

## **Quicker than Most: Autogenic vs. Allogenic Controls on Ultra-High Resolution, Centennial-Scale Sequences in Arctic Norway**

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Most sedimentary sequences are cyclic, resulting from alternating controls on sedimentation. In ancient sequences, the understanding of controls on cyclicity and whether these controls are intrinsic or extrinsic to the sedimentary system is mostly relative while the opposite is the case for most modern examples.

One remarkable modern example occurs in Sandfjorden along the Barents Sea coast of northernmost Norway and is a post-glacial succession dominated by very high-resolution forced regressive sequences. Since deglaciation, approximately 15000 years BP, uplift caused by post-glacial rebound has occurred. Despite uplift decay, it has outpaced global sea-level rise, providing a template for forced regression. The forced regressive record has been interrupted by two other controls: (i) climatically-controlled storms and an unevenly rising global sea level. In addition, sediment supply by two different sources has contributed to shaping the remarkable stratigraphic architecture. Finally, the valley base and depositional foundation formed by glacial processes prior to the cyclic sediments described here provide another limitation on accommodation in addition to the overall rate of sea-level fall.

The control mechanisms has created a stratigraphic architecture including one partial 6th order sequence, three and a half 7th order sequences, twenty-four 8th order sequences and fifty-five 9th order sequences, the latter around 100-200 years in duration. Each sequence, irrespective of order, is defined on the basis of standard seismic stratigraphic principles from a unique GPR (ground-penetrating radar) data set and surface geomorphology. While the cyclicity and sequences themselves have been formed by storm-punctuated sedimentation superimposed on an overall falling sea-level trend caused by uplift (i.e. allogenic controls), the nature of each individual sequence varies caused by autogenic mechanisms such as shifting sediment supply.

This example tests limits in terms of cycle resolution, impact of autogenic and allogenic controls and ability to upscale and transfer learnings to the ancient. It addresses the applicability of uniformitarianism in examples where complexity is large and controls on sedimentation many. Despite being a possible end-member, the Sandfjorden Basin leaves the geologist with a humble feeling that our ability to decipher autogenic vs. allogenic controls in ancient settings is not so great.