Isn't Everything: Predicting Clastic Injectites at Stratigraphic Traps Using Appropriate Analogues

Sarah Cobain[1], David Hodgson[2], and Jeff Peakall[2]

[1]Petrotechnical Data Systems Ltd, London, United Kingdom.
[2]School of Earth and Environment, University of Leeds, Leeds, United Kingdom.

ABSTRACT

Being able to accurately predict injectite location and geometry is important as they are increasingly recognised as significant components of sedimentary basin-fills, but are not predictable using traditional facies models. However, their apparently unpredictable, and chaotic nature at subseismic-scale makes prediction difficult. Here, analysis of injectites in a well-constrained palaeogeographic and stratigraphic context not only highlights the predictive nature of where they occur in basin-floor stratigraphic traps, but also emphasises the use of appropriate analogues when modelling injectites in the subsurface. Specifically, parent sand architecture and palaeogeographic setting have a huge control on the style of injectites produced. We examine the relationship between abrupt stratigraphic pinchouts in basin-floor lobe complexes, and the presence, controls, and character of injectite architecture. Injectites in this palaeogeographic setting occur where there is: (i) sealing mudstone both above and below the parent sand to create initial overpressure; (ii) an abrupt pinchout of a basin-floor lobe complex through steep confinement to promote compaction drive; (iii) clean, proximal sand beds aiding fluidisation; and (iv) a sharp contact between parent sand and host lithology generating a source point for hydraulic fracture and resultant injection of sand. In all outcrop cases, dykes are orientated perpendicular to palaeoslope, and the injected sand propagated laterally beneath the parent sand, paralleling the base to extend beyond its pinchout. Understanding the mechanisms that determine and drive injection is important in improving the prediction of the location and character of clastic injectites in the subsurface. Here, we demonstrate the close association of basin-floor stratigraphic traps and sub-seismic clastic injectites, and present a model to explain the presence and morphology of injectites in these locations. This should be considered when selecting outcrop analogues to model in the subsurface, and not selecting an analogue because it is seismic-scale. Thus, injectites can be predictive and used during reservoir modelling of fields.