

## Giant sediment-wave field and supercritical-flow bedforms in a Lower Mississippian carbonate ramp, Tenn-Ky, USA

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### Summary

The Fort Payne Formation (Lower Mississippian) is a crinoidal carbonate, calcareous shale, and chert succession, which was deposited in a distally steepened ramp to shallow basin-floor across the southern margin of Laurussia. This study proposes that a giant sediment-wave field is present in clinothem foresets and bottomsets across an area of ~20,000 km<sup>2</sup> in Tennessee and south-central Kentucky. Although sediment waves are common in modern slopes and basin-floors, few ancient analogs have been recognized, especially in carbonates. Recognition of “seismic-scale” sediment waves in well-known Mississippian outcrops of the southern Appalachian province represents a new and important step towards revising standard, and perhaps outdated, concepts about carbonate-ramp systems in terms of sediment transport and depositional processes.

### Methods

This investigation is based on (1) interpretation of roadcuts and continuous cliff exposures along waterways using UAV photogrammetry, (2) graphic logging of measured sections, and (3) subsurface well-log (GR) correlation and mapping in Kentucky and Tennessee.. Unlike most outcrop-based studies, much of the study area has been drilled extensively for hydrocarbons. Thus, several hundred gamma-ray (GR) well-logs from exploration and production wells were used to construct regional stratigraphic cross sections for correlating genetic stratigraphic units and mapping the thicknesses of the Fort Payne Formation.

### Results

Clinothem-foreset sediment-waves (Fig. 1) are slightly asymmetric downslope and their dimensions are ~20 m high and 100-500 m wave long. There is little or no indication of confinement. They are composed of foreset beds of shaley, crinoidal floatstones and backset beds of crinoidal rudstone. Bottomset sediment-waves are transverse to paleoflow, unconfined, symmetrical and downflow asymmetric with wave-lengths 100-700 m and heights 15-50 m. They

