# NEW SERIES

The history behind the development of some of the fundamental concepts in the geosciences is truly fascinating. Some outstanding characters with brilliant insights have laid the foundations of our discipline. This history has a full cast of characters, and major advances have been made by drinking potions laced with ingenuity, serendipity and happenstance. Hypotheses have come and gone, great debates have raged. You all know Paul Hoffman as a researcher of the highest stature, and he has garnered a host of the most prestigious national and international awards for his research. Paul is also a passionate student and disciple of this history, and as is evident from his photograph, he has lived through many of them! He will contribute a column, aptly entitled *Tooth of Time*, to each issue of Geoscience Canada. His contribution to this issue is the first of many fascinating narratives of how major discoveries are made, the amazing characters to whom we owe so much, and the importance of mentorship as transformative ideas are handed from generation to generation.

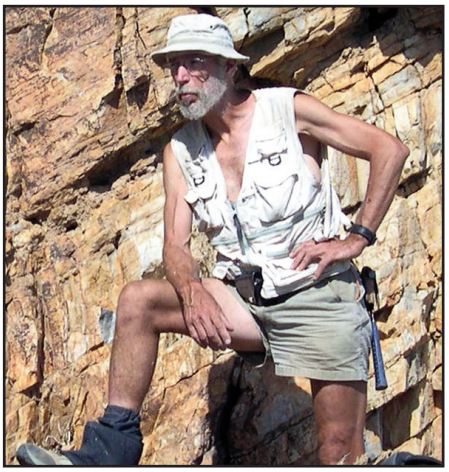

Photo credit: Francis Macdonald, 2004.

# Column

## The Tooth of Time: Cesare Emiliani

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It's funny how a seemingly minor event in graduate school can take on deeper meaning later on. We had a day to kill after a long drive from Baltimore to Miami through the Deep South. It was 1967 and we had long hair. Carbonate sedimentologist Bob Ginsburg had come to Johns Hopkins two years earlier, bringing Paleozoic limestones back to life in Florida Bay, the Florida Keys and Great Bahama Bank. He had to spend the day bartering with boat operators but he suggested we attend a talk on forams at the Institute of Marine Science (University of Miami). To be honest, I don't remember much about the substance of the talk, except that the shells of one foram species coil to the left where it is cold and to the right where it is warm–just like American politics. But I remember the speaker, a fast-talking, high-voltage Italian whose presentation was so charged with conviction that for years afterwards I gave all Linnean names an emphatic Bolognese accent in his honour. Only decades after the fact did I begin to appreciate the historic circumstances of Emiliani's talk in Miami.

Emiliani studied micropaleontology and published on Cretaceous and Pliocene forams in wartime and postwar northern Italy. He won a Fellowship to University of Chicago in 1948 and was recruited by Harold Urey into his research group, which was dedicated to realizing the dream that "such a transient physical quantity" as the temperature of seawater could be faithfully recorded in rocks for a hundred million years or more (1). The group included engineer Charles McKinney (who supervised the construction of a duplicate mass spectrometer to the one designed by Al Nier in Minneapolis), Urey's graduate student John McCrea and Sam Epstein, a postdoctoral chemist with an interest in geology from Winnipeg by way of McGill. Urey, a Nobel laureate in chemistry in 1934 (age 41), was the most important American Earth scientist of the 20th century, remarkable considering that he devoted only a dozen papers and a tiny fraction of his career to Earth science. As Karl Turekian recently remarked, "Geochemists are often accused of acting like God. There are good reasons for this."

In 1946, Urey had been asked (by Paul Niggli) after a talk at ETH in Zürich whether it might be possible, given that rainwater was isotopically lighter than seawater, to distinguish marine and continental carbonates by isotopic analysis. Urey did some calculations and discovered that there was a measurable temperature effect to contend with. "I suddenly found myself with an isotopic thermometer in my hands." he said (2). Not quite. The resolution of their mass spectrometer had to be improved by a factor of ten. And they had to figure out how to extract $CO_2$ gas from carbonate shells without contamination from the embedded organic matter, a problem Epstein solved by a method still used today (3). By 1951, Urey's group had perfected the measurement of paleotemperatures in ancient carbonates and were able to show that a 150-million-year old belemnite from the Isle of Skye had lived for four winters and three summers at temperatures ranging from 15 to 21°C, and that the winters grew progressively