

Forty Years of Exploration: Guy Plint and the Western Canada Sedimentary Basin

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Explorers are characterized by a variety of traits. They are naturally curious, independent, perseverant, understand geography, and they share their findings with others. Through his outcrop- subsurface-based work on Cretaceous deposits of the Western Canada Sedimentary Basin (WCSB), and the approximately 120 publications based on that work (including chapters of textbooks), Guy Plint has proven himself to be an explorer. He has persevered with his fundamental-science-focused analyses of the stratigraphy, sedimentology, and paleogeography of those rocks through four decades of changes in government funding and Industry priorities

Guy's first foray in the WCSB involved subsurface stratigraphic analyses of the Cardium with Roger Walker's McMaster group. At the time, Roger was interpreting the linear Caroline, Garrington, and other Cardium trends as having been deposited by turbidity currents. Prior to joining the McMaster group, Guy had defined links between sea-level change and sedimentation in Eocene deposits of England's Hampshire Basin. Making the connection between the Eocene of England and the Cretaceous of the WCSB, he recognized the linear Cardium trends could represent lowstand shorefaces, with other aspects of Cardium stratigraphy testifying to a eustatic driver. The turbidite model silently vanished. The door to sequence stratigraphy had been opened in Calgary. An increasing number of CSPG papers and presentations subsequently discussed possible links between sea-level change and sedimentation/stratigraphic architecture. CSPG Bulletin archives show eight papers (by various authors) referencing eustasy or eustacy (alternate spellings) prior to 1990. Thirty-three papers used one of those words in the next decade.

Guy's analyses of the Cardium led him to recognize (Plint, 1988) sharp-based shoreface sandstones as indicators of shoreline progradation being driven by a sea-level fall in. The concept of "forced regression" was not entirely new, and that idea was later co-opted by other authors. However, Guy's paper stands as another turning point in stratigraphic analyses. Since 1989, nearly 5,300 "stratigraphy" papers have used the expression "forced regression".

The stratigraphic framework established for the Cardium by Guy and coworkers generated controversy that usually centered on that framework's utility for guiding oil and gas development. This type of discussion is common at the interface between applied and fundamental science. Proponents of the traditional Cardium Zone- and Cardium-based terminology found, and still find, that framework useful for development purposes. The new stratigraphic framework recognized and emphasized the importance of surfaces (erosion and/or transgression surfaces) in stratigraphic analyses. It was based on allostratigraphy, a system for defining stratigraphic units based on bounding discontinuities such as erosion surfaces and flooding surfaces. The impact of fundamental science can be widespread and the use of allostratigraphy to understand depositional histories is no exception. A Google Scholar search found 14 references to allostratigraphy between 1900 and 1987, the year in which Guy and co-authors formally declared their E1/T1 – E7/T7 Cardium stratigraphic terminology to be based on allostratigraphy. A similar search shows the term allostratigraphy has been used 1600 times from 1988 to present.

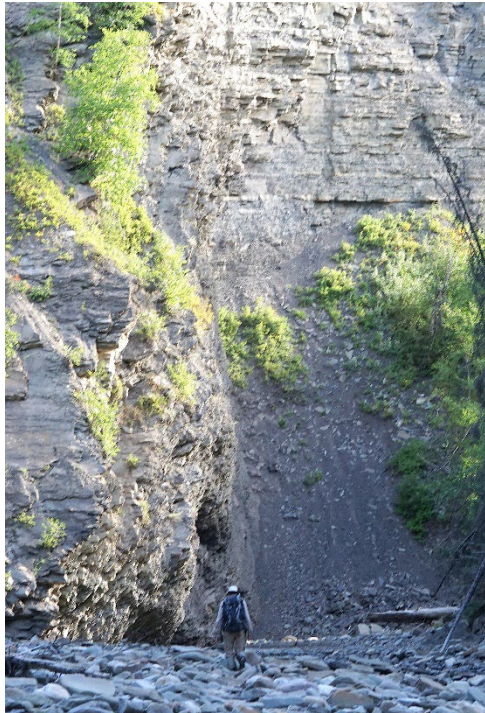


Figure 1. Helicopter-based exploration in the Rocky Mountain Foothills. Left: 1987. Right: 2021.

Guy's group of grad students (29) and post-docs (4) conducted outcrop- and subsurface-based analyses of the Cardium and other Albian to Santonian-aged units in the WCSB. Helicopter trips were often the only way to access key outcrops (Fig. 1). These studies include allostratigraphic analyses of the Viking, Peace River, Dunvegan, Bad Heart and Marshybank, and Puskwaskau (allo)formations. The group also studied mudstone-dominated units like the Joli Fou and Blackstone/Kaskapau. Collectively, this work has provided fundamental insights into the relationships between tectonism and sedimentation in foreland basins.

The workflow developed by Guy and collaborators for regional stratigraphic analyses is unique from a global perspective because the studies incorporate wireline logs and core from the many 10s of thousands of wells drilled through the Albian to Santonian section. Access to wireline logs was originally granted by Home Oil Company but is now through an academic license to Divestco Geoscience Ltd. The group has had access to many 100s of cores at AER's Core Research Center in Calgary and, to a more limited extent, BCER's Core Research Facility in Fort St. John. Nowhere else in the world is a database of this size available for academic research. Additionally, the subsurface work has been complemented by outcrop-based analyses. The amount of sedimentologic and stratigraphic information available from cores can be limited by their length, width, and preservation state. Outcrops expose much more of the stratigraphy (vertically and laterally), allowing much better stratigraphic and sedimentological characterization. Outcrops can expose shale-dominated units that are not cored. Around the margins of the WCSB, outcrops can sometimes be located within a few km of wells. As such, insights from the outcrops can be directly transferred into the subsurface.

Spin-off projects, driven by discoveries and natural curiosity, led to integration of Guy's stratigraphic work with vertebrate and invertebrate paleontology, diagenesis, and inter-basinal correlations of Late Cretaceous stratigraphy. Like any fundamental research, some of this work may have unexpected practical application at some future date and some may never be used outside of the academic world. Independent thinking, curiosity, and perseverance were and continue to be the drivers, leading Guy to continue his exploration of the Cretaceous section in the WCSB.



The Last Explorer. Maurice Creek, British Columbia, August 2021.

Selected Publications

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- Walaszczyk, I., Shank, J.A., Plint, A.G. and Cobban, W.A., 2014, Inter-regional correlation of disconformities in Upper Cretaceous strata, Western Interior Seaway: Biostratigraphic and sequence-stratigraphic evidence for eustatic change. *Geological Society of America, Bulletin*, 126, 307-316.