

## **Structural and tectonic setting and evolution of Orphan Basin.**

Research at Memorial University sponsored by PRAC/NSERC

by Stephen Kearsey, M Sc candidate

### **Thesis Research**

Stephen Kearsey conducts research toward a MSc. degree at Memorial University, partially funded by a grant from Petroleum Research Atlantic Canada to Dr. Michael Enachescu. My research concentrates on an integrated interpretation of the Orphan Basin, offshore Newfoundland, is focused on several representative transects and extends to the large rifted area. This involves using potential fields data (gravity and magnetics), in conjunction with high resolution, modern 2-D seismic data donated by GSI of Calgary. The thesis objective is to determine the basin architecture, tectonic and structural evolution, and influence on the resulting petroleum system.

Financial support to Enachescu from PRAC has allowed me to directly contribute to the current knowledge of Orphan Basin framework, collaborate with several worldwide organizations, and travel to conferences to present my findings.

### **Presentations**

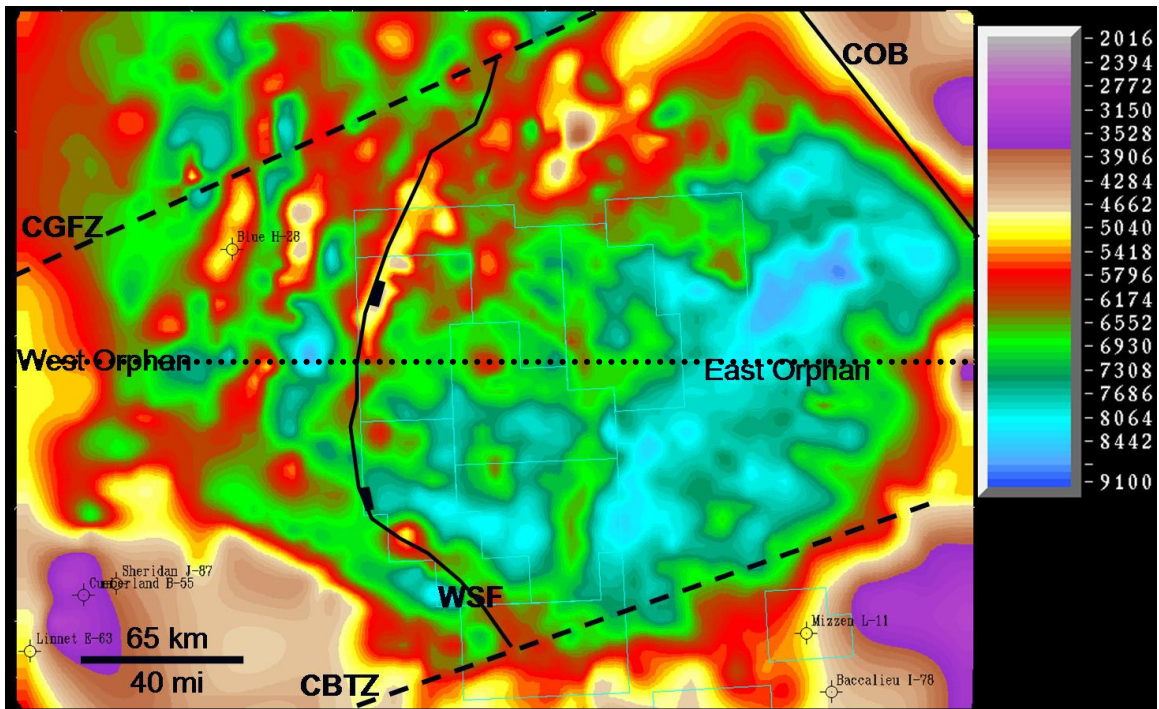
In 2005 I presented my findings at two major international oil and gas conferences and at a Canadian wide Geosciences conference. Here are my contributions to these conferences that included illustrated expanded abstracts:

1.) *Correlating regional structural trends with seismic and potential fields data: a case study from the Orphan Basin, offshore Newfoundland and Labrador.* Presented at the 75<sup>th</sup> Annual Society of Exploration Geophysicists in Houston, Texas, November, 2005. In addition I attended a two day course entitled: Gravity and magnetics for explorationists.

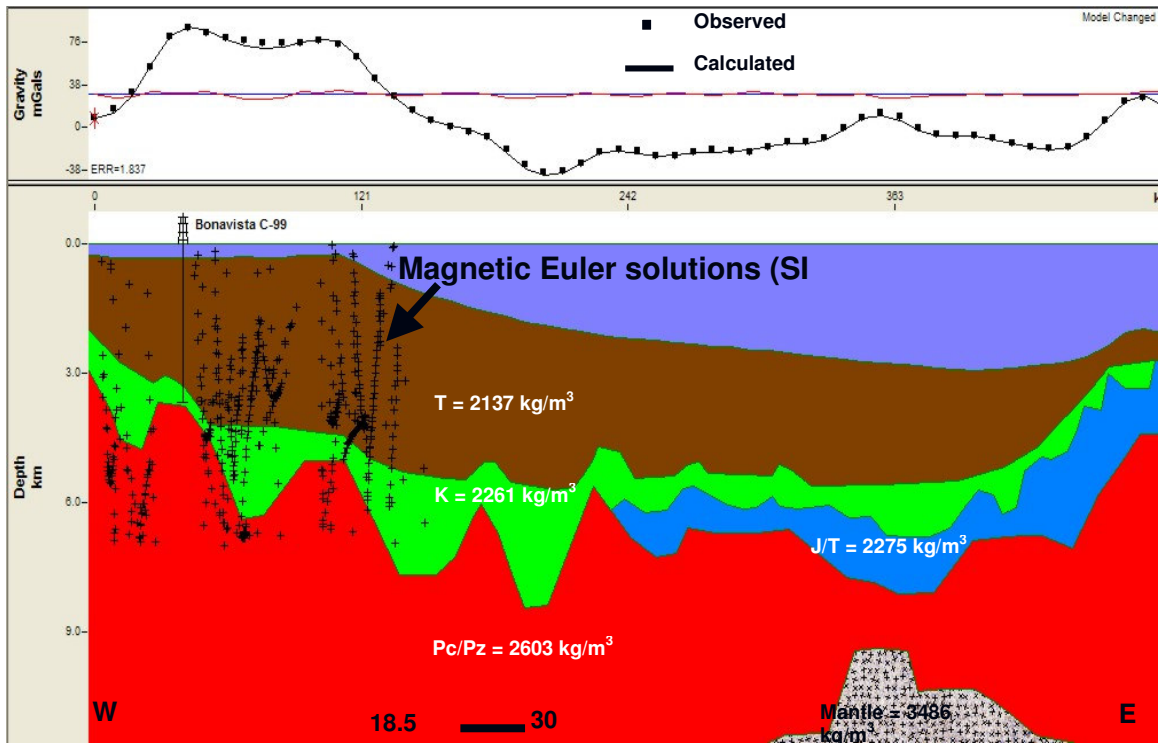
2.) *Orphan Basin – integrated geophysical study and implications for conjugate margin exploration.* Presented at the Annual European Association of Geoscientists and Engineers (EAGE), June, 2005 in Madrid, Spain. I also attended a short course: Insights and methods for 4D reservoir monitoring and characterization.

3.) *Orphan Basin, offshore Newfoundland: integrated geophysical analysis and evidence for extreme crustal thinning on the conjugate margins.* Presented at the Joint conference GAC-MAC-CSPG conference, May, 2005 in Halifax, Nova Scotia.

4.) *Orphan Basin – Offshore Newfoundland, Eastern Canada: Findings applied to a greater understanding of the conjugate Irish margin.* Presented at a workshop sponsored by the Petroleum Affairs Division of Ireland (PAD), October, 2005 in Naas, Ireland..



**Figure 1.** Economic basement time structure interpreted by Stephen Kearsy using an integrated approach of seismic interpretation, correlation to vertical derivative of gravity and potential field modeling. Seismic data courtesy of GSI of Calgary.



**Figure 2.** Representative cross-section of regional Orphan Basin structural framework using gravity modeling of sediment density and Euler deconvolution of magnetic data keyed to well Bonavista C-99.

I also presented my work to the management of Orphan Basin exploration partners, Chevron Resources in November 2005 in Houston and to Imperial Resources, November 2005 in Calgary. Chevron is also a financial contributor to Dr. Enachescu's Collaborative Grant PRAC/NSERC. Chevron together with ExxonMobil and Imperial Resources are strong supporters of PRAC.

## **Collaborations**

Under Dr. Enachescu's mentorship I have collaborated with several industry and academic units. In June, 2004 I worked with the Geological Survey of Canada – Atlantic Division (GSC-A) as staff scientist under Dr. David Piper aboard the CCGS Hudson summer cruise for three weeks. The main cruise objectives were to investigate shallow geo-hazards to future exploration drilling in the Orphan Basin and study the origins of deepwater seamounts observed on seismic data by Enachescu, and published in the *Leading Edge*. I participated in the acquisition of shallow seismic, physical "grab" sampling, heat flow measurements, and magnetometer readings.

Since April 2005 I have actively participated in collaborations with the Petroleum Affairs Division (PAD) of Ireland and associated Irish Universities (Trinity College and University College Dublin). To date we have traveled twice to Dublin and discussed the similarities of the tectonics, structure and petroleum systems of the conjugate margins. I also play an active role in a large scale re-evaluation of the Irish continental margin for future exploration and integration into a cross-Atlantic geoscience transect.

## **Scholarships and awards**

Beside benefiting of the PRAC/NSERC grant I was awarded a Canadian Society of Exploration Geophysicists (CSEG) scholarship of \$2000 for 2004 – 2005.

I was also a recipient of a Society of Exploration Geophysicists travel grant, awarded to ten students worldwide to attend and present at the SEG Annual conference in Houston. The grant provided for airfare, accommodations and a \$300 stipend for meals and expenses.

## **Other Duties**

For this research project I had created an offshore database of seismic lines donated by GSI of Calgary to MUN and loaded into Landmark Seisworks interpretation system. To date the database consists of approximately three hundred 2-D lines ranging from Southern Grand Banks to Northern Labrador of varying vintages, including approximately 20 000 line kilometers of modern Orphan Basin seismic reflection. Contoured digital gravity, magnetic, and bathymetry data over the entire Eastern Newfoundland and Labrador margin were also acquired and loaded to allow simultaneous interpretation of seismic and potential fields signatures in the project.

During last year, I also assisted and mentored other graduate students starting research in our group as to the available data for each specific area to create sub Seisworks projects for their research, and provide technical support for the software.

## **Biography**



Steve Kearsley has a Bachelor of Science (Hons.) with a geophysics specialization from Memorial University of Newfoundland and was awarded “The most outstanding Honours thesis in Earth Sciences, 2001” He worked as a summer student for PanCanadian and after graduation did field work in Texas for ExxonMobil and geophysical applications for GEDCO in Calgary. He started his graduate studies at University of Calgary CREWES consortium and then returned to St John’s to enhance his knowledge of Atlantic Canada basins and offshore seismic exploration. He is presently enrolled in a M Sc program under the supervision of Dr Michael Enachescu. He is a member of the PPSC Basin Analysis team that is doing research and mapping of Atlantic offshore less known rift basins and their petroleum systems. His thesis concerns the “Structural and tectonic setting and evolution of Orphan Basin”. Steve is a member of SEG, CSEG, EAGE, AAPG, and a Geophysicist-in-training with APEGGA.