# PAUL E. POTTER: HIS YEARS AT CINCINNATI, INTERWOVEN WITH THE IL, IN, OH, AND KY STATE SURVEYS

**J. Barry Maynard**, Craig Dietsch and Dan Sturmer

Department of Geology, University of Cincinnati,

Cincinnati, OH 45221-0013

University of CINCINNATI


Paul E. Potter 1925-2020

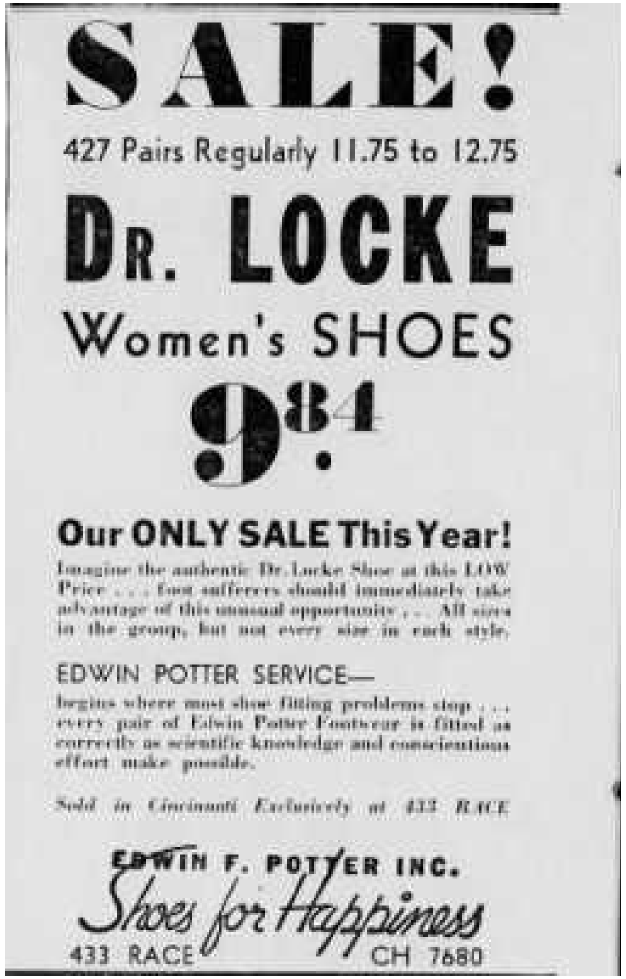
***Antecedents and Early Years***

Charles and Zenobia Yanser, maternal grandparents.

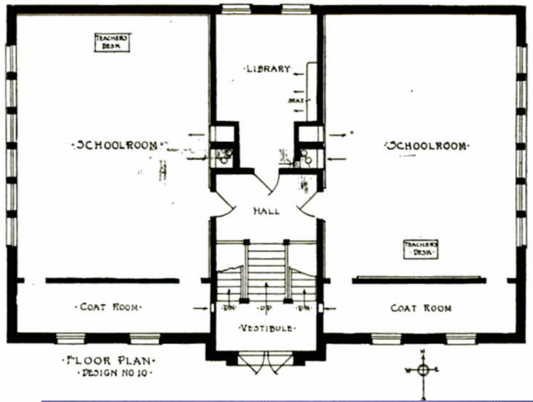
Charles was a prominent politician in Slatington PA, and was the manager of a slate quarry. Shown below is a typical slate operation in the Lehigh Valley


Boyhood home in Norwood OH

Paul's father, Edwin Forrest Potter was in the retail shoe business, with a store in downtown Cincinnati on Race Street, specializing in orthopedic shoes for women



## *EDUCATION*



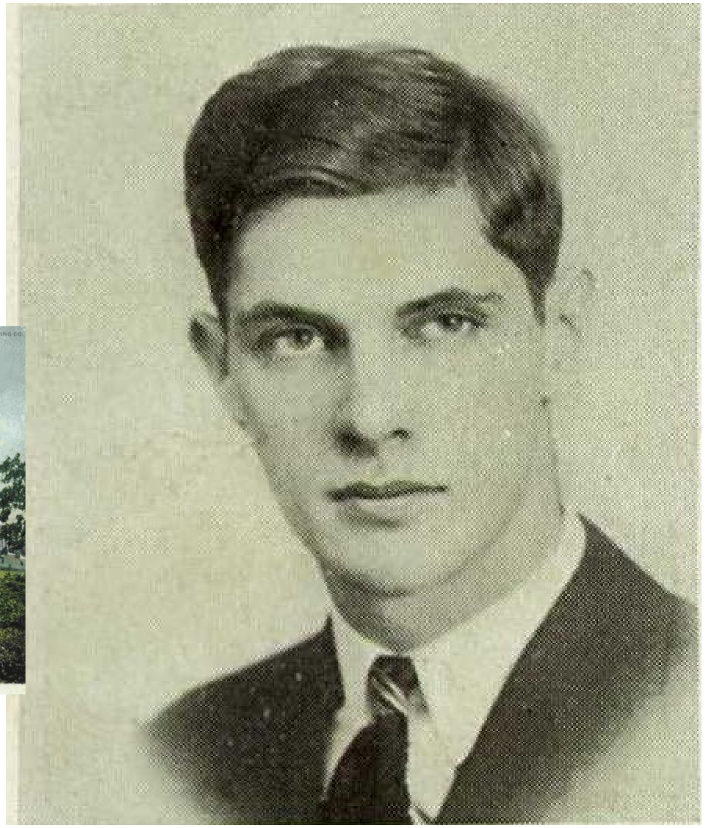

Typical Ohio two-room schoolhouse

- Two-room school for $5^{th}$-$8^{th}$ grades

Anderson HS

- High School at Anderson High – senior year at UC in joint HS/ College program

UC-Old McMicken



- US Army in Philippines – enlisted 1944. Discharged mid 1946

Figure 6. Close-up view of Lafayette gravel.

- U of Chicago on GI Bill – 1946-1953. PhD thesis on Lafayette Gravel

## *US Army – Jan 1944 - summer 1946*

Basic training, Ft Bliss TX
1944

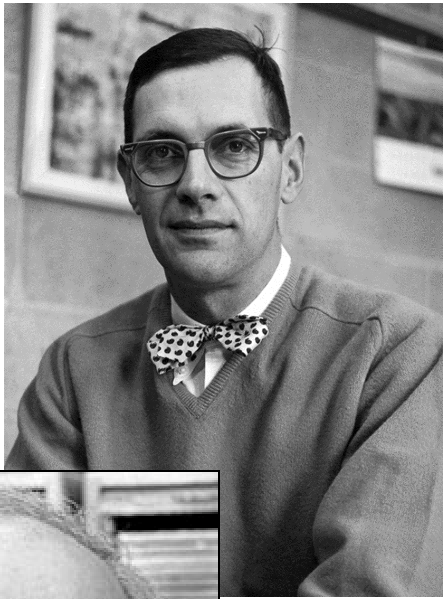
155 mm howitzer in action
Philippines 1944.

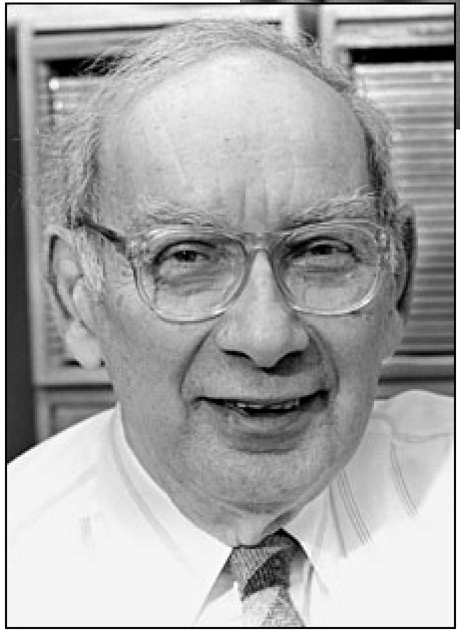
Paul was a PFC in a small detachment (one lieutenant, one sergeant, and two privates) acting as forward artillery observers for a 155 mm howitzer battery.

Philippines landscape, Luzon – we're not in Kansas anymore, or in Paul's case west Texas.

## *Illinois – The Geological Survey – 1952-1961*

Colin Blyth, statistician, a close life-long friend. Two of his sons, both geologists, with Craig Dietsch and Paul, ca. 2015





Ray Siever (1923-2004). Partner in sandstone petrology at Illinois State Geological Survey

# *Some examples of projects at IGS from the Potter-Siever team*

## A COMPARATIVE STUDY OF UPPER CHESTER AND LOWER PENNSYLVANIAN STRATIGRAPHIC VARIABILITY[1]

PAUL EDWIN POTTER AND RAYMOND SIEVER
Illinois Geological Survey

ABSTRACT

The most general property of any sedimentary sequence is its areal variation of gross lithology. This variation, here termed stratigraphic variability, is investigated in the Upper Chester and Lower Pennsylvanian sediments of a portion of the Eastern Interior Basin with the hierarchical case of the analysis of variance. Using electric log data, the hierarchical case of the analysis of variance segregates the total variability of sandstone and limestone proportion into components associated with increasing increments of area.

Variability of Upper Chester and Lower Pennsylvanian sandstones is broadly similar on all but the lowest sampling level. Tectonics appears to be the dominant control on the higher sampling levels, whereas length of section and hydrodynamic factors are most important within a square mile. Because limestone is predominantly an autochthonous rather than allochthonous sediment, its variability is much less. This contrast is also reflected in markedly differing distributions of sandstone and limestone thickness.

The practical applications of this methodology are important for determination of confidence limits for one or more wells as samples of areas of variable size and for allocation of sampling in comparative studies.

One of the most general properties of any sedimentary sequence is areal variation of gross lithology. This variation, here termed *stratigraphic variability*, has interpretive value because major environmental and tectonic sedimentary controls are expressed not only in kind and amount of sediment but also in lateral persistence or areal homogeneity. Stratigraphic variability in the past has been a source of concern to the stratigrapher because its appraisal has been qualitative and subjective, because it is difficult to convey to others a meaningful picture of the kind and degree of variability, and because stratigraphic variability affects the reliability of estimates of lithologic proportions.

For descriptive purposes alone the quantitative measure of stratigraphic variability has utility. For example, subsurface stratigraphic studies utilizing as many as 1,000 or more wells scattered over wide areas are common. Although the person who looks at the well logs often obtains a good qualitative picture of the variability, he may have difficulty communicating it to others. Detailed cross sections are impractical because of their size, and so qualitative verbal descriptions, such as "is underlain by a 20–30-foot interval of variable siltstone and shales," have to suffice. Such limitations alone suggest the need for quantitative studies.

A more important advantage of the quantitative study of stratigraphic variability than its use for precise description is the provision of confidence limits for the mean values of such sedimentary parameters as sand-to-shale ratios, proportions of limestone, sandstone or shale, etc. Related to confidence limits is the question of how accurately a given number of wells samples a square mile, a township, a county, or even an entire basin.

The quantitative study of stratigraphic variability on a small scale, such as that within a square mile, also has significance for a hydrodynamic interpretation of clastic sediments. In terms of texture, a bed-load function (Einstein, 1950)

[1] Published by permission of the Chief, Illinois State Geological Survey. Manuscript received September 17, 1954.



## SOURCES OF BASAL PENNSYLVANIAN SEDIMENTS IN THE EASTERN INTERIOR BASIN

### 1. CROSS-BEDDING[1]

PAUL EDWIN POTTER AND RAYMOND SIEVER[2]
Urbana, Illinois

ABSTRACT

The long distance separating the basal Pennsylvanian sediments of the Eastern Interior Basin from possible major source areas combines with mineralogic maturity to make solution of the source-area problem difficult. Our approach toward its solution utilizes both regional cross-bedding mapping and petrology.

Statistical analysis provided measures of reliability for estimates of regional cross-bedding directions, estimated the variability arising from levels of subsampling, and made possible significant economies in field sampling. Over 1,000 miles of linear basal Pennsylvanian outcrop in the Eastern Interior Basin, northwestern portions of the Appalachian Basin, and Michigan Basin were examined in 41 days. Over 950 measurements of cross-bedding in 340 outcrops were obtained.

The parallelism of local and regional cross-bedding directions to orientation of the subaerially formed channels of the Mississippian-Pennsylvanian unconformity, directions of regional stratigraphic overlap, and regional quartz-pebble distribution indicate that, measured over wide areas, cross-bedding direction reflects the regional slope from the source area.

Based on this hypothesis, the basal Pennsylvanian sediments of the Eastern Interior Basin had a minor source area to the northwest, in the direction of the Transcontinental Arch, and a major source area to the northeast. Northeasterly source directions are also indicated for the basal Pennsylvanian sediments of the Michigan Basin and adjacent portions of the Appalachian Basin. Hence, excluding the western shelf area of the Eastern Interior Basin, the craton in the north-central states had a regional slope to the south-southwest. This portion of the craton had source areas in the middle and northern Appalachians and the southeastern Canadian Shield.

INTRODUCTION

The purpose of this study is to demonstrate a regional method of sediment-source determination. Its essentials are threefold: (1) regional investigation of directional sedimentary structures[3] such as cross-bedding, flow, or ripple mark to establish the regional pattern of sediment transport; (2) systematic regional petrology to establish regional mineral associations; and (3) use of statistics as a guide to sampling effort, to provide measures of reliability for mean values, and to test geological hypotheses.

The individual elements of this methodology are, with the possible exception of the application of statistics, not new; a number of investigators have made studies of either directional properties or mineralogy. But the combined study of directional structures and petrology on a regional basis is just beginning. Two examples of the application of this methodology to areas of moderate size are the combination cross-bedding and petrologic studies of Lemcke, Von Engelhardt, and Fuchtbauer (1953) and of Potter (1955).

Because of its relatively isolated yet strategically located mid-continent position, the basal Pennsylvanian sediments of the Eastern Interior Basin provide an ideal test for this methodology. Because the Eastern Interior Basin is far removed

[1] Published by permission of the Chief, Illinois Geological Survey, Urbana. Manuscript received June 23, 1955.

[2] Associate geologist and geologist, Illinois Geological Survey.

[3] We use the term *directional structure* to include all those sedimentary structures which have directional significance and to differentiate them from scalar sedimentary properties, such as grain-size distributions, mud cracks, etc.



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## SOURCES OF BASAL PENNSYLVANIAN SEDIMENTS IN THE EASTERN INTERIOR BASIN

### 2. SEDIMENTARY PETROLOGY[1]

RAYMOND SIEVER AND PAUL EDWIN POTTER[2]
Urbana, Illinois

ABSTRACT

Sedimentary petrology was used in this provenance study to map regional mineral associations and to indicate the composition and tectonic states of their source areas. Quantitative estimates of tourmaline roundness and varieties of quartz were the primary basis for recognizing two regional mineral associations. The statistical significance of quartz varieties and tourmaline roundness was evaluated with a form of multivariate analysis. Estimation of the other mineralogical constituents supplemented the differentiation of mineral associations and the reconstruction of source-area composition.

The two areas of contrasting mineral associations are western Illinois (no metamorphic quartz pebbles, high tourmaline roundness, low metamorphic quartz, insignificant feldspar) and the remainder of the areas studied, including southern Illinois, Indiana, eastern and western Kentucky, Ohio, and Michigan (metamorphic quartz pebbles, low tourmaline roundness, medium to high metamorphic quartz, 1–5 per cent feldspar). The source-area interpretation, based on integration of petrology with cross-bedding, indicates that a source to the north and northwest of western Illinois—in the direction of the Transcontinental Arch—contributed detritus to western Illinois. Sources contributing to the rest of the north-central United States lay to the north and northeast—parts of the Canadian Shield and uplifted parts of the linear mobile belt bordering the craton on the east. The clastic material from all sources was primarily from pre-existing sediments, but that from the Transcontinental Arch had a long abrasion history of many earlier sedimentary cycles, whereas that from the east and northeast was only a few cycles removed from igneous and metamorphic derivation. The craton sloped southwest from the most stable parts of the continent to the more rapidly subsiding portions of the mobile belt. Basal Pennsylvanian sediments overlapped the craton in a northeasterly direction, up the regional slope.

INTRODUCTION

Part 1 of this study (Potter and Siever, 1956), a regional field study of cross-bedding, indicated the transport pattern of the basal Pennsylvanian sediments of the Eastern Interior Basin. In this part, sedimentary petrology is used to discriminate further between source areas and to assess source-area composition.

Published sedimentary petrologic studies include those by Gault (1938) on the heavy minerals of the Mansfield of Indiana, by Kelly (1931) on the Parma sandstone of Michigan, and by Fuller (1955) on the Sharon of northern Ohio. Rittenhouse (1946) has studied the Sharon of Ohio and the Olean of New York. These studies have covered relatively restricted areas, and most have emphasized study of heavy minerals. There has been no previous broad regional study of the sedimentary petrology of these rocks.

The first objective of the petrographic study was to distinguish regional mineral associations related to contributions from

[1] Published by permission of the Chief, Illinois State Geological Survey, Urbana. Manuscript received June 23, 1955.

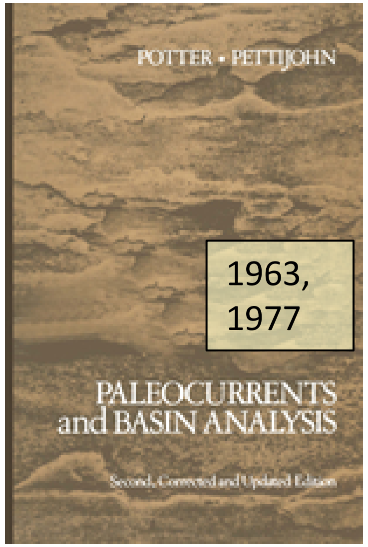
[2] Geologist and Associate Geologist, Illinois State Geological Survey.

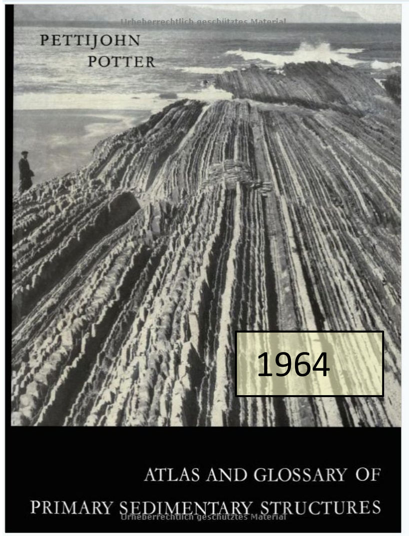
## ***Characteristics***

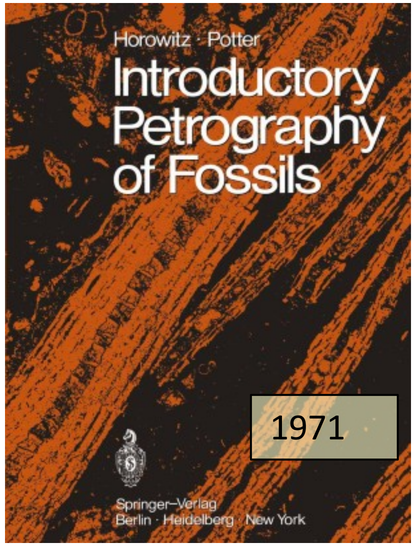
- Think big. What is the larger framework for this work?
- Work big. Whole basin approach
- Combine surface and subsurface investigation
- Use multiple, quantitative techniques
- Do the statistics
- Work with state geological surveys

# *Johns Hopkins 1962-63; Indiana University 1963-1970 – Migration to the Professoriate*

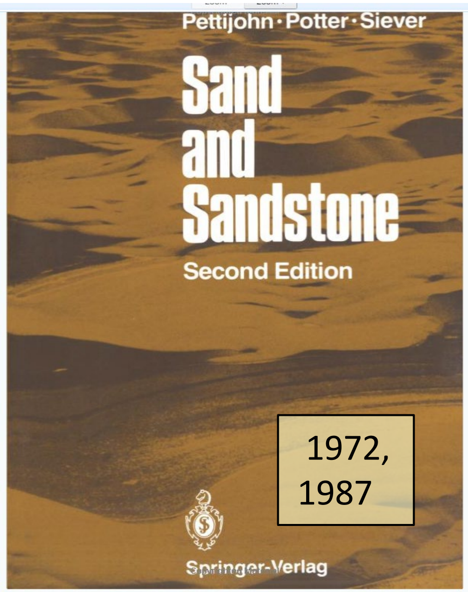
Books written at
Hopkins and IU







## *Characteristics*

- Think world wide.

- Work big. Whole basin approach – use the basin as the integrating framework. Paleocurrents, petrography, geophysics, wire-line log signatures, sand-body geometry all tied together.

- Work collaboratively (and needle collaborators regularly) with faculty and state survey colleagues

- Write for a larger geologic audience; use clear illustrations with large fonts.  For an example of the success of this approach, check out the following blog page by Elisabeth Kosters

https://earthsciencesociety.com/2013/11/26/the-king-of-sand-paul-edwin-potter/



← SWITCH – The Future of Energy – @SwitchEProject Canadian Earth Science for @PMHarper – Preamble →

# The King of Sand: Paul Edwin Potter

Posted on November 26, 2013 by earth science society

I only ever truly loved two textbooks. I only ever loved these books because they were capable of captivating my attention, enhancing my understanding, and making me realize the depth of the subject. Most textbooks are poorly written encyclopedias that should be thrown out, no matter how beautiful they look and how famous their writers. No matter how relatively useful they are.

The first textbook I ever truly loved was 'Sand and Sandstone' by Francis Pettijohn, Paul Potter and Raymond Siever. It was first published in 1972 by Springer. I used a library copy during my MSc studies, wanted to own it right away, but couldn't afford it until I was a professional with a real salary. I bought it in 1984. The second edition was published in 1987 and you can still buy it for $239.00 (ex shipping). YES! I am obviously not the only one: this must be a darn good book if Springer can still sell it for that price 26 years after it was published!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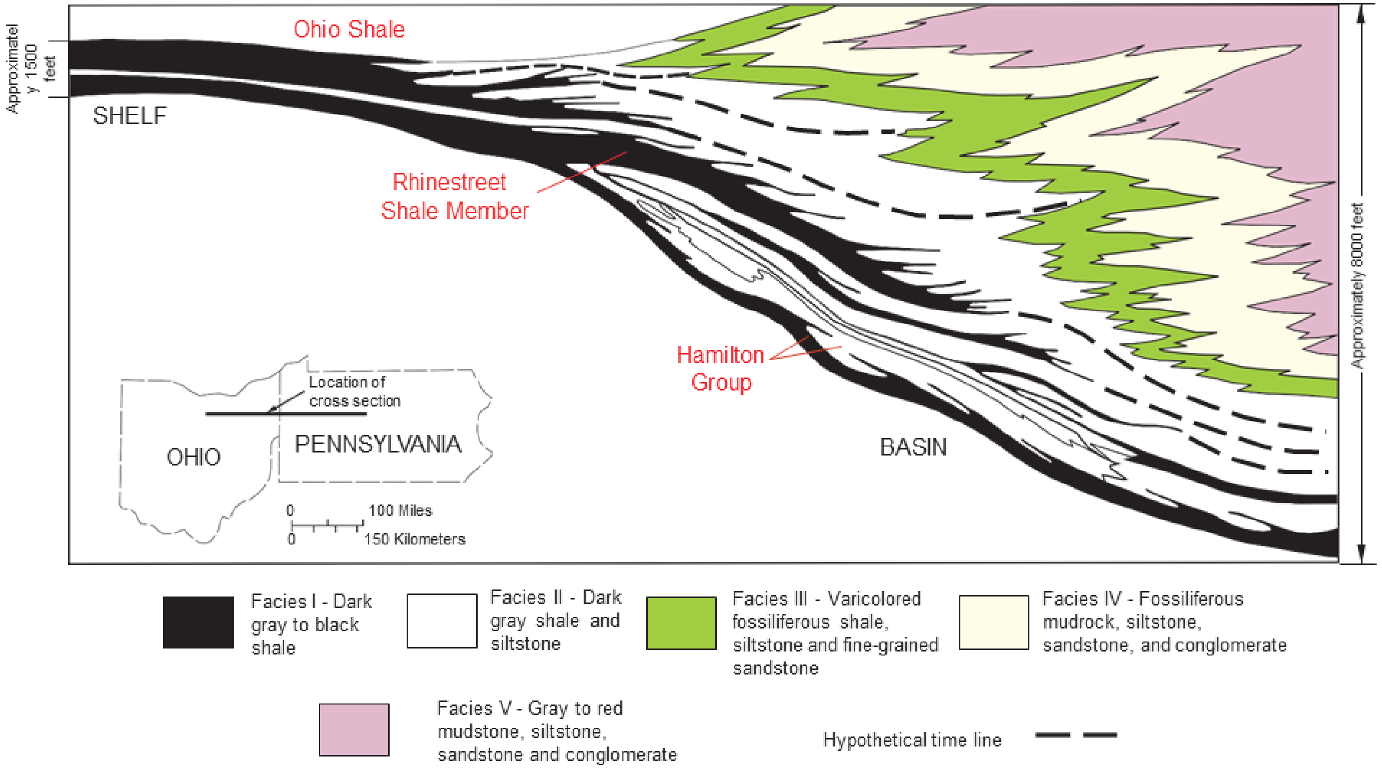
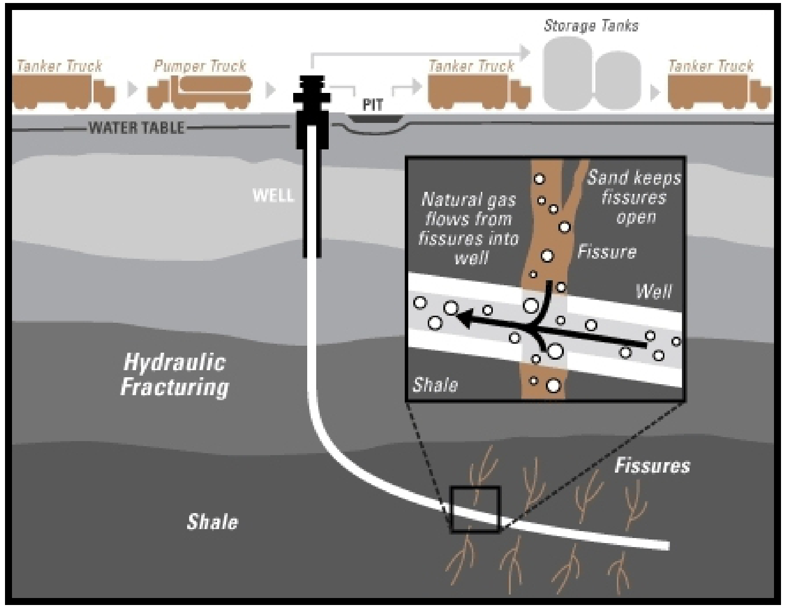
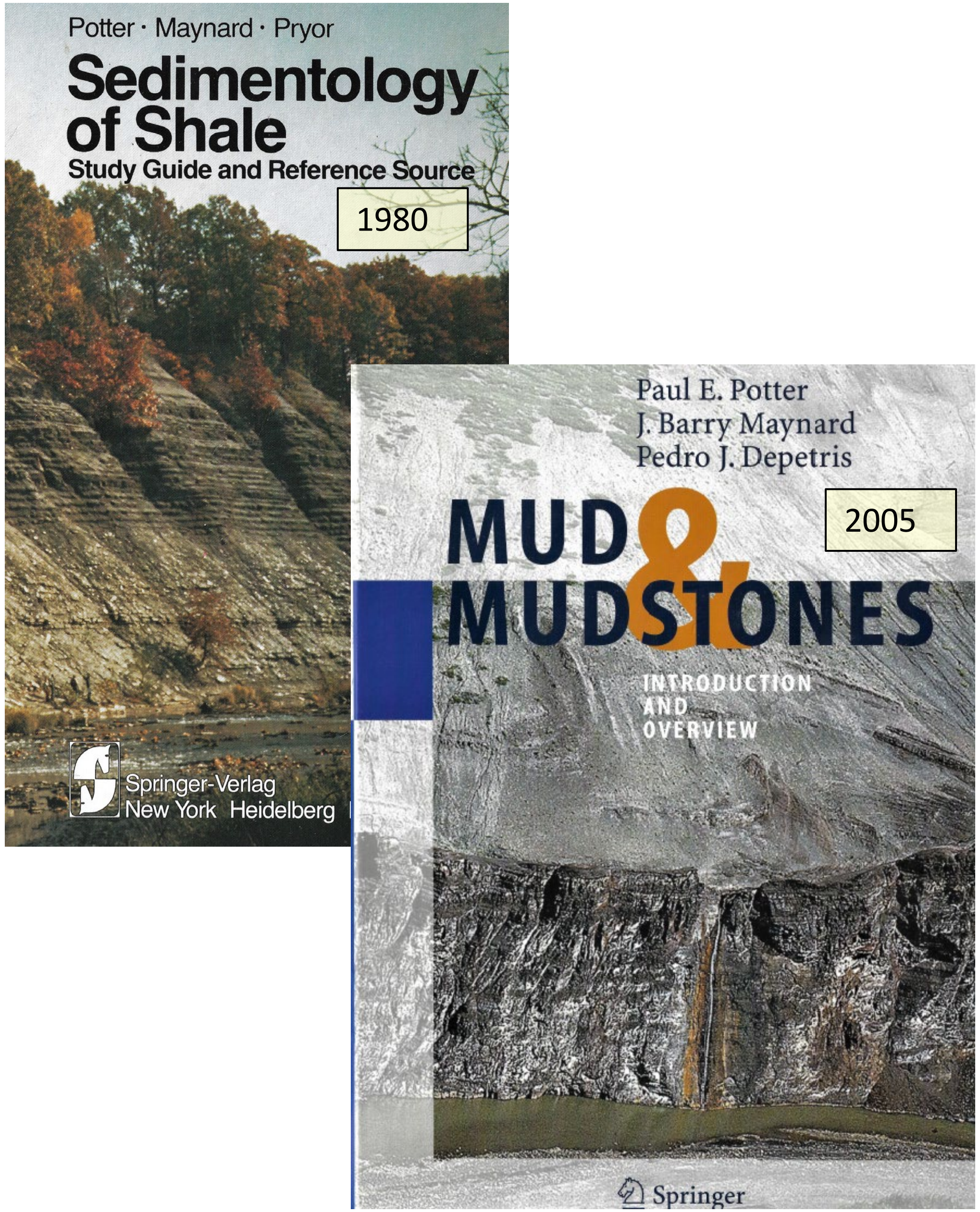
# *Crossing Over – The University of Cincinnati 1971-1992*

# *New horizons, a new class of rocks*



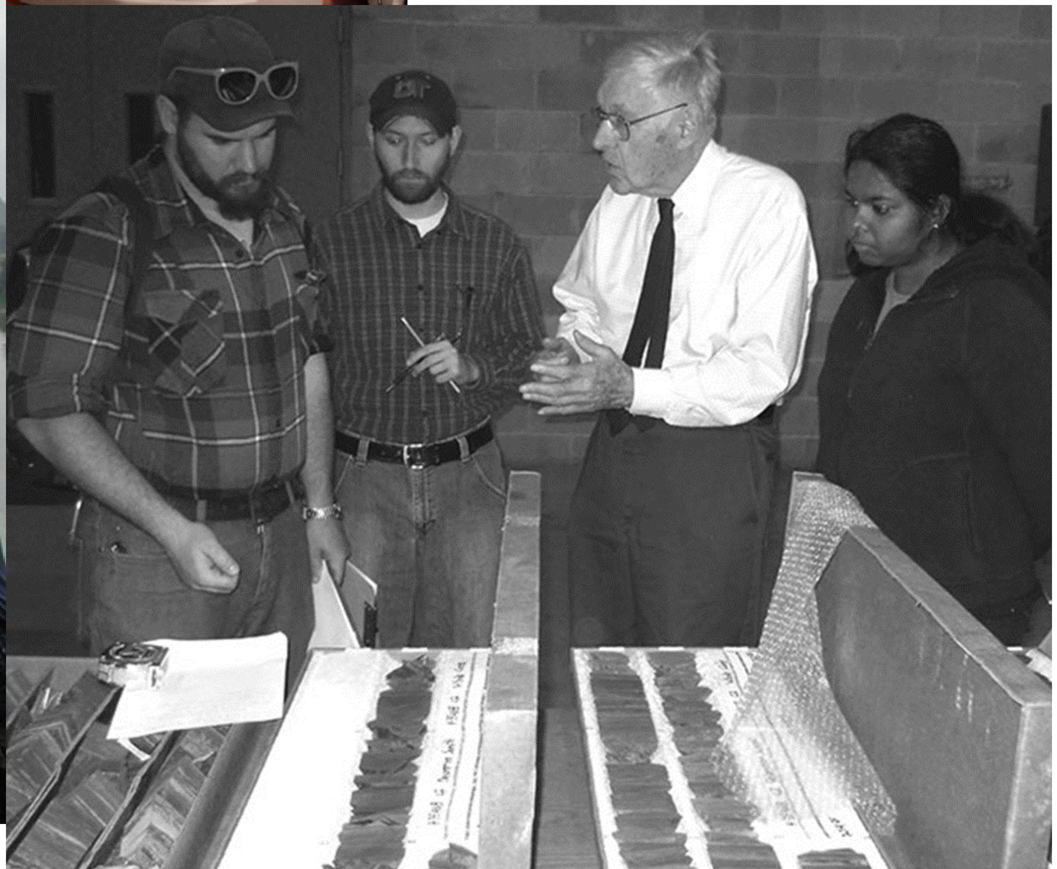




## *Characteristics*

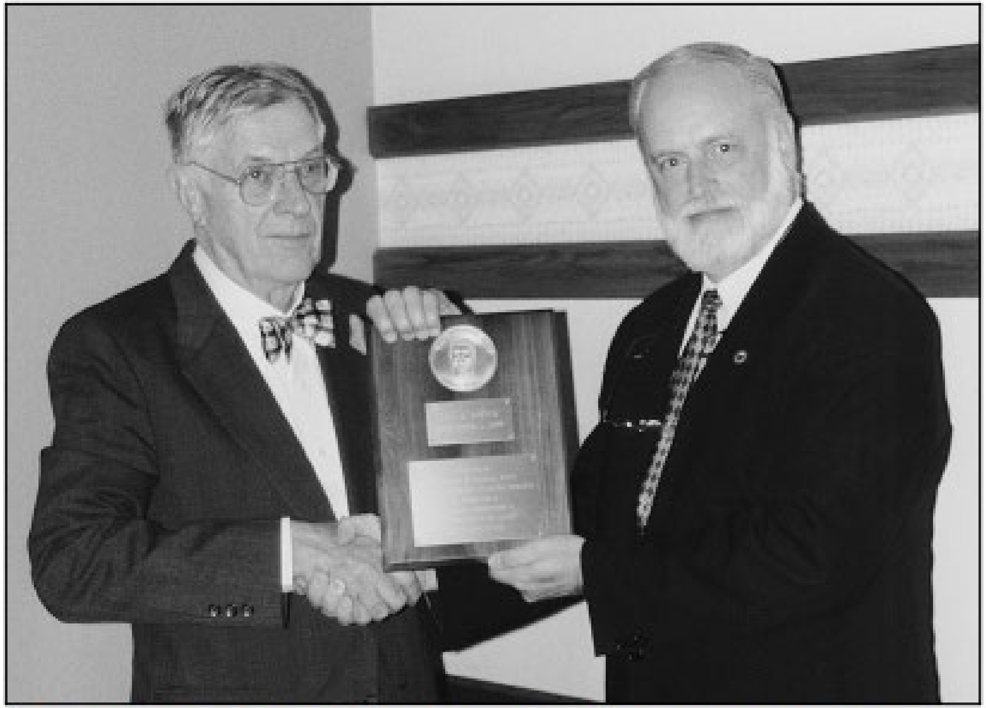
- Think big
- Cover the whole basin
- Combine surface and subsurface (make outcrop gamma-ray logs)
- Work closely with USGS, OH-KY-IN-IL-WV surveys + other faculty
- Involve lots of graduate students
- Write for a larger audience – geologists and engineers

## *Teaching – field work; petrography; cores*

4-day field trip to southern Illinois; Paul's microscope; student lab work on core description



# *COMMUNITY SERVICE: the City, the States – IL-IN-KY-OH; Countries – Brazil, the US*



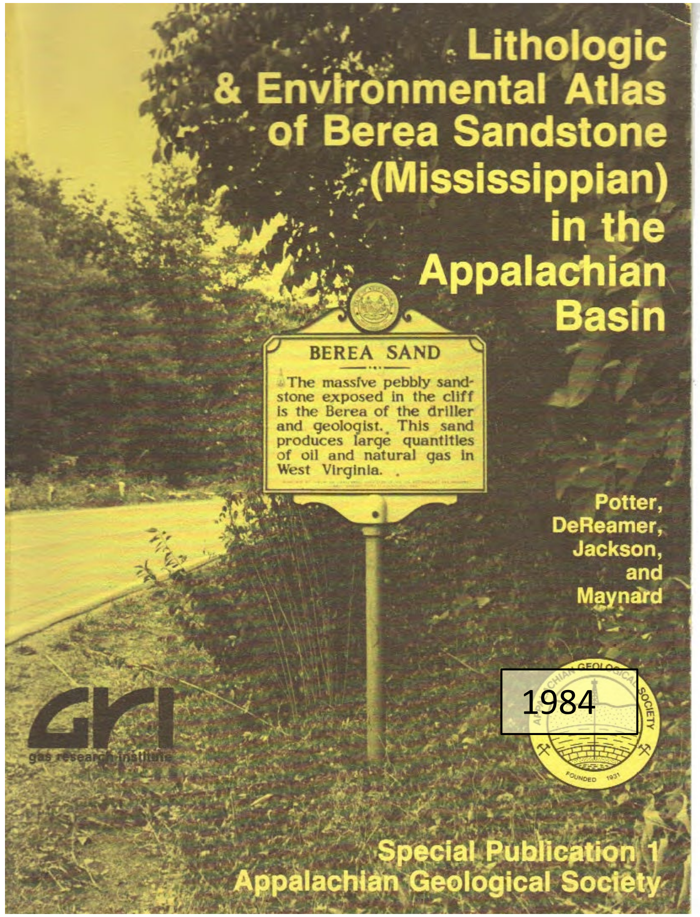
*Paul Edwin Potter receiving the Mather Medal from Division Chief Tom Berg. Photo by Dale Wilson.*

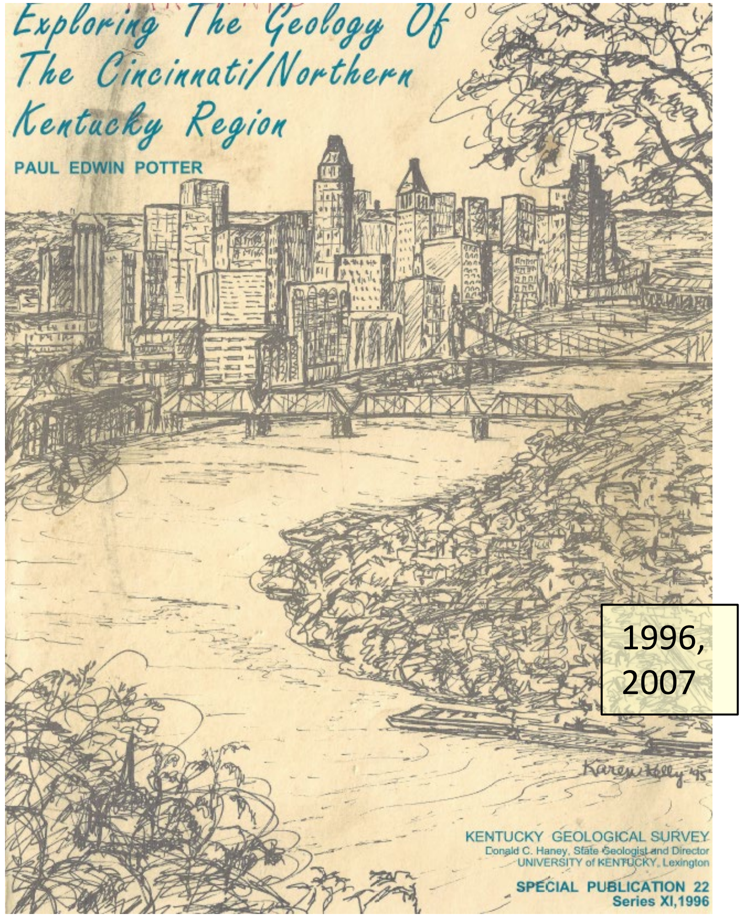
1999: Presentation of the Mather Medal, for contributions to OH geology, by OH Survey Chief Tom Berg

Mark Bowers, UC Engineering Asst Dean; Paul; Tim Burke, Cinti political leader, discussing Cinti infrastructure and training future government employees (ca 2015)

Distinguished service award from Petrobras - 2007

# *COMMUNITY SERVICE: Regional and local publications*



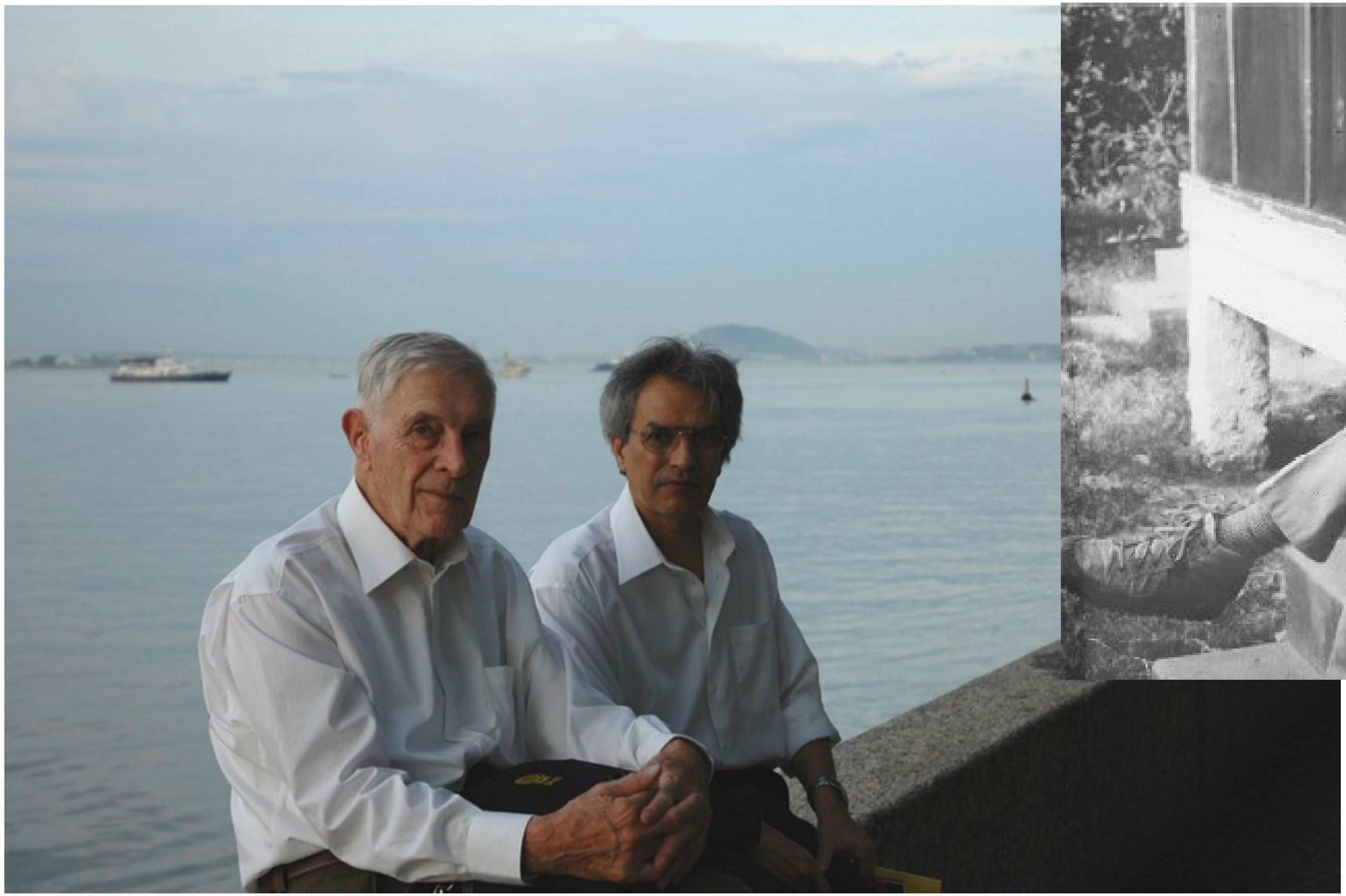



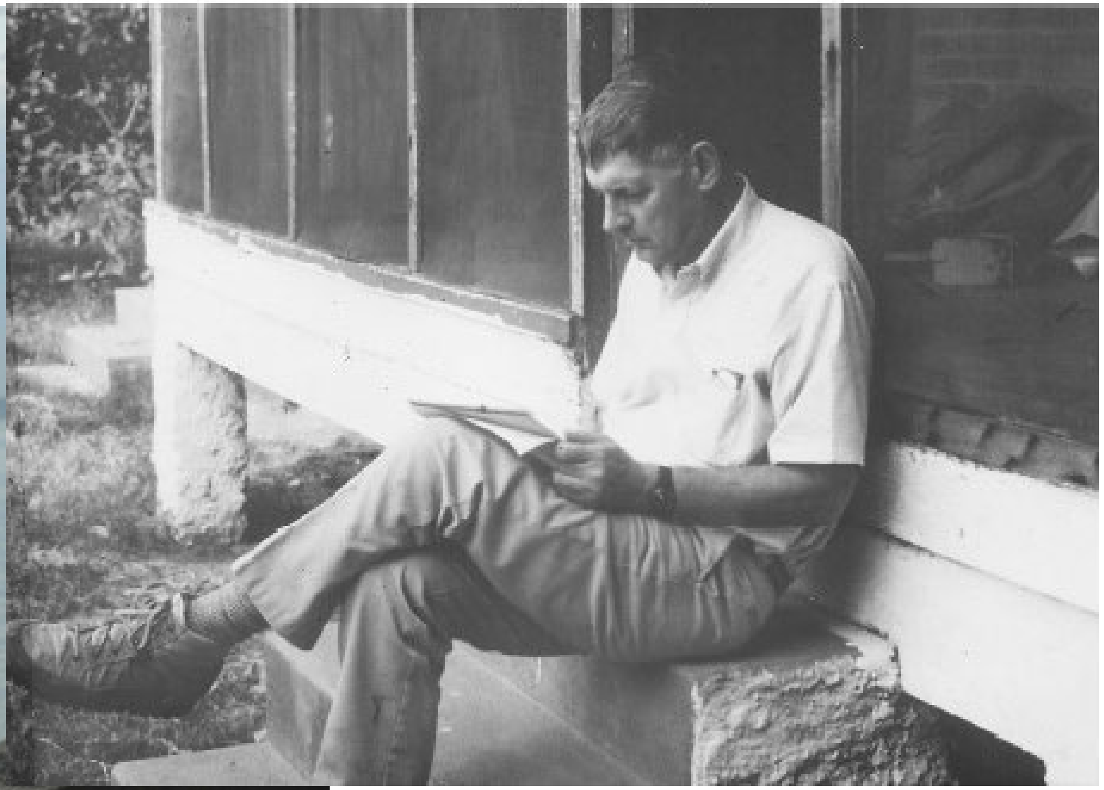


## *Characteristics*

- Combine surface and subsurface
- Work closely with surveys
- Involve lots of graduate students
- Write for a larger audience – geologists and engineers

## *Shaking things up again: Brazil 1993-2000*

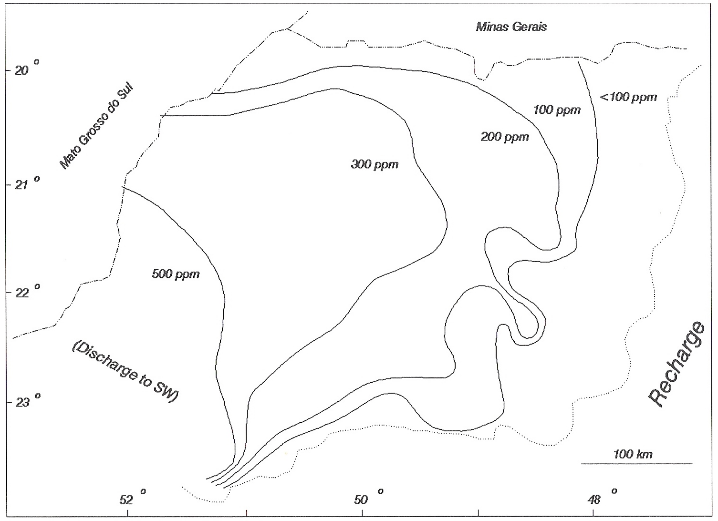




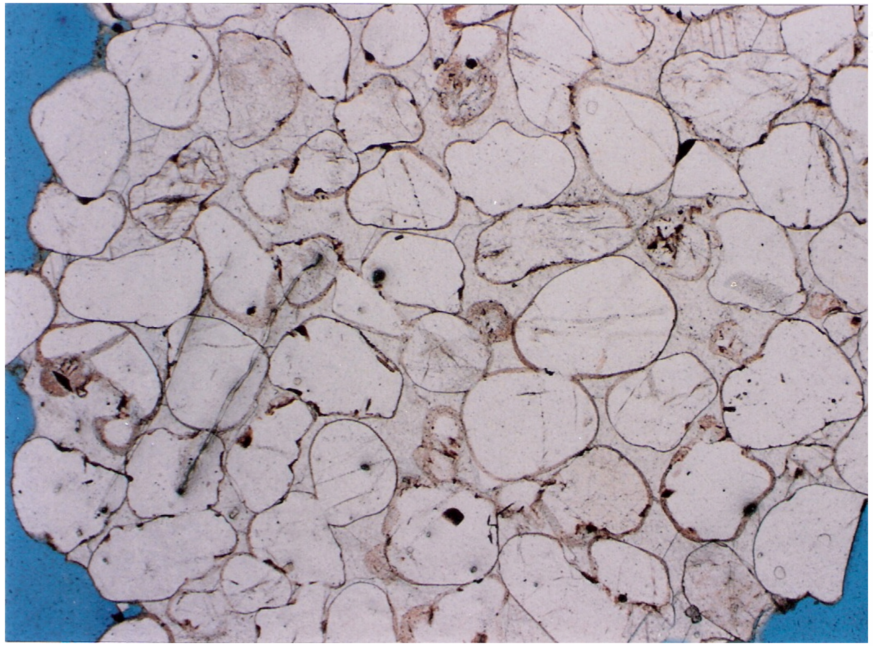
Field work on the Parana River, 1987

With Almerio Franca, Rio 2007

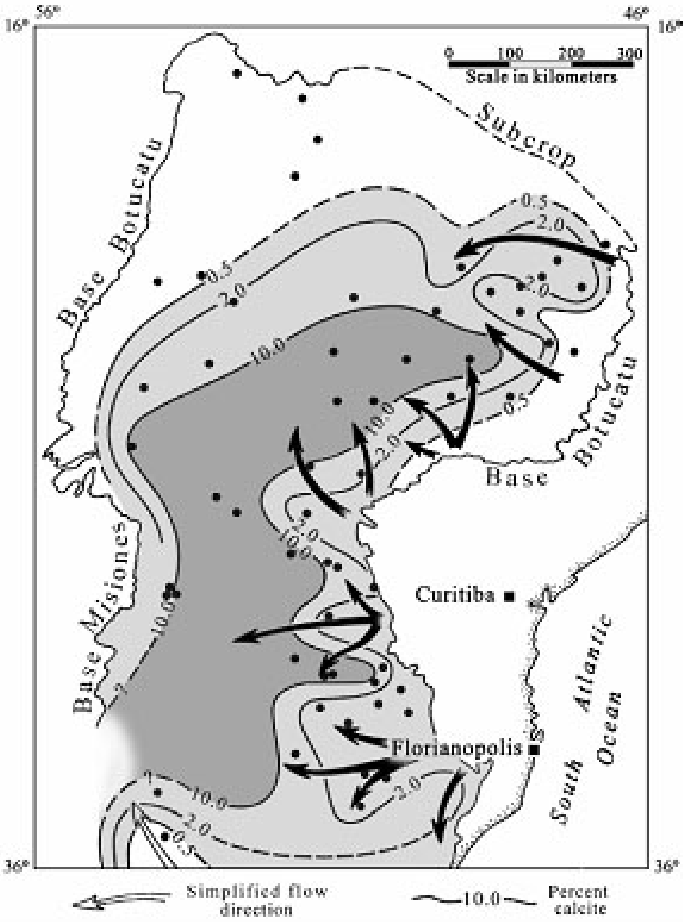
# *An example: The Botucatu Sandstone – making quartz arenites*




Remarkable penetration of fresh groundwater into deep subsurface



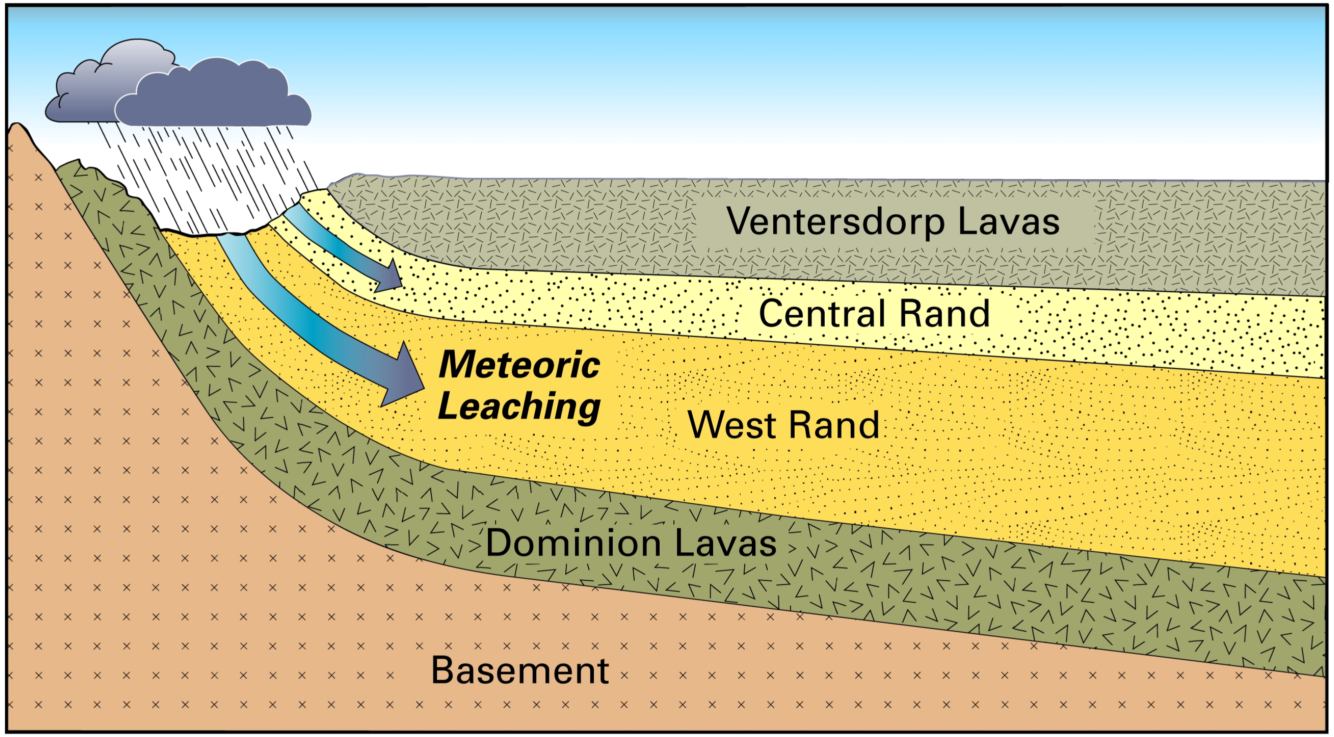
Open fabric indicates early calcite cement; hematite rims indicate desert environment




Ground water flow leaches feldspar and calcite cement from areas 100-200 km from outcrop

## *Characteristics*

- Think small – that is microscopic. Use sandstone petrology to unravel depositional and diagenetic history
- Work the whole basin – especially the subsurface
- Think outside the North Atlantic framework
- Apply locally (find groundwater supplies) and globally (what other sandstones could be like this?)



*The biggest project –*
*sands of a whole continent*

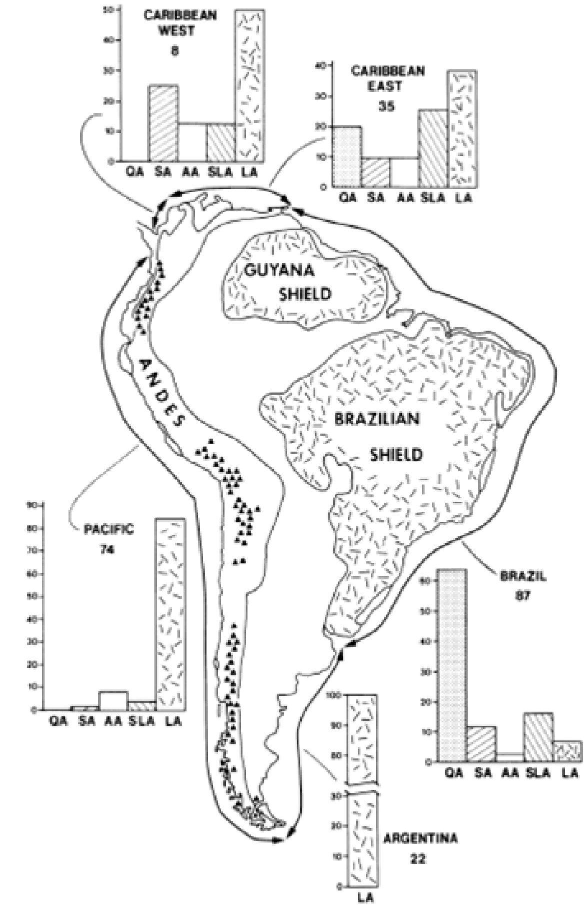
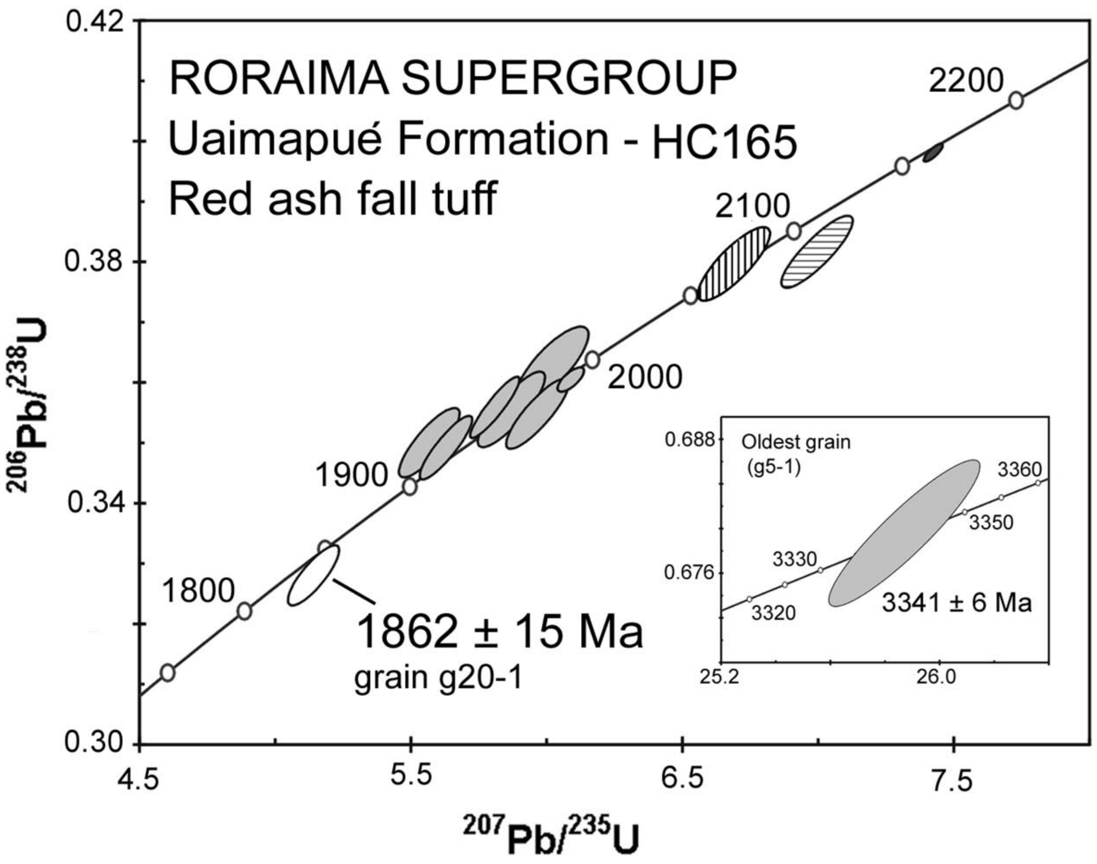


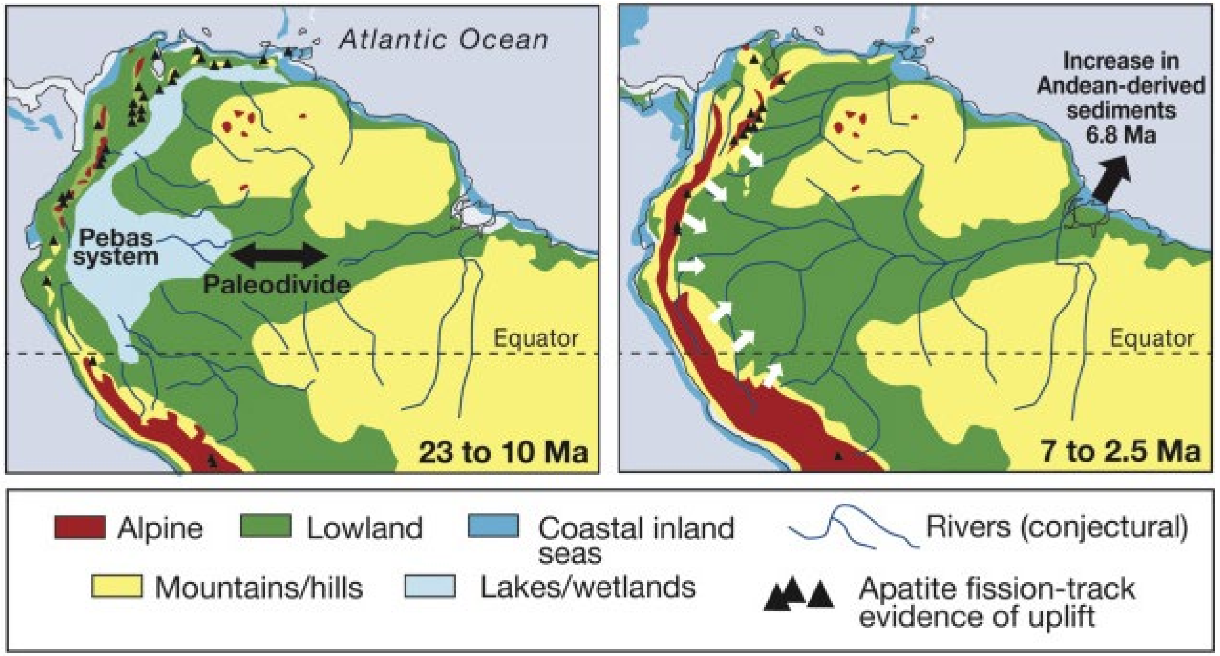

Fig. 10.—Bar graphs of petrographic types in each mineral association: AA, arkosic arenite; SA, subarkose; LA, lithic arenite; SLA, sublithic arenite; and QA, quartz arenite.

*The newest tools –*
*single-zircon ages for provenance*

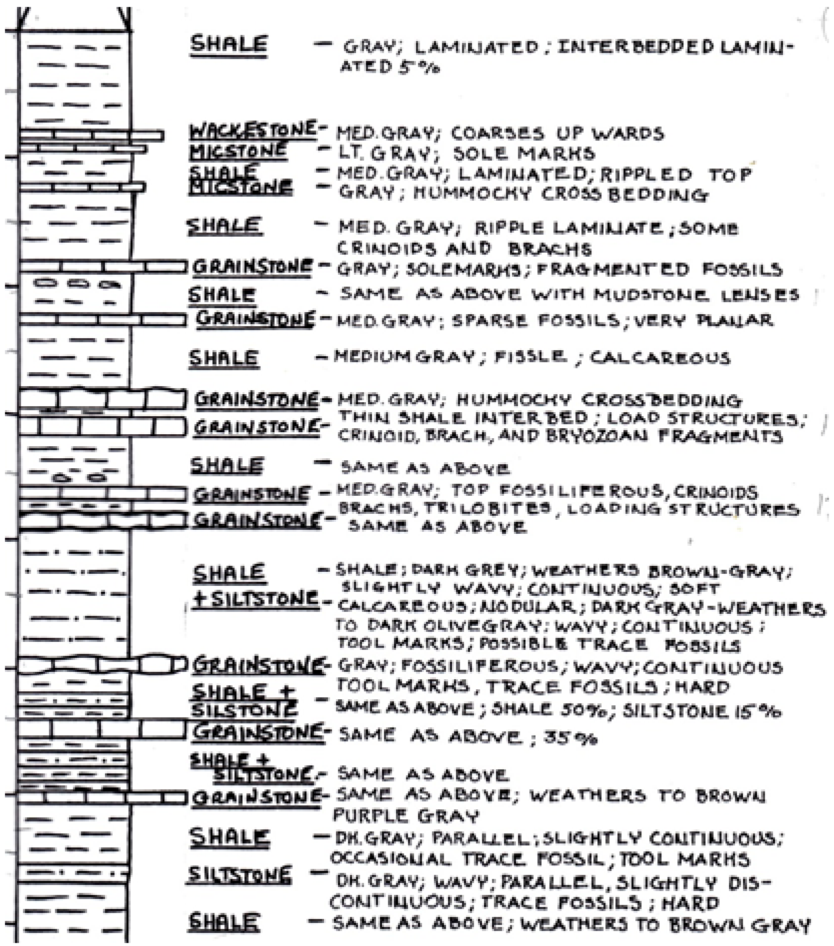


# *Return to Cincinnati 2000-2020*

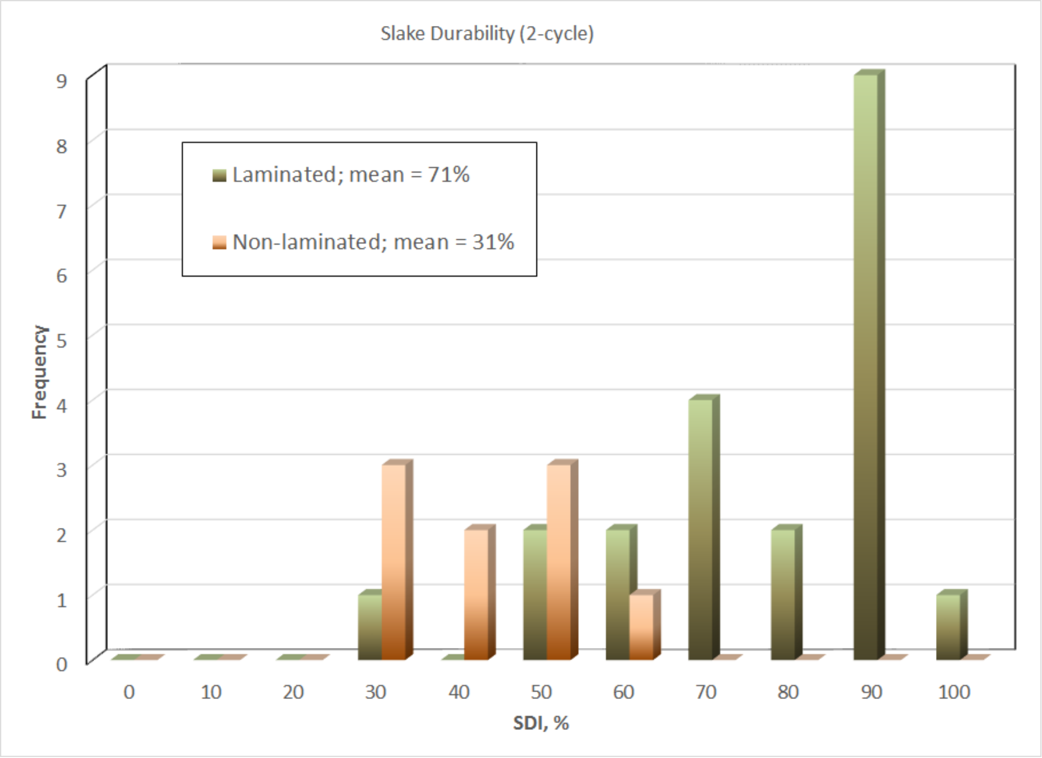

New (or renewed) directions: the Global Miocene and the Kope Formation

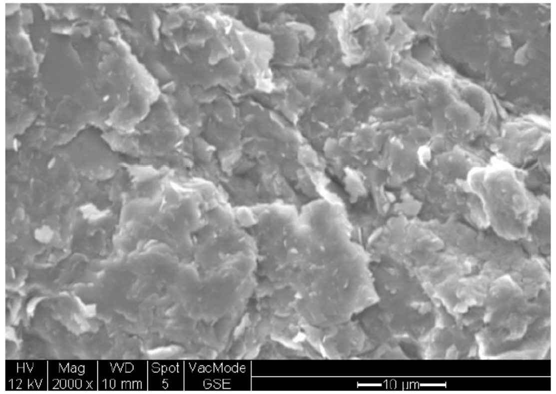



# *The troublesome Kope Fmn*

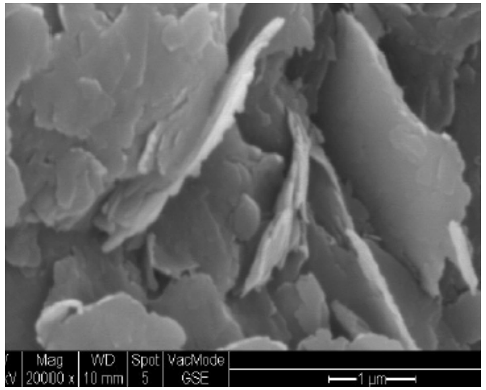



Measured section Northern KY by sedimentology class




Laminated

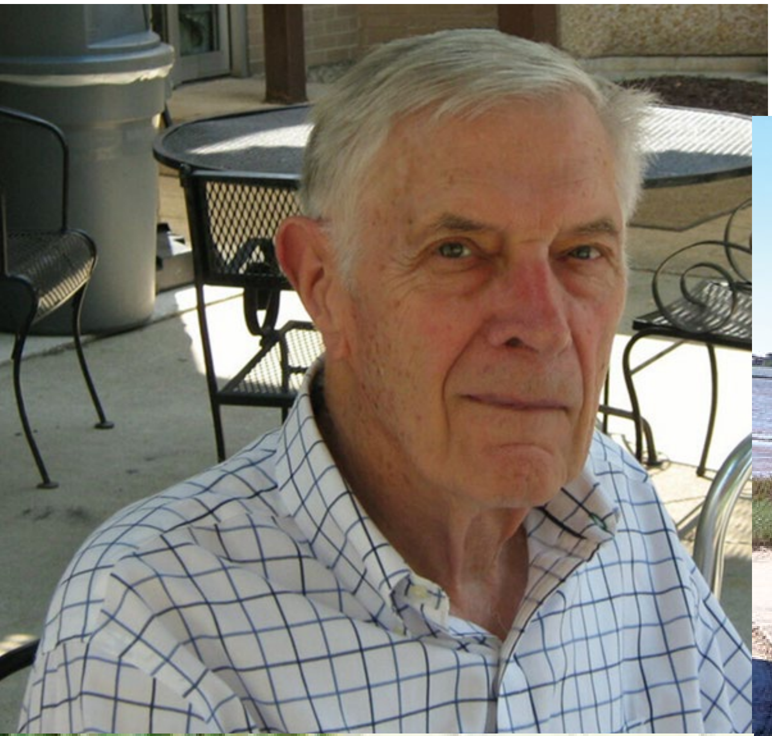



Non-laminated


***THE AAPG SIDNEY POWERS MEDAL 2016***

Mike Lewan (the Robert Berg medalist that year); Paul; Barry Maynard; and Todd Stephenson (Chief Geologist at BP North America Gas and later VP Chesapeake Energy).

Paul, Barry, and Mike are $1^{st}$, $2^{nd}$, and $3^{rd}$ generation geologists going back to Francis Pettijohn.




TABLE

With his death, the period of “romantic geology” ends, when the geologist was an adventurer through distant and unknown places, and mapping was still his main activity. A life populated by jeeps, boats, single-engine airplanes, horses and camps, that certainly new generations will not have the opportunity to know. Prof. Potter is gone, but his mark will remain for a long time in the world of geology and GEMA.  José C. Stevaux