

UC SANTA BARBARA
Department of Earth Science

Speakers Club

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Low gradient, single-threaded rivers prior to greening of the continents

Vamsi Ganti

**Department of Geography
UC Santa Barbara**

The origin of low-gradient meandering rivers — the primary conduits of water, carbon and nutrients in present-day terrestrial landscapes — is considered coeval with Silurian-age plant evolution. It is hypothesized that pre-Silurian rivers lacked bank strength and were dominantly steep and braided, implying vastly different transport capacities of water and sediment. This hypothesis, however, is inconsistent with the super-continental-scale drainage of Neoproterozoic rivers, which requires unrealistically high mountains to achieve the necessary river gradients. In this talk, I will provide geologic evidence that pre-Silurian rivers were low gradient, deep, and single-threaded, similar to modern meandering rivers. These results are built upon on a well-developed quantitative framework of river bar and dune formation, global compilation of geometries of Proterozoic fluvial deposits, and original field measurements of the scale, texture and structure of fluvial deposits in Proterozoic-age Torridonian Group, Scotland—a type-example of pancontinental, pre-vegetation fluvial systems. These results point to the abundance of low-sloping, single-threaded rivers in the Proterozoic eon, at a time well prior to the evolution and radiation of land plants, and demonstrate uniformity of fluvial morphology despite a global revolution in Earth's terrestrial biota, with ramifications for the topographic signature of life on Earth and other planets.