Geophysical Research Abstracts
Vol. 20, EGU2018-933, 2018
EGU General Assembly 2018

Common mistakes in recognizing and working with ancient shelf margin clinoforms

Cornel Olariu and Ronald Steel
Department of Geological Sciences, The University of Texas at Austin, USA

It is well known in the sedimentology-stratigraphy community that sediments tend to fill deepwater basins by sand and mud dispersal across clinoformal geometries resulting in gently dipping topsets, steeper foreset and gently dipping bottomsets. Despite descriptions of "ramp" margins without any shelf-slope break, these cases are short lived, out of equilibrium and transient as siliciclastic basin margins in comparison with clinoformal geometries. However, the entire geometry of these ubiquitous clinoforms are not always recognized in all margins or are erroneously interpreted as "layer cake" stratigraphy or "ramps" because of limited data that do not "image" the clinoforms. Here we show some of the common pitfalls in recognizing ancient shelf-slope clinoforms.
Worldwide morphological analysis of modern and recent shelf-slope clinoforms along the margins of oceans or deep lakes indicate subaqueous topset gradient with a fraction of a degree that is increasing at the shelf edge to typically 2-4 degrees onto the slope and flattens at the base of slope to less than a degree on the basin floor. Deepwater plate-margin basins tend to form "complex" shelf-slope clinoforms that in addition to "simple" morphologies described above will have: (1) multiple long-lived shelf-edge growth faults that modify the shelf-edge; (2) salt or mud diapirs on the slope that form "mini basins"; (3) toe of slope thrust structures; (4) common large (1000m), shelf-incising and long lived submarine canyons.
For the ancient "simple" clinoforms lacking seismic data to image their geometries, there is a common mistake in thinking that the lithostratigraphic units forming the sandy topset or shelf deposits, the muddyslope deposits and the sandier basin floor deposits are also chronostratigraphic units. Examples from upper Cretaceous Washakie Basin in Wyoming, Miocene Dacian Basin in Romania, Jurassic Neuquen Basin in Argentina show that despite generations of research on the depositional environments that point to linked depositional environments in a clinoformal geometry, the sheetlike geometry of the lithostratigraphic intervals have all too commonly be thought of as chronostratigraphic units.
Another common mistake has been to interpret clinoform topsets as only marine shelf or only fluvial deposits. Such mistake is commonly made during interpretation of subsurface (seismic) data when clinoforms are recognized, but without additional information on facies or depositional environments. The interpretation is erroneous because the mechanism that underlies the progressive outbuilding of clinoform geometry is the repetition of shoreline regression and transgression. This mechanism generates an alternation of non-marine (that commonly reaches the shelf edge) and shelf deposits. The latter are transgressive and they flood back tens to hundreds of kilometers landward from the shelf edge.
Additional themes that will be discussed are: 1) What are the necessary conditions for the development of large shelf-slope clinoforms, and what are the main controls that define its typical geometry? 2) Why is it strongly necessary to separate delta clinoforms, which have topset-foreset-bottomset morphologies, from shelf-slope margins?