

Oil & Natural Gas Technology

DOE Award No.: DE-FE0010667

Research Performance Progress Report

Quarterly Report: July 2016 to September 2016

Liquid-Rich Shale Potential of Utah's Uinta and Paradox Basins: Reservoir Characterization and Development Optimization

Project period: October 1, 2012 to September 30, 2015 (extended to March 31, 2017)



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A handwritten signature in black ink, appearing to read "Michael D. Vanden Berg".

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Office of Fossil Energy



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EXECUTIVE SUMMARY

As the project progresses into its second no-cost extension, several different research activities are still on track to help better characterize Utah's tight oil plays. Core analysis, outcrop examination, and regional mapping activities are helping to create a clearer understanding of the Uteland Butte tight oil play, and several research projects on the Cane Creek shale are nearing completion. Another 6-month no-cost extension, which was approved by DOE, was requested to give graduate students working on the project a little more time to finalize their theses. This changes the project ending date to March 31, 2017.

Technology transfer remains a vital tool for communicating the project results with interested stakeholders. Two project-related oral presentations were accepted for the AAPG Rocky Mountain and Pacific Section meeting, which was held in Las Vegas, Nevada, in early October 2016. In addition, a major paper on the Uteland Butte portion of the project was published as a Utah Geological Survey (UGS) open-file report in August.

PROGRESS, RESULTS, AND DISCUSSION

Task 1.0: Project Management Plan

During July 2016, the PI wrote and submitted the project's 15th quarterly report for April to June 2016. This report was subsequently sent via email to all interested parties and posted on the UGS project website.

Task 2.0: Technology Transfer

- The UGS project website was updated with new information:
http://geology.utah.gov/emp/shale_oil
- The PI completed the 15th quarterly report and emailed it to all interested parties. The report is also available on the UGS project website.
- Publication on Uteland Butte member:
 - Logan, S.K., Sarg, J.F., and Vanden Berg, M.D., 2016, Lithofacies, Deposition, Early Diagenesis, and Porosity of the Uteland Butte Member, Green River Formation, Eastern Uinta Basin, Utah and Colorado: UGS Open-File Report 652.
 - This publication is available on the UGS project website:
http://ugspub.nr.utah.gov/publications/open_file_reports/ofr-652.pdf
- Two project-related abstracts were accepted for presentation at the AAPG Rocky Mountain and Pacific Section meeting, held in Las Vegas, Nevada, in early October 2016.
 - Rueda, F., Vanden Berg, M.D., and Machel, H.G. – Origin of Petroliferous Dolomitic Beds in the Uteland Butte Member, Lower Green River Formation, Uinta Basin, Utah.
 - Birdwell, J.E. (USGS), Vanden Berg, M.D., Johnson, R.C. (USGS), and Boehlke, A.R. (USGS) – Geochemistry and Mineralogy of the Uteland Butte Member of the Green River Formation, Uinta Basin, Utah.

Tasks 3.0 and 4.0: Data Compilation and Core-Based Geologic Analysis

Uteland Butte member: Various projects are still underway on the Uinta Basin portion of the project. A paper by Dr. Rick Sarg and Katie Logan (M.S. student), with the PI as third author, on the eastern outcrops of the Uteland Butte has been published (UGS Open File Report 652). Our collaboration with U.S. Geological Survey (USGS) is ongoing. Recently, USGS researchers extensively sampled several Uteland Butte cores for detailed mineralogy and organic geochemistry analyses (the subject of an oral presentation at the 2016 AAPG-RMS/PS meeting). For example, figure 1 displays the core description for the Uteland Butte portion of the Petes Wash U 13-06 GR core, including high resolution organic

geochemistry data. Figure 2 shows a preliminary interpretation of these data that includes a mix of kerogen types, but mostly oil prone type I or II (figure 2a, b, and c), which ranges from immature to being in the oil window (figure 2b, c, and d). Research at the University of Alberta is ongoing, including detailed thin section petrography and mineralogy focused on the dolomites of the Uteland Butte (also the subject of an oral presentation at the 2016 AAPG-RMS/PS meeting). Over the duration of the no-cost extension, the PI will work to finalize all core descriptions, regional mapping, and facies analyses and synthesize collaborator research into a comprehensive final report.

Cane Creek shale: Research on the Cane Creek shale in the Paradox Basin is essentially finished and the focus has shifted to preparing a comprehensive final report.

Task 5.0: Outcrop Examination and Characterization – Uinta Basin

An important collaboration was set up with Dr. Rick Sarg, prominent carbonate geologist at the Colorado School of Mines (CSM). UGS partially funded a CSM graduate student, S. Katie Logan, to research the Uteland Butte on the eastern side of the Uinta Basin. Logan measured several Wasatch-Green River-transition outcrop sections on the western flank of the Douglas Creek arch and compared them to the Anadarko Uteland Butte cores from the Natural Buttes gas field. A publication based on her thesis was published in August 2016 (UGS Open-Field Report 652).

Task 6.0: Well Completion Optimization

Research is ongoing and will continue throughout the no-cost extension.

CONCLUSION

The PI recently requested an additional 6-month no-cost extension, which was approved by DOE, to give graduate students working on the project more time to finish their theses. This changes the project ending date to March 31, 2017. The PI and other UGS geologists are currently finalizing research tasks and synthesizing collaborator research into a comprehensive final report. In addition, several project team members continue to share their results at regional and national meetings.

Well name: **Petes Wash U 13-06 GR** (4301333203)

Operator: EOG Resources

Location: T10S, R16E, Sec. 6, Duchesne County, UTM E 570985, UTM N 4425749

Cored interval: 5524-5645 ft (core shifted up ~4.6 ft to match logs)

Core location: Utah Core Research Center, Salt Lake City

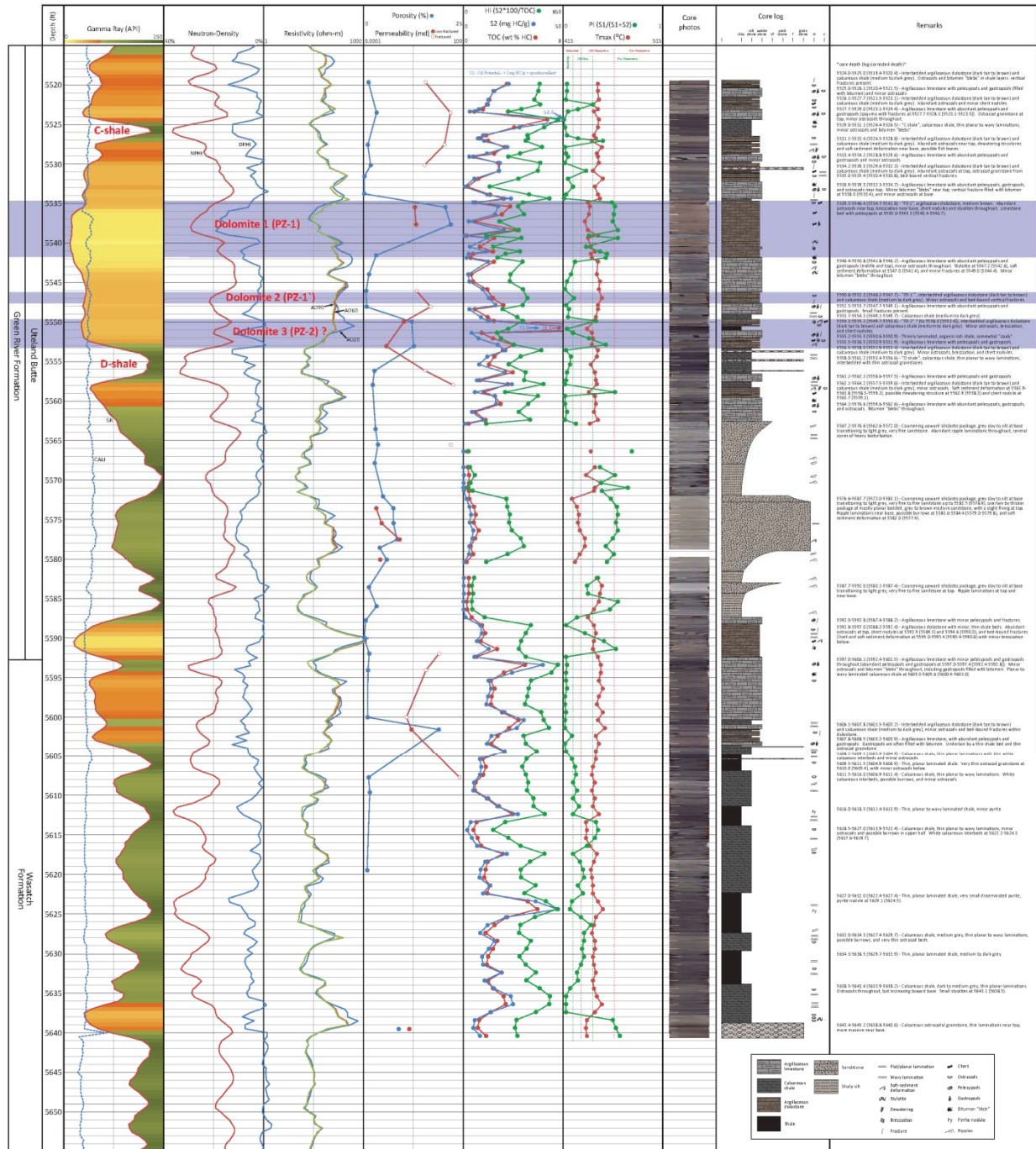


Figure 1. Petes Wash U 13-06 GR core description and related data.

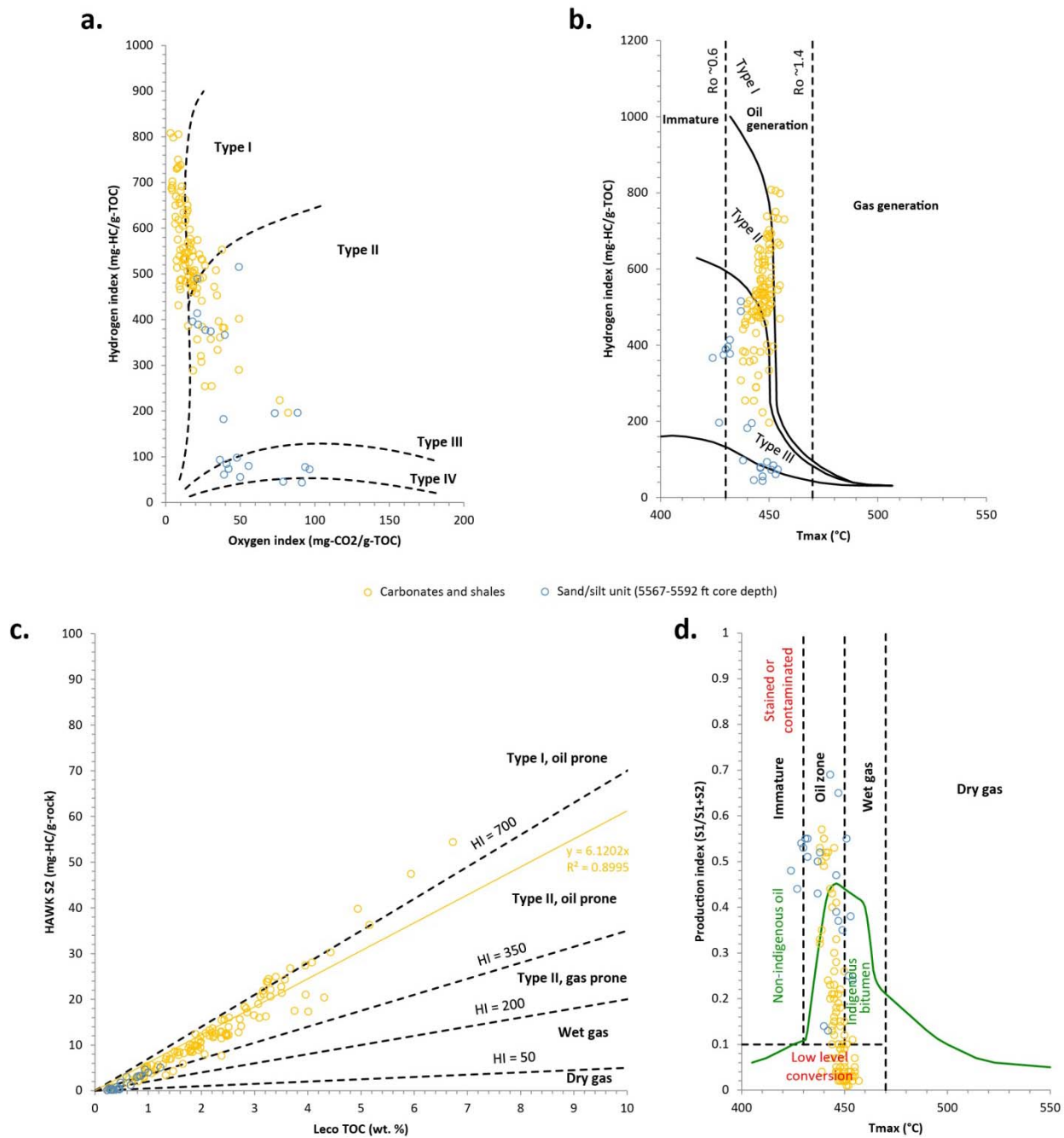


Figure 2. High resolution organic geochemistry data from the Uteland Butte portion of the Petes Wash U 13-06 GR core.

COST STATUS

Table 1. Project costing profile for 1.5-year no-cost extension.

	Jul 2016		Aug 2016		Sep 2016	
	Plan	Actual	Plan	Actual	Plan	Actual
UGS-personnel		\$1,253		\$1,682		\$593
Travel Expenses ¹						\$721
Analyses						
Miscellaneous ²				\$42		
SUBTOTALS		\$1,253		\$1,725		\$1,314
UGS OVERHEAD (34.44%)		\$432		\$594		\$452
SUBCONTRACTS						
EGI				\$7,576		
Eby						
CSM						
EGI - Moore						
U. of Alberta						
GRAND TOTALS		\$1,685		\$9,895		\$1,766

¹Sep – AAPG-RMS/PS in Las Vegas and some minor in-state travel

²Aug – Shipping charges

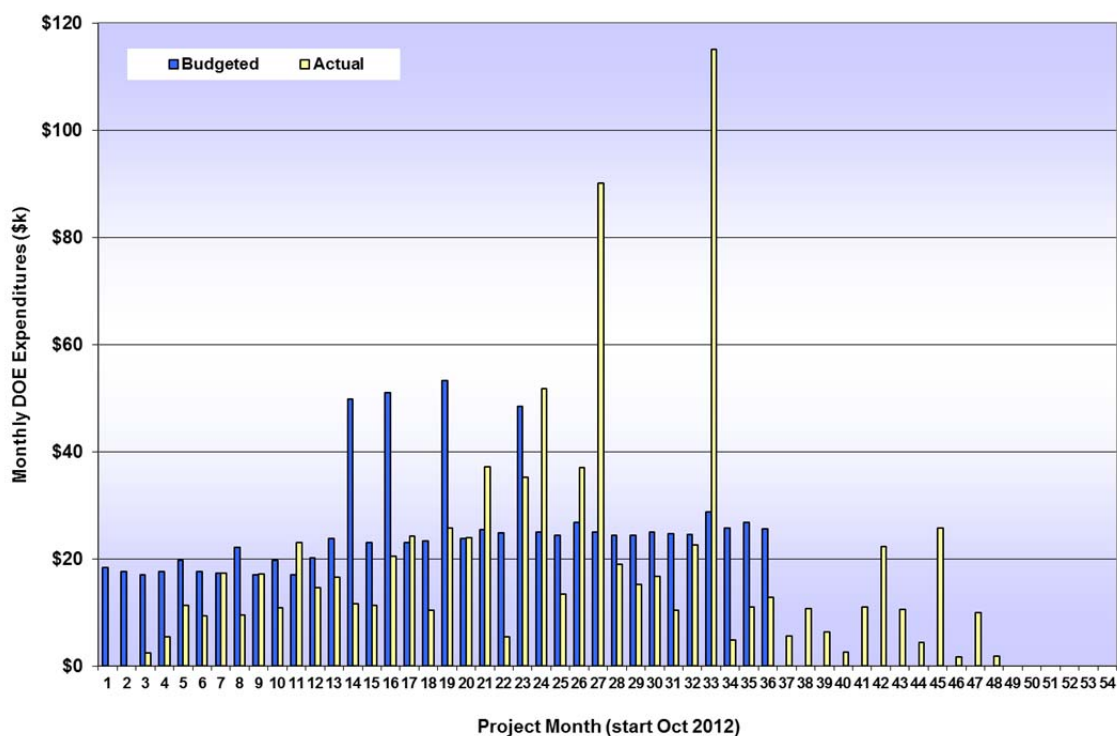


Figure 3. Project costing profile.

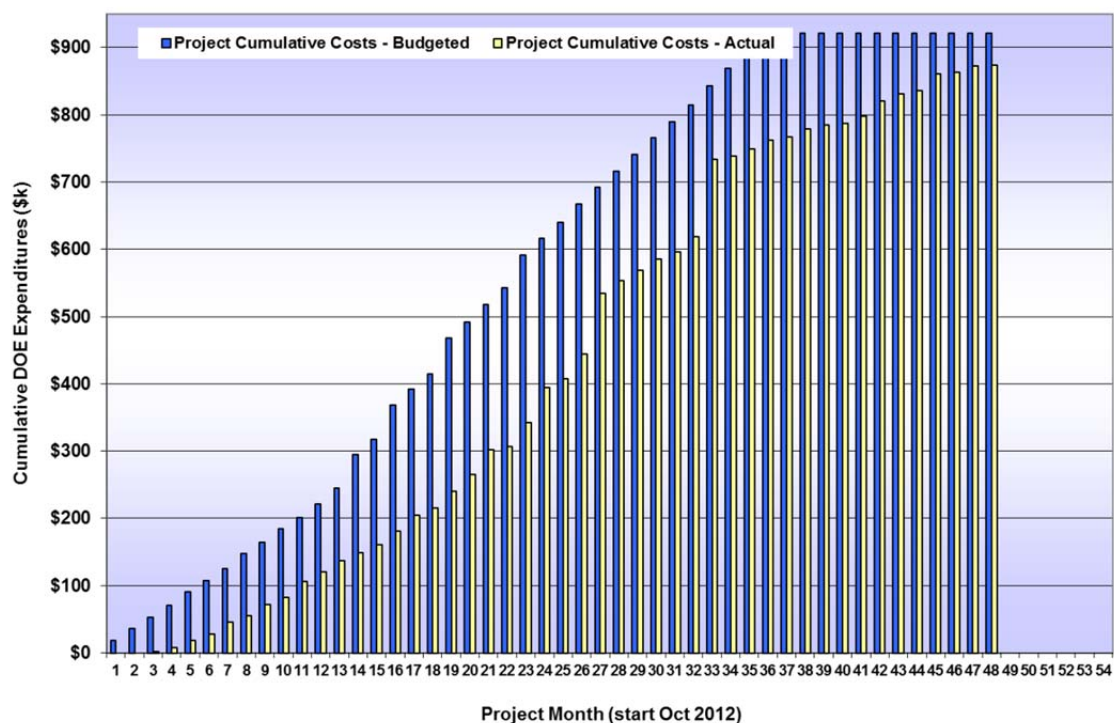


Figure 4. Project cumulative costs.

MILESTONE STATUS

Table 2. Milestone log for 1.5-year no-cost extension

	Title	Related task or subtask	Completion Date	Update/comments
Milestone 32	Quarterly updates of website	Subtask 2.1	Quarterly	Ongoing, 1.5-year extension
Milestone 33	Quarterly reports	Subtask 2.2	Quarterly	Ongoing, 1.5-year extension
Milestone 34	Profiles of mechanical stratigraphy	Subtask 6.5	31-Mar-15	Ongoing, 1.5-year extension
Milestone 35	Regional correlation and mapping	Subtask 7.1	31-Mar-15	Ongoing, 1.5-year extension
Milestone 36	Regional cross sections	Subtask 7.2	31-Mar-15	Ongoing, 1.5-year extension
Milestone 37	Sweet spot maps	Subtask 7.3	31-Mar-15	Ongoing, 1.5-year extension
Milestone 38	Technical presentations at National AAPG	Subtask 2.4 & 5	Apr-15	2 abstracts accepted to RMS/PS AAPG 2016 (early October)
Milestone 39	Core workshop and/or field trip	Subtask 2.7	Jul-15	Delayed until winter 2017
Milestone 40	Locating completions	Subtask 6.4	30-Sep-15	Ongoing, 1.5-year extension
Milestone 41	Stimulation diagnostics modeling	Subtask 6.6	30-Sep-15	Ongoing, 1.5-year extension
Milestone 42	Reservoir simulations/stimulation locating	Subtask 6.7	30-Sep-15	Ongoing, 1.5-year extension
Milestone 43	Final publications	Subtask 2.6	30-Sep-15	1.5-year extension
Milestone 44	Final interpretation	Task 8	30-Sep-15	1.5-year extension

ACCOMPLISHMENTS

- Publication now available:
 - Logan, S.K., Sarg, J.F., and Vanden Berg, M.D., 2016, Lithofacies, Deposition, Early Diagenesis, and Porosity of the Uteland Butte Member, Green River Formation, Eastern Uinta Basin, Utah and Colorado: UGS Open-File Report 652.
 - http://ugspub.nr.utah.gov/publications/open_file_reports/ofr-652.pdf
- Two publications are currently “in press” and should be published soon:
 - Birdwell, J., Vanden Berg, M.D., Johnson, R.C., Mercier, T.J., Boehlke, A.R., and Brownfield, M.E., in press, Geological, Geochemical, and Reservoir Characterization of the Uteland Butte Member of the Green River Formation, Uinta Basin, Utah, *in* Dolan, M.P., Higley, D.K., and Lillis, P.G., editors, Hydrocarbon Source Rocks in Unconventional Plays, Rocky Mountain Region: Rocky Mountain Association of Geologists (due out November 2016).
 - Chidsey, T.C., and Eby, D.E., in press, Potential Oil-Prone Areas in the Cane Creek Shale Play, Paradox Basin, Utah, Identified by Epifluorescence Microscopy Techniques: UGS Special Study. (due out in fall 2016)
- Two project-related abstracts were accepted to the joint AAPG Rocky Mountain and Pacific Section meeting, held in Las Vegas, Nevada, in early October 2016 (see titles below).

PROBLEMS OR DELAYS

The project has now completed the original one-year no-cost extension and has started a second six-month extension, which will end the project in March 2017. This second extension is mostly to give graduate students working on the project enough time to finish and publish their research. The PI did not project expenditures for each month of the extensions, but sufficient funds remain to support the project through March 2017. The project is currently 93.9% of total budget.

PRODUCTS AND TECHNOLOGY TRANSFER ACTIVITIES

- Project website
 - The project website has been updated with new reports and abstracts.
 - http://geology.utah.gov/emp/shale_oil
- Quarterly Report – April to June 2016
 - Completed late July and is available on the project website.
- Publication:
 - Logan, S.K., Sarg, J.F., and Vanden Berg, M.D., 2016, Lithofacies, Deposition, Early Diagenesis, and Porosity of the Uteland Butte Member, Green River Formation, Eastern Uinta Basin, Utah and Colorado: UGS Open-File Report 652.
 - This publication is available on the UGS project website:
http://ugspub.nr.utah.gov/publications/open_file_reports/ofr-652.pdf
- Abstracts – Two project-related abstracts were accepted for presentation at the AAPG Rocky Mountain and Pacific Section meeting, held in Las Vegas, Nevada, October 2-5, 2016.
 - Rueda, F., Vanden Berg, M.D., and Machel, H.G. – Origin of Petroliferous Dolomitic Beds in the Uteland Butte Member, Lower Green River Formation, Uinta Basin, Utah.
 - Birdwell, J.E. (USGS), Vanden Berg, M.D., Johnson, R.C. (USGS), and Boehlke, A.R. (USGS) – Geochemistry and Mineralogy of the Uteland Butte Member of the Green River Formation, Uinta Basin, Utah.
 - Both abstracts have been posted on the UGS project website.

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