

Distinguishing multi-decadal, quasi-periodic autogenic processes from external forcings in deltaic stratigraphy

Pavano, F.,^a Pazzaglia, F.J.,^a Bliss, B.R.,^a Rittenour, T.M.,^b Tanski, N.,^b Roberge, L.,^c Gasparini, N.M.,^c and Lyons, N.J.^c

^a *Earth and Environmental Sciences, Lehigh University, Bethlehem, PA (USA)*

^b *Department of Earth and Environmental Sciences, Tulane University, New Orleans, LA (USA)*

^c *Department of Geology, Utah State University, Logan, UT (USA)*

Periodic external environmental forcings, typically operating at Milankovitch frequencies, are known to be encoded in sediments and sedimentary rocks, but sub-Milankovitch frequencies are more difficult to recognize, in part because of temporal overlap with autogenic processes. Here we use luminescence geochronology and rock-magnetic and lithostratigraphic-based cyclostratigraphy to investigate sub-Milankovitch periodicity in three high sedimentation rate deltas located in diverse tectonic and climatic settings. The Sciota kame delta in tectonically stable eastern Pennsylvania (USA) was deposited at a rate of ~2.5 cm/yr over ~1 kyrs and has a concentration of magnetic spectral power at ~53 cm, corresponding to a ~22 yr period. Lacking a subaerial fluvial catchment, periodicity in this delta is necessarily restricted to depositional processes or ice-wasting discharge fluctuations. Similarly, the Provo-stage Lake Bonneville High Creek delta (Utah, USA) was deposited at a rate of ~3 cm/yr over ~3 kyrs. It displays meter-scale coarsening-up bedsets interpreted as decadal-scale discharge variations during foreset propagation. Unlike the Sciota kame, the High Creek delta is fed by a subaerial catchment with little storage that supported a small cirque glacier during the LGM. The High Creek delta also aggraded in the subsiding hanging wall of the East Cache Valley fault and experienced at least one syn-depositional earthquake. Lastly, The Pagliara delta (northeast Sicily, Italy) was deposited at a rate of ~3 cm/yr in the rapidly uplifting footwall of a coastal seismogenic normal fault. This delta has a concentration of magnetic susceptibility spectral power at ~60 cm corresponding to a ~20 yr period. A multi-decadal periodicity emerges in all three deltas, despite the variable catchment, climate, and tectonic setting. We interpret this as representing a quasi-periodic, autogenic depositional process possibly related to distributary channel switching. However, differences in the rock-magnetic power spectra and lithostratigraphy of the Pagliara and High Creek deltas respectfully, indicates that sub-Milankovitch external forcings in the catchments, including tectonics, are also encoded in the delta stratigraphy.