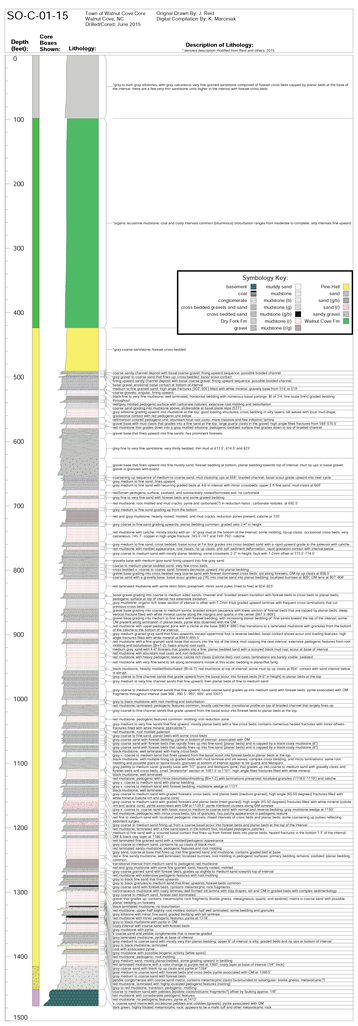
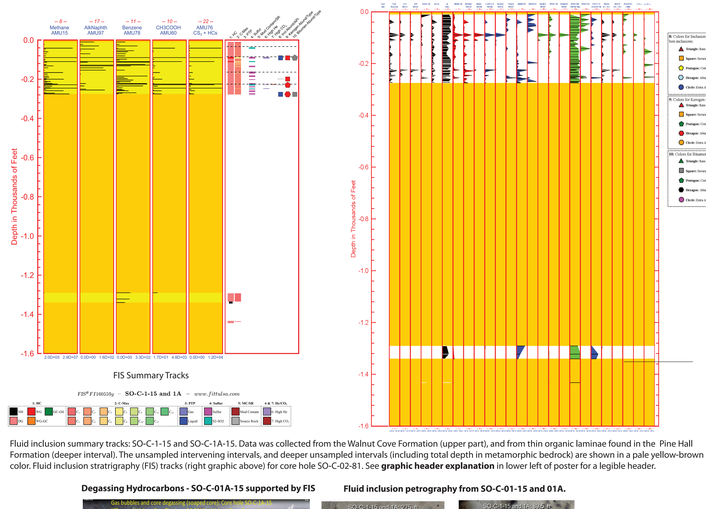
Confirmation of hydrocarbon shows and helium in the Walnut Cove Formation: Triassic rift / lacustrine Dan River basin (Stokes and Rockingham counties), North Carolina -- A potential new helium province in the Eastern United States?

North Carolina Geological Survey
Open-File Report 2018-01





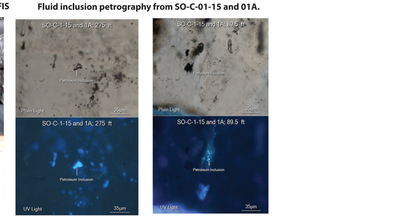
This table summarizes the fluid inclusion petrography from core holes SO-C-01-15 and SO-C-01A-15 (Town of Walnut Cove), Stokes Co., NC.

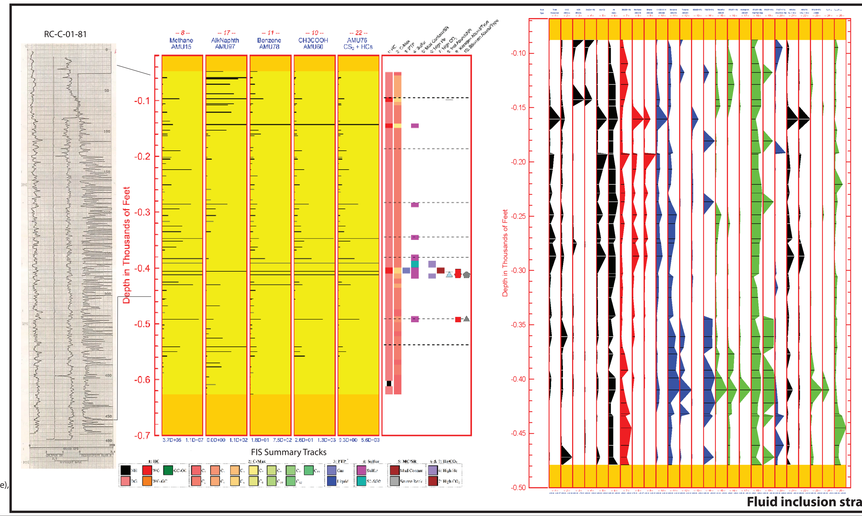
Fluid inclusion summary tracks: SO-C-1-15 and SO-C-1A-15. Data was collected from the Walnut Cove Formation (upper part), and from thin organic laminae found in the Pine Hall Formation (deeper interval). The unsampled intervening intervals, and deeper unsampled intervals (including total depth in metamorphic bedrock) are shown in a pale yellow-brown color. Fluid inclusion stratrigraphy (FIS) tracks (right graphic above) for core hole SO-C-02-81. See **graphic header explanation** in lower left of poster for a legible header.

Degassing Hydrocarbons - SO-C-01A-15 supported by FIS

Fluid inclusion stratigraphy (FIS) results: Core hole SO-C-01-15

Fluid inclusion petrography from SO-C-01-15 and 01A.





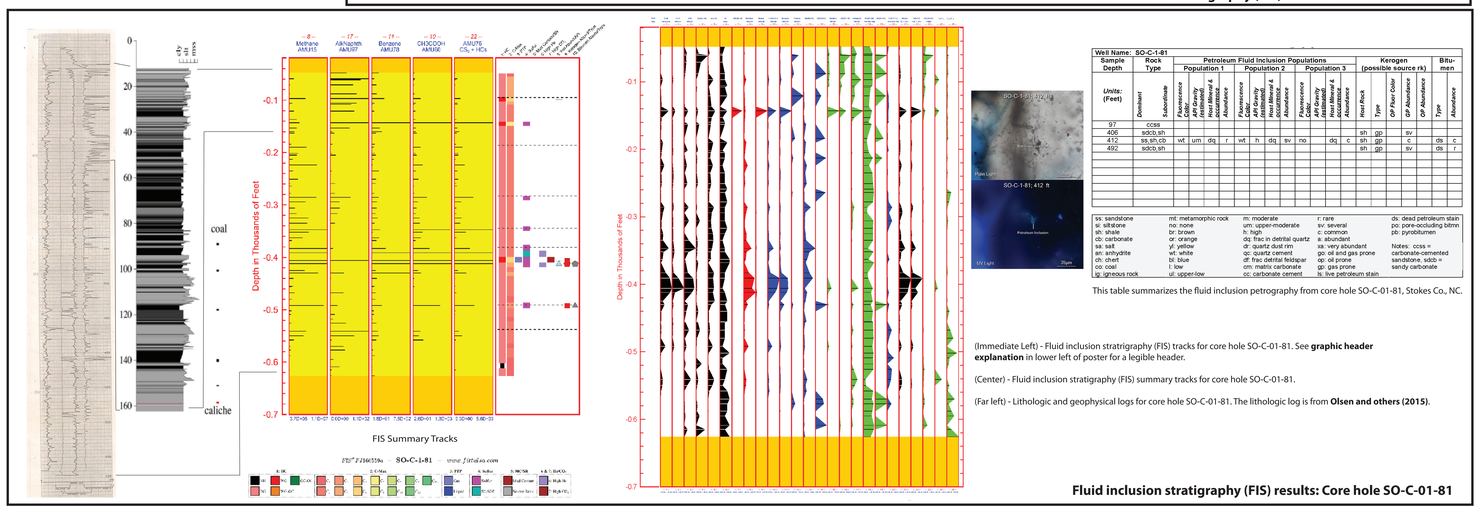
(Above) - This table summarizes the fluid inclusion petrography from core hole RC-C-01-81 Rockingham Co., NC.

(Immediate Left) - Fluid inclusion stratrigraphy (FIS) tracks for core hole RC-C-01-81. See **graphic header explanation** in lower left of poster for a legible header.

(Center) - Fluid inclusion stratigraphy (FIS) summary tracks for core hole RC-C-01-81.

(Far left) - Geophysical log for core hole RC-C-01-81.

Fluid inclusion stratigraphy (FIS) results: Core hole RC-C-01-81



(Immediate Left) - Fluid inclusion stratrigraphy (FIS) tracks for core hole SO-C-01-81. See **graphic header explanation** in lower left of poster for a legible header.

(Center) - Fluid inclusion stratigraphy (FIS) summary tracks for core hole SO-C-01-81.

(Far left) - Lithologic and geophysical logs for core hole SO-C-01-81. The lithologic log is from **Olsen and others (2015)**.

This table summarizes the fluid inclusion petrography from core hole SO-C-01-81, Stokes Co., NC.

Fluid inclusion stratigraphy (FIS) results: Core hole SO-C-01-81

Graphic header explanation

The following table provides readible headers for the columns of the second graphic panel for the FIS data:

Rock	Total	CO2	H2S	34/(34+15)	4/(4+2)	Air	30/(30+15)	Methane	Ethane	CH3COOH	Benzine	Toluene	60/(60+57)	78/(78+95)	Paraffins	57/(57+17)	AlkNaphth	57/(57+55)	97/(97+91)	77/(77+71)	AMU64	AMU76	97/(15+97)	C5 - C13	C6-13/C1-5
Type	Response	AMU44	AMU34			index		AMU15	AMU30	AMU60	AMU78	AMU91			AMU57		AMU97			Arm/Arm+Par					
	--1--	--2--	--3--		--4--	--5--	--6--	--7--	--8--	--9--	--10--	--11--	--12--	--13--	--14--	--15--	--16--	--17--	--18--	--19--	--20--	--21--	--22--	--23--	--24--	--25--

Conclusions

Fluid inclusion stratigraphy (FIS) of the Walnut Cove Formation, Dan River basin, confirms the presence of light hydrocarbons and helium from four cores along about 20 strike miles of the formation's outcrop. GCMS data are complemented by photomicrographs that document petroleum inclusions.

FIS document light hydrocarbons from organic-rich laminations near the base of the underlying Pine Hall Formation, a dominantly clastic unit. The light hydrocarbons may indicate the potential for basin center gas.

The presence of helium is now documented in two Triassic rift basins with lacustrine strata in North Carolina. The Deep River basin is the second Triassic rift basin where helium concentration has been measured in two shut-in wells and comprehensive noble gas and their stable isotope ratios have been determined (**Reid and others, 2015a**). The noble gas stable isotopes constrain the helium's origin to an upper crustal origin.

The two Triassic rift basins with documented helium may indicate an emerging helium province in the Triassic rift basins of the Eastern United States. Further analyses in other Triassic rift basins in the Eastern United States is required to test this hypothesis.

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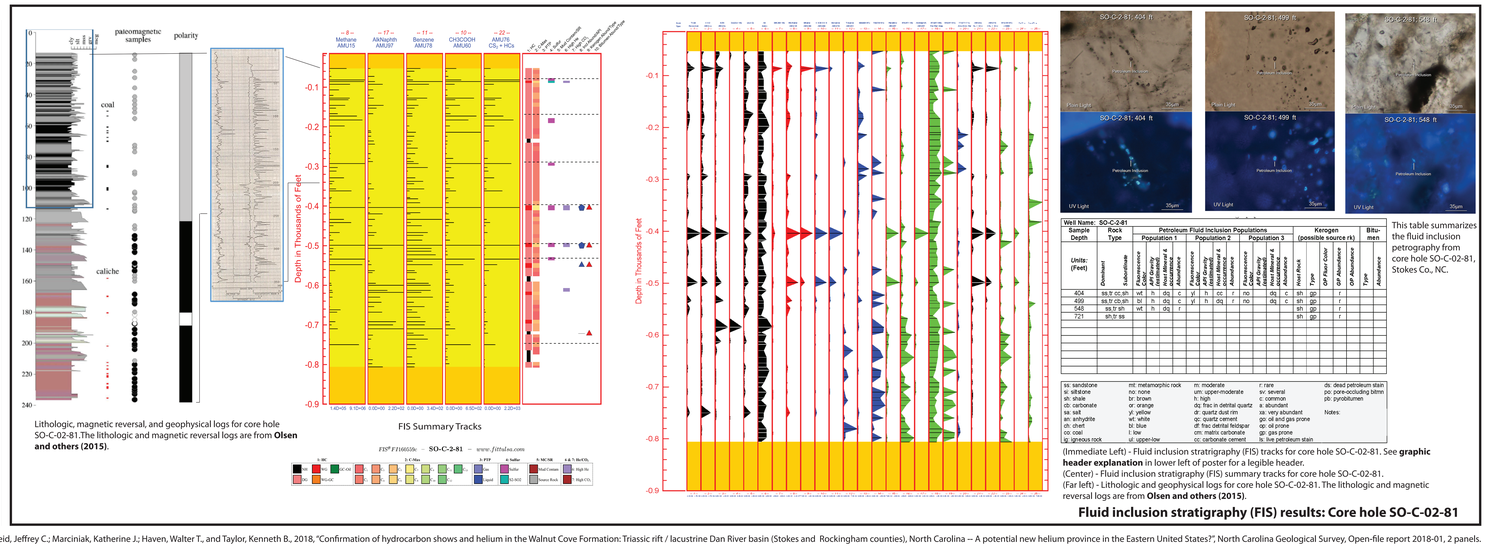
Ryan A. Channell, Ann T. Shields and Chandler I. Warner assisted with field sample collection and retrieval of samples from the North Carolina Geological Survey's core repository and in aspects of the 2015 core drilling. Ann T. Shields prepared many of the core photographs. Funding for the drilling was provided by the North Carolina General Assembly (FY 2014-15) as part of appropriations to undertake additional geological studies of the Dan River basin. Contact the State Geologist, North Carolina Geological Survey to make arrangements to view the core.

We thank the Commissioners of the Town of Walnut Cove, North Carolina, for permission to drill this stratigraphic core hole on city property. Mr. Monty Stevens, former Town Manager, was our primary point of contact with Town of Walnut Cove and his professionalism and assistance is much appreciated.

Mr. Orus F. Patterson III, Patterson Exploration Services, Inc., Sanford, N.C., was the drilling contractor. Core holes SO-C-01-15 and SO-C-01A-15 were drilled by Ruben Drilling Inc. in June 2015.



Lithologic, magnetic reversal, and geophysical logs for core hole SO-C-02-81.The lithologic and magnetic reversal logs are from **Olsen and others (2015)**.

(Immediate Left) - Fluid inclusion stratrigraphy (FIS) tracks for core hole SO-C-02-81. See **graphic header explanation** in lower left of poster for a legible header.

(Center) - Fluid inclusion stratigraphy (FIS) summary tracks for core hole SO-C-02-81.

(Far left) - Lithologic and geophysical logs for core hole SO-C-02-81. The lithologic and magnetic reversal logs are from **Olsen and others (2015)**.

This table summarizes the fluid inclusion petrography from core hole SO-C-02-81, Stokes Co., NC.

Fluid inclusion stratigraphy (FIS) results: Core hole SO-C-02-81

Suggested citation: Reid, Jeffrey C.; Marciniak, Katherine J.; Haven, Walter T., and Taylor, Kenneth B., 2018, "Confirmation of hydrocarbon shows and helium in the Walnut Cove Formation: Triassic rift / lacustrine Dan River basin (Stokes and Rockingham counties), North Carolina -- A potential new helium province in the Eastern United States?", North Carolina Geological Survey, Open-file report 2018-01, 2 panels.