

# CORE CONFERENCE

16-17 May 2019 • AER Core Research Centre • Calgary, AB  
Celebrating 50 Years

## ***OUR RESERVOIRS THROUGH TIME***

As the core committee was preparing for what to look forward to in 2019, we stumbled upon the CSPG historical time line. It so happened that in 1969, the CSPG saw the first inaugural Core Conference! That got the committee thinking about what the Core Conference looked like 20, 30, or even 50 years ago. It is on this anniversary that we reflect on all the analysis that have been done, learnings that have been applied, and how many times Geoscientists have immersed themselves in the truths of the subsurface that are revealed by the core. It is this desire to identify and discover features hidden in the rocks that has given success to our industry and shaped the reservoirs our industry develops today. In many ways, the history of Core Conference showcased the history of how we have unlocked the potential in the reservoirs of today, that historically, would never have been thought possible. The committee felt a strong desire to gather what information we could on the history of the Core Conference and present our findings as a reflection of 50 years of Core Conference history. However, several unique challenges were encountered along the way. How would one go about gathering this information? Where should one look, and how best to quantify the information we do find. Furthermore, there were key individuals who assisted the committee's ability to properly catalogue the past 50 years of Core Conference.

Current CSPG President, Clinton Tippet, was an invaluable resource to guide us on our initial path. It was he, whom brought to our attention that the Gallagher Library at U. of C. may have a collection of Conference Abstracts, as well as the Glenbow museum. As well, as the Chairman for the CSPG Archives, Clinton had in his possession an impressive compilation of Core Conference materials, abstract publications etc. Thus, the goal would be to create an indexed list of previous talks and a searchable spreadsheet that could be sorted on lithology, play type, geotechnical theme, author and year. Wouldn't it be interesting to see who's shown their work on Mississippian carbonate reservoirs in the Foothills or perhaps the complex Mannville stratigraphy in Southern Alberta? When did we first describe the hydrocarbon potential in the Montney Turbidites or the SAGD potential in the McMurray? These were the questions we thought would be worth asking.

A task such as quantifying 50 years of Conference Abstracts was, as one can imagine, daunting. The committee sought out an engaged volunteer, with whom to entrust this responsibility. Melissa Macdonald, a first-year graduate student at the

University of Calgary, quickly stepped up to the task. Melissa spent three months meticulously cataloguing the data from past abstracts and programs, summarizing them into a database that could be used to analyze historical trends. Leveraging Melissa's work, we now see interesting trends in the presentations of the past and how they relate to our industry, challenges we have overcome in our discipline, and the cyclic nature of our industry. We will look at how trends have shifted, often based on what was “in-vogue” at the time, and how those trends shaped our understanding of the subsurface as we move forward. Like most things, our vision for this endeavor evolved as we continued to strive for further understanding. Our new goal is to have a searchable database hosted on the CSPG website that can be the building block for the 100<sup>th</sup> CSPG anniversary in 2027.

The first CSPG Core Conference took place in 1969. The geologists in attendance were entertained by twelve presentations and core displays. The displays included cores from the Cardium Fm., Turner Valley fm., and the Halfway Fm. The purpose of this first conference was to reacquaint geologists with the fundamental principles that only the rocks can show. In the preface of the 1969 CSPG Core Conference Abstract book, the chair G.D Grant mentioned that the methods for obtaining geological information have become varied and specialized. G. D Grant & J.W Keith, proposed that core analysis is the key to adjusted exploration thinking and subsequent success. This point was emphasized by the first moon landing that happened the same year as the first Core Conference. The 1969 moon landing allowed for the first non-terrestrial rock sample to be collected and analyzed which provided information about our planet's past – like the core presented at the CSPG Core Conference. The variation and specialization of geology has not slowed down since 1969 and it shows in the development of the presentations and interpretation of the cores over subsequent conferences.



1974 Core Conference. The Use of Sedimentary Structures for Recognition of Clastic Environments. Presentation on “Recognition of Fluvial Depositional Environments: The Meandering stream model” L to R; Robin Gourlay, Mike Bulina, Gene Levitt and Monti Leland

The formations showcased at past Core Conferences often reflect what was important to geological exploration at that time, but also gives a leading indicator as to where the evolution of oil and gas development was going. We can see the resurgence of old formations, as geoscientists began looking at the halo regions of classic reservoirs with technological advancements. Figure 1 showcases the popularity of the various formations, including some mainstays such as the Cardium Fm, the Mannville Group and the Montney Fm over the 50 years of Core Conference, and highlights the evolving development of those reservoirs. In some cases, we can often find that presentations at Core Conference preceded the commercial development of many successful plays. Furthermore, we see an interesting relationship between presentations at Core Conference and the annual average oil price, as shown in Figure 2. What is most profound, is that an inverse relationship exists between high oil prices and minimal to absent core conferences. This likely follows with the reality that high oil prices, and the workload that comes with it, inhibit geologists with sharing ideas.

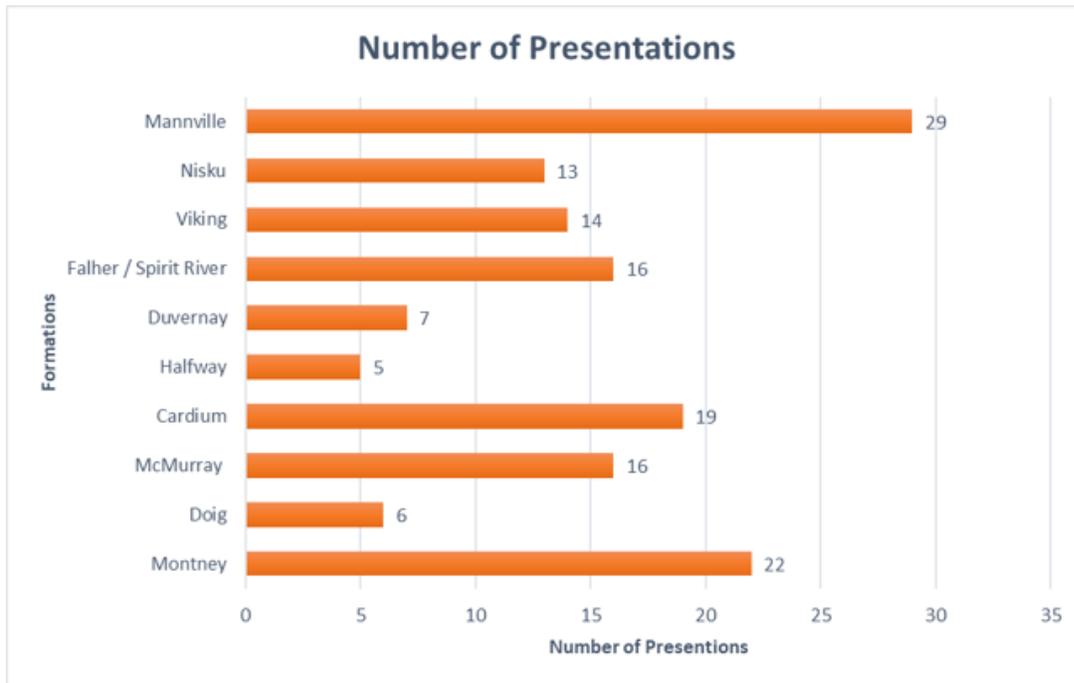


Figure 1. Number of presentations per formation for the last 50 years

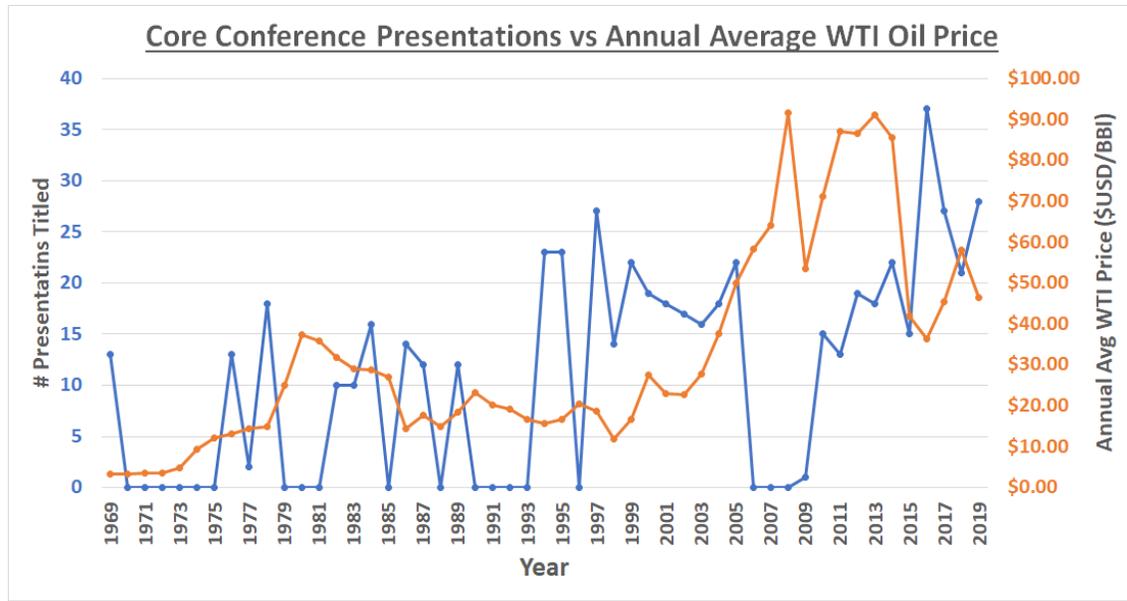


Figure 2. WTI annual oil price versus number of presentations per year. Note how when oil price spikes, there is a concurrent drop in presentations.

The Cardium Fm. has been a mainstay in Core Conference since the inaugural presentation in 1969 (Figure 3). It is no secret that the Cardium, has been an important zone of interest to the Alberta oil and gas industry for many years. Michaelis and Dixson described the sedimentary structures of the Cardium at the first CSPG Core Conference in 1969. Following that presentation, the Cardium Fm. and the Carrot Creek member were displayed in 1976, 1982 and 1995. The formation was then reborn in 2010 after the development of horizontal drilling and hydraulic fracturing along the halo and bioturbated reservoirs. The Cardium Fm. presentations since then have become more specialized in their focus, exploring detailed aspects of stratigraphy and reservoir characterization “The Sedimentary and Stratigraphic architecture of the Wapiti Cardium halo Play” by J.P Zonneveld.

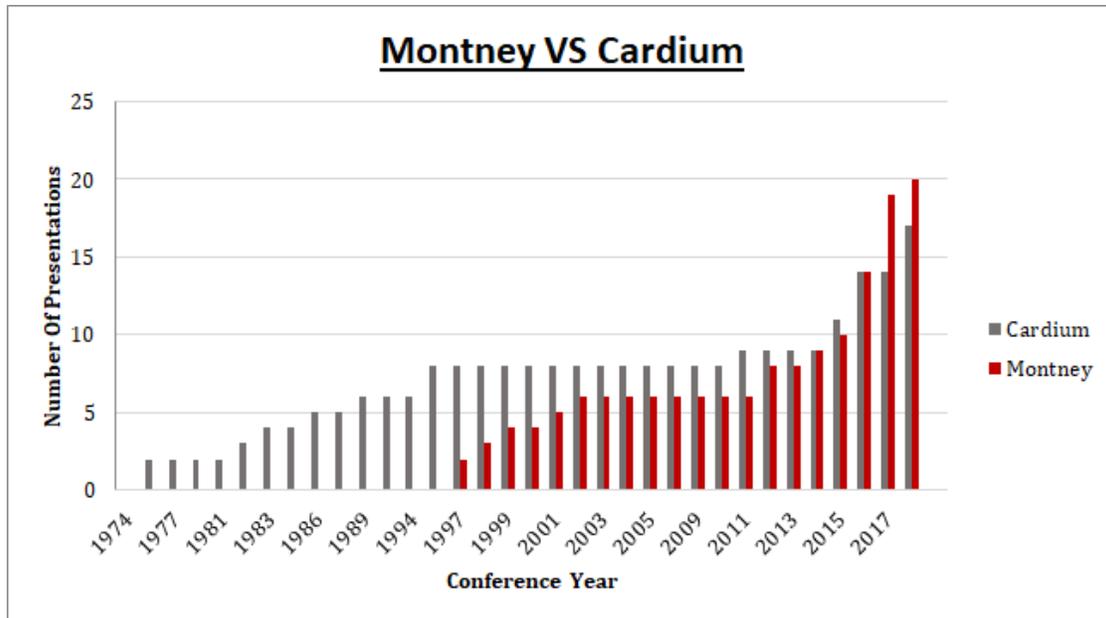


Figure 3. Montney vs Cardium, occurrences in terms of number of presentations on each formation, recorded in the last 50 years

The Montney formation’s first appearance at the CSPG Core Conference was in 1997 (Figure 3), with a focus on the conventional Coquina shorefaces Polt & Krause, 1997 & Davies & Sherwin, 1997. This was followed up by the discovery of La Glace turbidite deposits Kendall, 1999 interest continued to build until 2003. This period was followed by a 9yr period until 2012 where Montney was not en vogue. After 2012 a resurgence occurred with the advent of hydraulic fracturing and the ability to economically develop tight siltstones. These advances in completions technology increased the popularity of the Montney formation, making it a mainstay topic at the Core Conference since 2012. The most recent talks have focused on detailed core analysis and comparisons to other prominent tight reservoirs. The popularity of the formation has sparked creativity not only in research topics but in presentation titles as well, with arguably the most memorable one recently one titled “Just how fracked up are your Montney perms?” by Patrick Russell in 2017.



Core Conference 1974. The Use of Sedimentary Structures for Recognition of Clastic Environments. Presentation on 'Shallow marine Sandstones-a brief review' L to R Aston Embry, Bert Van Biezen and Frank Lee.

The Mannville Group is historic, complex and has represented many important hydrocarbon producing zones. In total, zones within the Mannville group have been the topic of numerous presentations and core displays at CSPG Core Conferences (Figure 4). In 1994, the Core Conference was dedicated to the Mannville Group, only featuring cores from zones found within it! The core from zones within the Mannville group have been at most Core Conferences and have been interpreted and analyzed by many geologists over the last 50 years. What is interesting, is the absence of presentations that have focused on the Deep Basin Mannville stratigraphy and reservoir characterization.

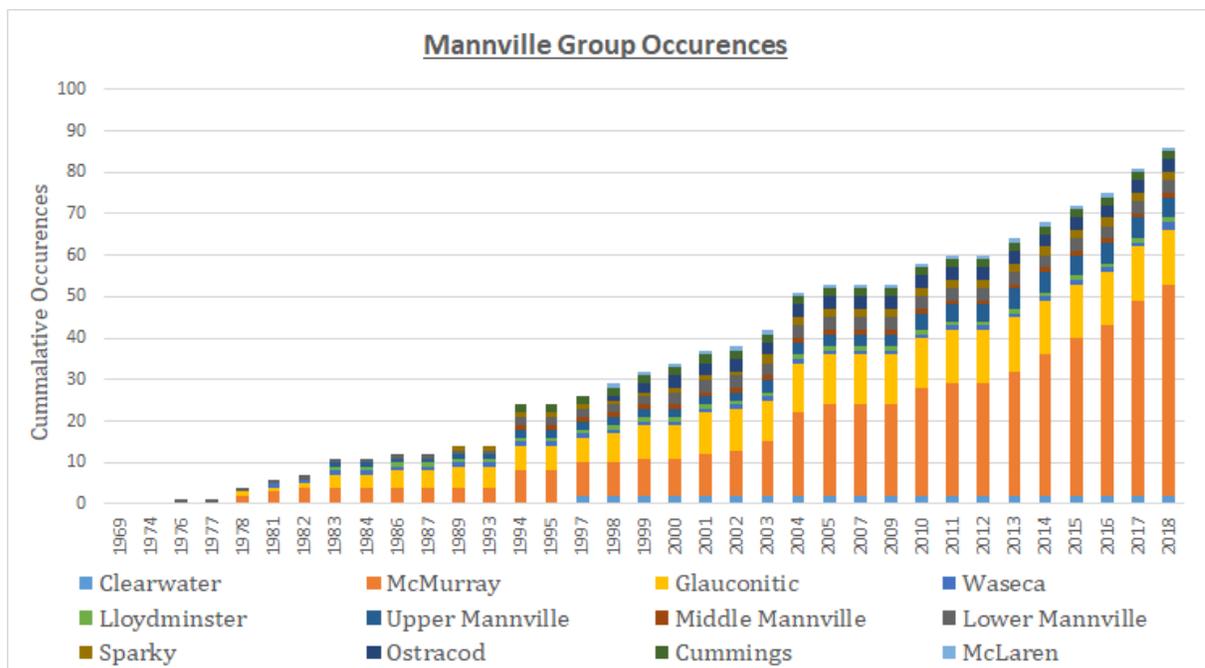


Figure 4. Mannville Group formation occurrences, throughout that last 50 years.

The Mannville Group has been one of the most prolific gas, oil and coal reservoirs in the history of the WCSB, explaining the popularity of this formation in presentations throughout the past 50 years. In these past 50 years, our understanding of the importance of the geometry and source of the stratigraphic relationships has evolved, as well as the technology in how we exploit these complex reservoirs. As the chart in Figure 4 showcases, there has been a lot of work done to understand the classic reservoirs of the Mannville, such as the Lower Mannville, Glauconite, Middle Mannville, and Upper Mannville. These reservoirs continue to see renewed interest from its first appearance in 1976 to the continued presence in presentations year after year much like, ‘Paleoenvironmental Reconstruction of the Bluesky Formation in Sinclair Field, West-Central Alberta: An Integrated Inchoological and Sedimentological Approach” by Brekke, H.G and Pemberton S.G, 1994 Core Conference. In addition, it is important to note the increase in presentations and applications on the McMurray formation, as we continued to increase and utilize technology and increase the production of Canada's vast Heavy Oil deposits. “Post-Steam Core: The key to understanding recovery mechanisms for optimizing recovery and enhancing SAGD performance”, by R. Strobl, M. Fustic & D. Gray, 2017 Core Conference.

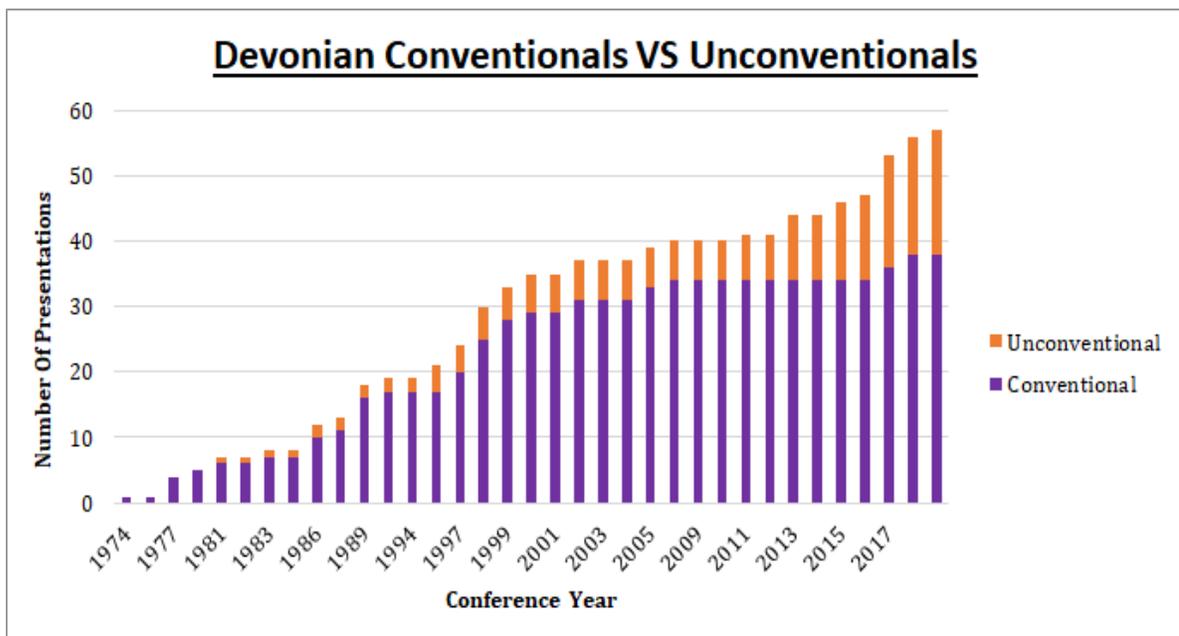


Figure 5. Devonian Conventional Vs Unconventional presentations throughout the last 50 years.

The Devonian is also an interesting case study, early exploration was focused on large targets, these included reef buildups of the Leduc – Nisku – Swan Hill Formations and silicasiltics of the Gilwood formation. These conventional reservoir discoveries were becoming rare by the late 90’s the next phase of exploration focused on horizontally developing the platform (Stoakes, 2016) (Figure 5). Finally, the basinal equivalents were starting to be shown at core conference in 2010 with Ness et al., 2010 Horn River display being the first modern treatment of basinal mudstones. Interestingly Stoakes, 1984 had a

core display on the Duvernay “Sedimentology of a Carbonate Source Rock: The Duvernay Formation of Central Alberta” this reaffirms the pattern of Core Conference previewing our reservoirs of the future.

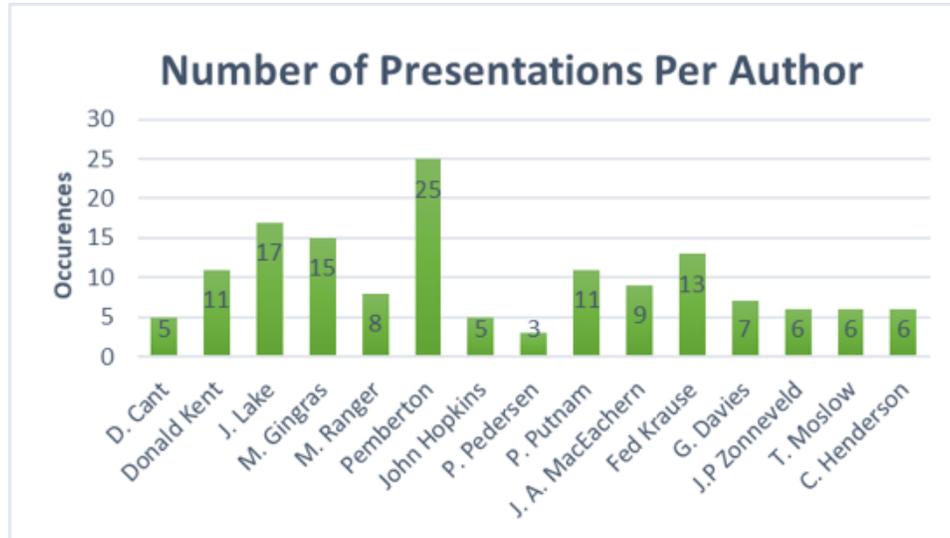


Figure 6. Author frequency plot.

In addition to the significant trends we have seen with presentation topics, the committee identified three very prolific contributors to the conference, John Lake, Dr. Federico Krause and the late Dr. George Pemberton. Combined, they have given a total 55 of presentations over the past 50 years (Figure 6, Frequency plot).

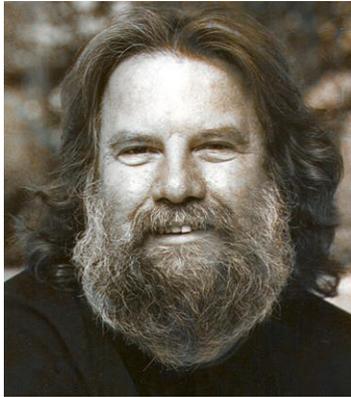


John Lake, first presented at the CSPG Core Conference in 1989, with a talk titled: “Mississippian Transgressive Cycles, Nottingham Unit, Southeast Saskatchewan”. Since then, John has continued to present core from formations in Saskatchewan with seventeen presentations since 1989. In the last two decades, John has presented detailed core interpretations of various formations within the Williston Basin and will be revisiting his earlier work on the Alida Fm. at the 2019 CSPG Core Conference.

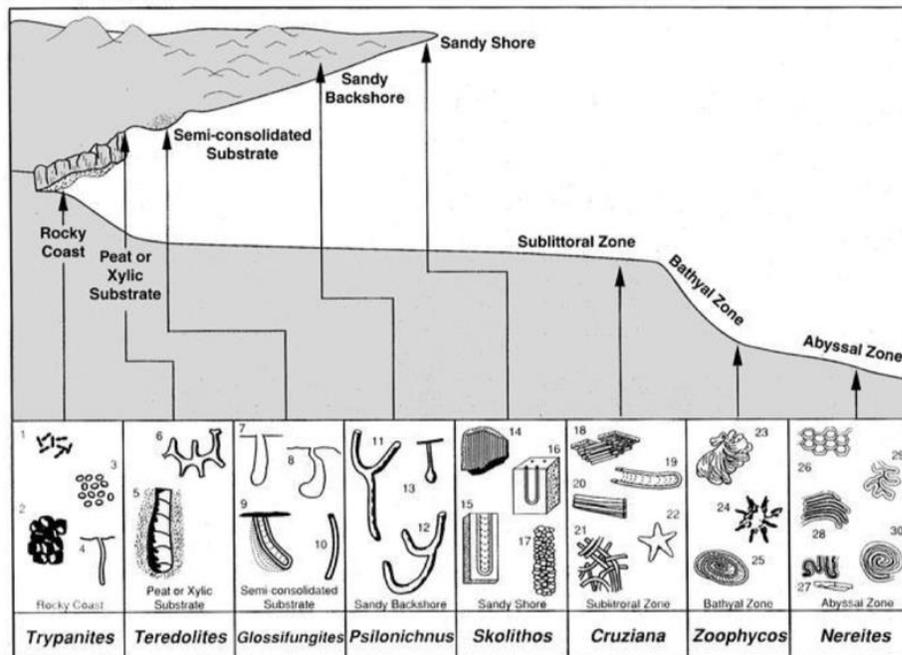


Dr. Federico Fernando Krause, or Fed as some have come to know him, has contributed several presentations at the CSPG Core Conference, with many notable topics including the first Montney presentation at the conference. That presentation was titled “New discovery in the Montney Formation: Sturgeon Lake South, Triassic F Pool, a shoreface sandstone reservoir” and took place at the 1997 Core Conference. Dr. Krause’s sedimentological expertise has been fundamental to many CSPG Core Conferences, and as the author of thirteen

Core Conference presentations, it is an understatement to say he has contributed immensely to the knowledge of the Western Canada Sedimentary Basin.



Last, but most certainly not least were the contributions made by Dr. George Pemberton. A prolific contributor to the geoscience community, he authored or co-authored more than twenty-five presentations from 1983 until 2012. As an expert on ichnology, Dr. Pemberton, has contributed to core discussions referencing many types of reservoirs including the Upper Mannville, McMurray and Montney formations. As head of the Ichnology Research Group at the University of Alberta, he contributed to countless research projects involving ichnology and the petroleum industry, solidifying the importance of ichnology in reservoir characterization. Dr. Pemberton impacted many people in the geological community with his ichnological core displays and took a relatively unique facet of geoscience and made it relevant to all soft rock geologists. It should not be understated the profound contribution he has made to geoscience, as well as Core Conference. His legacy continues to live on through those who carry on research, analysis and of course, presentations at the CSPG Core Conference. The committee believe it can speak for all geoscientists when we say thank you to Dr. Pemberton, for all the contributions he made over 50 years of Core conference.



*Distribution of Common Marine Ichnofacies*

George Pemberton-Ichnofacies Model

The committee would like to thank all the delegates who attend Core Conference every year, and the sponsors who help make it happen. Even after 50 years, Core Conference has not lost the casual, jovial atmosphere that it has had since Woodstock and the Moon Landing. We look forward to another 50 years of delegates and presenters enjoying an environment that fosters discussion, networking, learning and fun.



1974 Core Conference (October). "Just imagine if it could produce"

Thank you!

Your 2019 Core Conference Committee

Christa Williams, Tom Plumridge, Carson Renaud, Liese McLaren, Kelsea Pedersen and Brent Kuntz

*"Discovery thinking", to paraphrase Halbouty (1970, p.5) in AAPG Memoir 14, is the key to our success in exploration and exploitation. "As we make it a point how these giant (oil & gas) fields formed, we should study the modes of occurrence of the accumulations, the types of trap, how each trap formed and how it was found, the age of the reservoir and the age, or ages, of the sediments in which the petroleum generated and from which it was expelled and migrated to the trap. We should ask ourselves: first, what is unusual about each of these accumulations? And second, what is unusual? Then we must concentrate on the unusual, for commonly it is that unusual aspect which is the key to accumulation. Prejudiced ideas should be discarded, for it is these old, ingrained, hard-nosed prejudices which also stifle exploration; old prejudices must not be tolerated in our thinking of the future"*