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Seismic geometries in cool-water carbonates, Browse Basin, NW Australia

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Submarine canyons are widely distributed on modern carbonate platform slopes, but relatively little is known about their occurrence on ancient slope systems. Conventional 2D grids often lead to a spatial aliasing whenever the size of submarine gullies and canyons is less than the spacing of the grid. Most studies of modern submarine canyon systems therefore rely on multi-beam bathymetric and sidescan sonar data combined with 2D seismic profiling. This means that although the surface morphology is often very well resolved, the sub-seabed stratal geometries are less clear, preventing a rigorous stratigraphic analysis of canyon evolution through time. In contrast, high-resolution 3D seismic data constitute stacked examples of paleo-seafloors, which are ultimately comparable in resolution to those achieved by multi-beam bathymetry of the present seafloor. Seismic data from the western part of the Browse Basin, North West Shelf, Australia, reveal the internal geometry and depositional history of a progradational Eocene-Oligocene cool-water carbonate shelf. The prograding slope system is superbly imaged by two adjacent, three-dimensional multichannel seismic volumes embedded in a two-dimensional multichannel seismic grid. Based on this data, the three-dimensional stratal architecture of prograding clinoforms can be mapped throughout an area of $\sim$ 1000 km^2. The prograding clinoforms of the Eocene-Oligocene succession progressively develop highly dissected, gullied foresets. Numerous submarine channels on the slope define a line-sourced system which develops a sedimentary apron along the carbonate ramp. The relatively high sinuosity of some of the channels is not known from submarine channels from tropical carbonate platforms but rather resembles siliciclastic systems. On the other hand, the relative

scarcity of well developed levee systems might be attributed to the reduced mud content in cool-water carbonates compared to siliciclastic systems. The spatial control provided by the 3-D seismic volume supports a detailed analysis of the relationship between the overall morphology of carbonate systems and the erosion mechanisms on their foresets. This will contribute to a better understanding of cool-water calciclastic submarine slope systems.