

Pleistocene-Holocene Karsification of Barbados and its Implications for the Devonian Grosmont Reservoir

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Abstract

About 80% of the surface of Barbados is made up of Quaternary carbonates with ages approximately 800,000 years to recent. These carbonates are extensively overprinted by epigene (top-down) karst processes. Epigene karst features include various types of caves, solution valleys, and sinkholes. Flank margin caves are the most common cave type. Sinkhole density is high, with an average of 5 sinkholes per square km. However, some areas have a much higher density while others are almost devoid of sinkholes. Sinkholes range in diameter from about 10m to 120m and are up to about 15m deep. Another striking morphological karst feature is a network of valleys, locally referred to as gullies. Their origin is problematic and much debated. Most gullies have caves along at least a part of their paths, commonly decorated with flowstone or other speleothems.

A number of lessons learnt from the karst in Barbados can be applied to the Devonian Grosmont reservoir in Alberta, despite the vast differences in age and size. For example, numerous sinkholes identified in seismic images can be interpreted as epigene karst features that developed rapidly on one or several former land surfaces. Drainage patterns akin to the gullies of Barbados can be expected in the Grosmont as well, but not as deep or as densely spaced, and with different orientations. The Grosmont may contain a few stream caves and many more flank margin caves, while the latter should not be as frequent as in Barbados but may be considerably larger.

Integrating these aspects with the known geologic history of the Grosmont platform, it appears that the Grosmont platform was karstified in at least two major epigene episodes. The first episode was a 'warm epigene karstification' during the Jurassic – Cretaceous, for which Barbados provides a useful analog. The second episode was/is a 'cold epigene karstification' that started sometime in the Cenozoic and is continuing to this day. The present repertoire of karst features probably is a composite of these two epigene karstification episodes. In addition, circumstantial evidence suggests that epigene karst gives way to a deep hypogene (bottom-up) karst in the downdip part of the platform. The latter likely has different characteristics, i.e., most notably a maze system of passages rather than a stream system overlain by sinkholes. At present the hypogene karst system in the Grosmont is virtually unexplored.