



AAPG

Research LAUNCHER Program

About You

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Check which apply to you: Student Non Student Independent Researcher Professor Corporate Research Other

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Short Bio: (250 words or less)

As a nontraditional student I bring a variety of educational and life experiences to graduate school. I obtained my bachelor's in physics from the University of Kansas (KU), earned my private pilot's license at the age of 23, and I began studying geology as a young widow with a two-year-old son. After challenging hurdles at the University of Colorado, Denver, and Colorado School of Mines, I received my M.S. in geology and moved to Casper, Wyoming, to work for Marathon Oil Company. I worked as an exploration geologist in the Green River Basin as part of a team consisting of two geologists, a geophysicist, and a landman.

Project Description

1. Name of project Relationships of Ichnofacies and Ichnofabrics in Mississippian Carbonate and Chert Lithofacies of Southcentral Kansas and Northern Oklahoma

2. Brief synopsis/areas of geosciences or engineering (50-75 words)

My research is an ichnological study of 5-6 Mississippian mixed carbonate-siliciclastic units in cores from southern Kansas and northern Oklahoma and the development of an ichnofacies model. Several researchers have shown that trace fossils can serve as a control on fluid flow, porosity, and permeability (Pemberton and Gingras 2005, Gingras et al. 2009, Bednarz and McIlroy 2012), similar to fracture porosity that can enhance production. Porosity and permeability enhancement of bioturbated zones within cores is the focus of my research.

- 3. Bullet list of 5-7 main outcomes/goals. Results of the research will include:

- Trace fossil identification in the Mississippian strata of Kansas and Oklahoma;
- Development of an ichnofacies model;
- Tables of Porosity, Permeability, Transmissivity (PPT) data;
- Ichnofabric interpretations and the relationship to environment of deposition;
- Diagrams of three dimensional burrows;
- Maps of burrow-enhanced PPT zones.

4. In two or three sentences, describe why your research is important. Please mention who will benefit from your work.

Bioturbation in mixed carbonate-siliciclastic (MSC) strata is poorly understood (Hasiotis and Rankey 2014). This research will determine whether trace fossils enhance porosity and permeability of MSC strata, and whether similar ichnofacies models and interpretations hold true for MSC strata. Oil and gas producers working in Kansas and Oklahoma will benefit from this information since identification of the enhanced PPT ichnofacies will provide a correlation tool to assist in locating pay zones.

5. Timeline with milestones (12 month/18 month)

June 2014 – June 2015: Ichnological study of 3 cores at the Kansas Geological Survey correlating porosity and permeability with bioturbation. Field work to outcrops in southwestern Missouri and Northeastern Arkansas. Begin writing dissertation.

June 2015-June 2016: Continued ichnological study of 2–3 additional cores. Write dissertation. Present findings at appropriate scientific meetings.

6. Funding amount needed to achieve first basic goals within 12 months. Please provide a brief summary overview of your budget. List costs of 5-10 main items.

Micro CT scans	\$2,000
Thin sections	\$2,500
Minipermeameter	\$2,000
Field work w/supplies	\$1,100
Digital camera w/SD cards	\$ 510
Total	\$8,110

7. In the process of gaining background knowledge in the field of your proposed research, who did you find to be the top two or three researchers? What are the main concepts that are being explored? Please briefly describe.

The top researchers I have found are Dr. Murray K. Gingras, Dr. S. George Pemberton, and Dr. Stephen T. Hasiotis.

The main concepts being explored in my research are:

- A) Whether the ichnofacies models developed for siliciclastic strata are similar to the ichnofacies to be studied in mixed carbonate-siliciclastic strata. Several researchers have established that trace fossils can enhance porosity and permeability in reservoirs (see

Bednarz and McIlroy, 2012, Pemberton and Gingras, 2005, and others), but these studies are typically done in siliciclastic strata. Ichnology of carbonates and mixed carbonate-siliciclastic (MSC) reservoirs needs to be studied and compared to the current models, and new models should be created.

- B) Bioturbation optimally enhances PPT of MSC petroleum reservoirs (Pemberton and Gingras 2005). Open burrows near the sediment surface become filled with coarser grained sediment, followed by early and late stage diagenesis that create burrow enhanced pathways of fluid flow (Gingras et al. 2009).
- C) Trace fossils act as origination sites for the early diagenetic chertification process (Franseen 2006). This will be tested by petrographic analysis to assess the relationships of burrows, early cementation, dissolution, late cementation, and porosity creation.
- D) Subaerial exposure surfaces and the overlying karst unconformity of the Mississippian strata contain continental ichnocoenoses and paleosols (Hasiotis and Platt 2012). This hypothesis can be tested by identification of trace fossils, roots, and paleosol characteristics.

8. Please provide a photo of yourself and a photo related to your proposed project. It will be very helpful in publicizing your project and potentially securing funding. The project photo shows a mudstone in core with *Phycosiphon* burrows, the fine black dots and lines surrounded by lighter halos. *Planolites* burrows may also be seen.

9. Who will benefit? The oil and gas exploration and production companies working in southern Kansas and Oklahoma will benefit from this research, by having ichnofacies models to correlate to the standard facies models used in planning wells. In the larger picture, this research will add to the body of knowledge in ichnology by providing an ichnofacies model in mixed carbonate-siliciclastic strata.

AAPG Research LAUNCHER supporters receive

The opportunity to work directly with you and receive reports, information, and findings, depending on the level of support.

The Deal

The researcher agrees to:

- ❖ Develop a brief public presentation on the research to be made available to AAPG
- ❖ Share an annotated bibliography and review of relevant published articles
- ❖ Present research findings on project at an AAPG Forum, GTW, or Research Symposium
- ❖ Write a detailed report on the results of your research to be made available to LAUNCHER supporters
- ❖ Write an extended abstract on the results of your research to be made available to AAPG

Thank you for submitting your research proposal to the AAPG Research LAUNCHER Program. Your proposal will be reviewed and upon acceptance you will be contacted by AAPG Education/Research. If your proposal is accepted, we will publicize your proposal and encourage funders to contact you directly. AAPG does not guarantee funds nor have any connection with the success or failure of the endeavor. The goal is to support scientific research in the petroleum geosciences and engineering and launch the next generation of geological advances.

Rebecca C. Dorward
Research Candidate (print)

June 14, 2014
Date

AAPG Education/Research (print) Date

Rebecca C. Dorward
Research Candidate (sign)

6-14-14
Date

AAPG Education/Research (sign) Date

AAPG Education/Research

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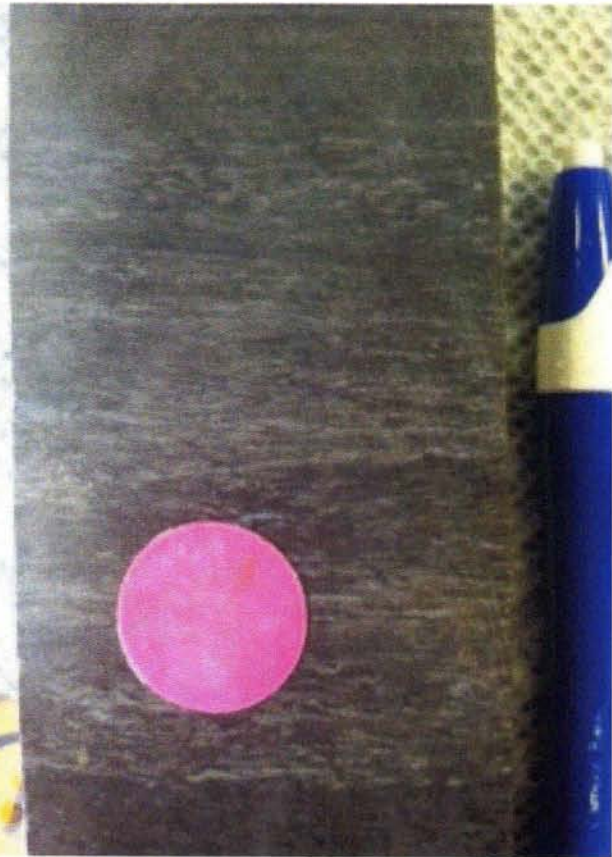
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- Hasiotis, S.T., and Platt, B.F., 2012, Exploring the sedimentary, pedogenic, and hydrologic factors that control the occurrence and role of bioturbation in soil formation and horizonation in continental deposits: An integrative approach, SEPM, The Sedimentary Record, v. 10, no. 3, p. 3–9.
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- Gingras, M., Pemberton, G., Henk, F., MacEachern, J., Mendoza, C., Rostron, B., O'Hare, R., Spila, M., and Konhouser, K., 2009, Applications of Ichnology to Fluid and Gas Production in Hydrocarbon Reservoirs, SEPM Applied Ichnology, p. 131–145.
- Pemberton, S.G., and Gingras, M.K., 2005, Classification and characterizations of biogenically enhanced permeability, AAPG Bulletin, v. 89, no. 11, p. 1493–1517.



A Rebecca Dorward photo.



B Core example from study area showing *Phycosiphon* burrows, the small black pin pricks and 1 mm size lines surrounded by light silt sized halos. These trace fossil halos have been shown to have increased porosity and permeability compared to the matrix.