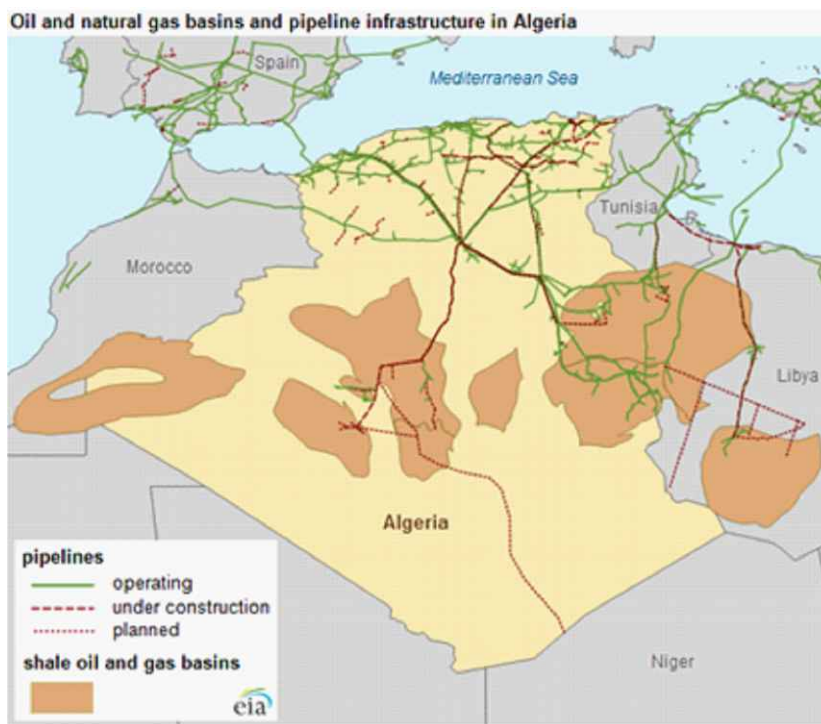


# EASTERN ALGERIA PROJECT

## Prospect Evaluation for Hybrid Shale and Conventional Reservoirs - 2020

### Proposal

The Canesis Data Eastern Algerian Project is proposed to develop drill sites to exploit the Shales and Conventional Reservoirs over the Ghadames/Berkine and Illizi Basins. The Project area is broken into two parts: an initial evaluation area in the southern Berkine and northern Illizi Basins. This evaluation will be centered on the organic Famennian, Frasnian, and Givetian shales and associated conventional sand reservoirs. The evaluation is intended to develop drill sites from geologic, geophysical, and geochemical data. With the completion of the initial evaluation area, it is proposed to expand the area to encompass client's areas of interest using Canesis extensive seismic and well data. The shale targets offer a thick section with excellent gas saturations and cover extensive areas. These shales are very comparable to the American shale plays.



### Project Objective

The Project will be carried out using Canesis extensive Algeria datasets together with the experience of a shales expert in order to develop potential drill sites. The initial shale test wells could be placed to maximize the potential of finding excellent conventional sand reservoirs in the Devonian and Silurian sections. Proper placement could reduce the well risk by 50% based on previous drilling and interpretations.

## Shale Reserves

(EIA - Technically Recoverable Shale Oil and Shale Gas Resources: Algeria, September 2015)

### Ghadames/Berkine

Upper Devonian

Frasnian

8,000 – 10,500	35.4 BCFG/sq. mi.	Gas/Condensate
9,000 – 10,000	111.4 BCFG/sq.mi.	Gas/Condensate
10,000 – 16,000	133.9 BCFG/sq.mi.	Dry Gas

Tannezu

10,000 – 14,500	42.9 BCFG/sq.mi.	Gas/Condensate
11,000 – 16,000	54.5 BCFG/sq.mi.	Dry Gas

(Note: The potential in the Famennian and Givetian Shales are not included)

### Illizi Basin

Tannezu

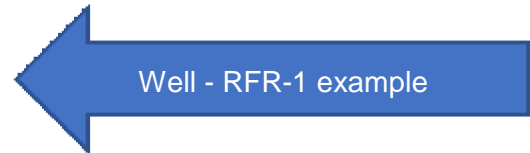
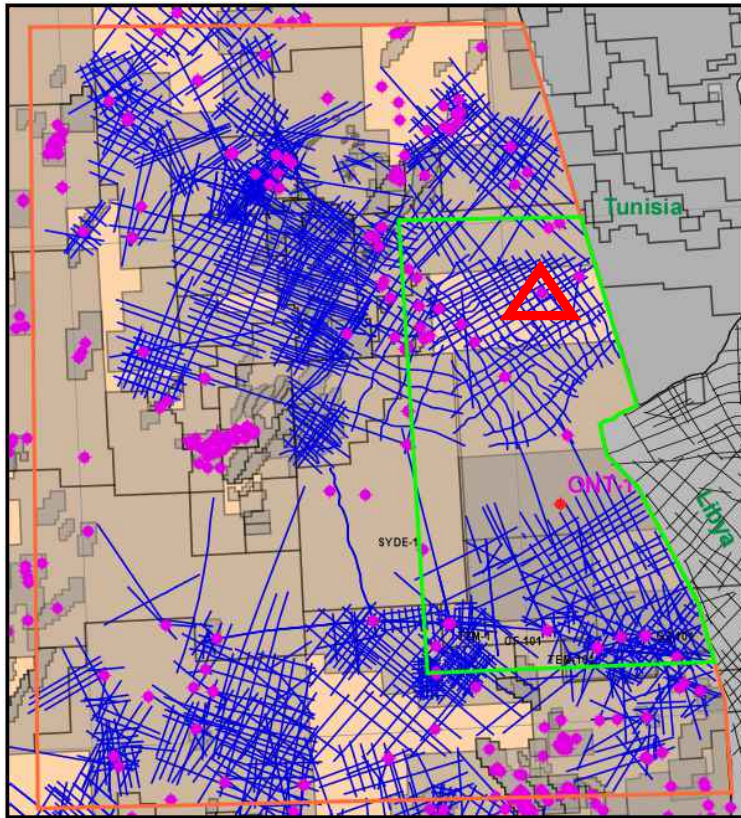
3,300 – 8,000	50.9 BCFG/sq.mi.
3,300 – 8,000	60.7 BCFG/sq.mi.

Shale Gas Reservoir Properties and Resources of Algeria.

Basic Data	Basin/Gross Area		Ghadames/Berkine (117,000 mi <sup>2</sup> )				Illizi (44,900 mi <sup>2</sup> )		
	Shale Formation		Frasnian			Tannezuft			
	Geologic Age		U. Devonian			Silurian			
	Depositional Environment		Marine			Marine			
Physical Extent	Prospective Area (mi <sup>2</sup> )		2,720	3,840	3,490	6,050	22,080	9,840	16,760
	Thickness (ft)	Organically Rich	275	275	275	115	115	180	180
		Net	248	248	248	104	104	162	162
Depth (ft)	Interval	8,000 - 10,500	9,000 - 10,000	10,000 - 16,000	10,000 - 14,500	11,000 - 16,000	3,300 - 8,000	3,300 - 8,000	
	Average	8,500	9,500	13,000	10,500	13,000	5,000	5,000	
Reservoir Properties	Reservoir Pressure		Mod. Overpress.	Mod. Overpress.	Mod. Overpress.	Mod. Overpress.	Mod. Overpress.	Mod. Overpress.	Mod. Overpress.
	Average TOC (wt. %)		6.0%	6.0%	6.0%	5.7%	5.7%	5.7%	5.7%
	Thermal Maturity (% Ro)		0.85%	1.15%	1.70%	1.15%	1.90%	1.15%	1.70%
	Clay Content		Medium	Medium	Medium	Medium	Medium	Medium	Medium
Resource	Gas Phase		Assoc. Gas	Wet Gas	Dry Gas	Wet Gas	Dry Gas	Wet Gas	Dry Gas
	GIP Concentration (Bcf/mi <sup>2</sup> )		35.4	111.4	133.9	42.9	54.5	50.9	60.7
	Risked GIP (Tcf)		48.2	213.8	233.7	129.9	601.3	100.1	203.6
	Risked Recoverable (Tcf)		4.8	42.8	58.4	26.0	150.3	15.0	40.7

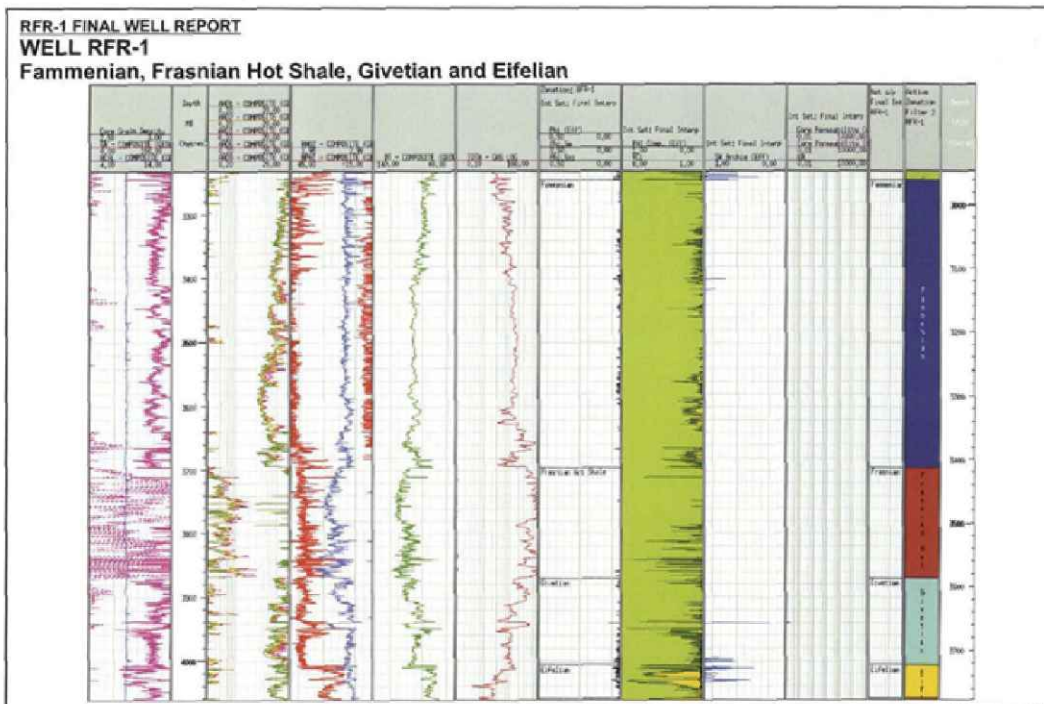
# Seismic and well data coverage available

Initial evaluation area: 20,000 km - Green



## Well RFR-1

A review of well data in the Initial Evaluation Area shows that the prospective section of the Famennian, and Frasnian, Givetien shales to be 2457 ft thick (749 m) with over 1017 ft. (310 m) of gas saturations averaging over 50%. This is significantly thicker than the 275 ft (85 m) used in the EIA report.



# Well RFR-1 Analysis

Analysis of the Famennian, Frasnian Radioactive and Givetian Organic Shales  
Gas and Gas/Condensate Productive

### 3.1.6.2 Famennian (3244 m - 3696 m)

The Famennian Silt/Shale interval consists of black to very dark brown shales with some interbedded sandstones and silts toward the top and dolomitic limestones at the base. The ROP averaged around 18.7 m/hr.

**TOTAL GAS RANGE: 1.0 – 87.0 %**

CHROMATOGRAPH READINGS (ppm): C1: 7628-505766  
C2: 335-10613  
C3: 69-1928  
iC4: 0-165  
nC4: 0-288  
iC5: 0-34

WIRELINE: Logged in 8 1/2" open hole with AIT/PEX/DSI/CAL/GR.

### 3.1.6.3 Frasnian Shales (3696 m - 3869 m)

The Frasnian Shales are thought to be the main source rock in this area and consists of dark brown organically rich shales. There are occasional light blue-grey glauconitic bands and rare argillaceous limestone beds. Total Gas in the Frasnian reached 100 % for most of the interval. The ROP averaged around 22.3 m/hr.

**TOTAL GAS RANGE: 16.6 – 100 %**

CHROMATOGRAPH READINGS (ppm): C1: 94934-916388  
C2: 830-12916  
C3: 0-1357  
iC4: 0-73

WIRELINE: Logged in 8 1/2" open hole with AIT/PEX/DSI/CAL/GR.

### 3.1.6.4 Givetian Shales (3869 m - 4006 m)

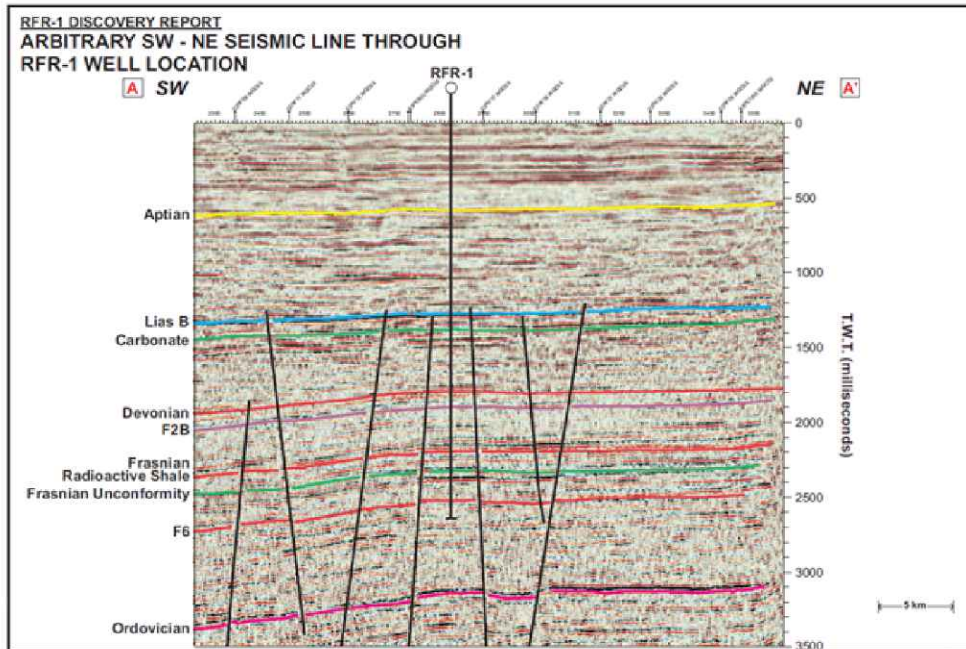
The Givetian Shales are predominantly dark shales with thin limestone beds. The ROP averaged around 13.1 m/hr.

**TOTAL GAS RANGE: 3.0 – 51.3 %**

CHROMATOGRAPH READINGS (ppm): C1: 30368-486308  
C2: 147-2839  
iC4: 0-266

WIRELINE: Logged in 8 1/2" open hole with AIT/PEX/DSI/CAL/GR.

## Seismic Line Through RFR-1 Well



A southwest – northeast line through the RFR-1 well. The section between the F2B to Frasnian Unconformity appears to be uniform in thickness.



## Deliverables

1. Proposed drill sites to test the hybrid shales and conventional targets. Where possible combining both will lead to risk reduction
2. Maps – Integrated well data and seismic over the Hybrid Shales and Conventional Reservoirs. Structure, porosity, and facies covered.
3. Well and Petrophysical Cross-sections. Projected drill sites plotted on the cross-sections
4. If possible, integrated mineralogy on the mapping and cross-sections.
5. Surface and pipeline evaluation
6. Reserve calculations – From Project to drill site

### **Author bio: James Bedford**

*James Bedford in collaboration with Canesis Data will be heading this project. James began his involvement in shale plays at Chesapeake Energy in 2006. As a member of a small East Texas team, he helped lead Chesapeake into the Haynesville and Bossier shale plays. He was involved in the location, design and fracturing of the initial wells. As Chesapeake's involvement in shale plays expanded he became part of the New Ventures group where his skills in geophysics, geology, geochemistry, and gravity/magnetics helped guide the company's involvement in the Barnett, Marcellus, Woodford, Bakken and Utica shales. His expertise in analysing wells, cores, maturation, and gravity/magnetics helped to locate test holes for evaluation.*

*Upon leaving Chesapeake, he continued as New Ventures Manager for Kerogen Exploration working the Woodford, Sunniland, and the Second White Specs shales.*

*James has experience in North Africa working geophysics with ARCO International on conventional plays in Tunisia and Algeria, nonetheless he recently identified the Project shales as very comparable to the American shale plays.*

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