

PSTracing Main Structures with Radon, Thoron, and Carbon Dioxide Fluxes in Sedimentary Basins of Argentina*

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Search and Discovery Article #11339 (2020)**
Posted July 6, 2020

*Adapted from poster presentation given at 2019 AAPG Hedberg Conference, Hydrocarbon Microseepage: Recent Advances, New Applications, and Remaining Challenges, Houston, Texas, June 18-20, 2019

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Abstract

The use of geogenic gases as tracers for faults and main structures has been tested at many sites (King et al., 1996; Ciotoli et al., 1999; Giannanco et al., 2009, and references therein). Geochemical tracers like carbon dioxide and radon can help to identify fault structures. In this case, we have used carbon dioxide, radon, and thoron surficial fluxes in order to determine the location of faults in different basins of Argentina, including the main gas producer (Neuquen Basin) in the core of shale gas/oil exploitation and a poorly explored frontier Basin (Chaco-Parana Basin). The results lead to the identification of the surface expressions of faults, demonstrating in both cases the ability of surficial emissions to determine the interception of deep faults with the surface.

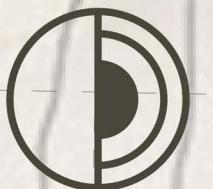
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Tracing main structures with radon, thoron and carbon dioxide fluxes in sedimentary basins of Argentina

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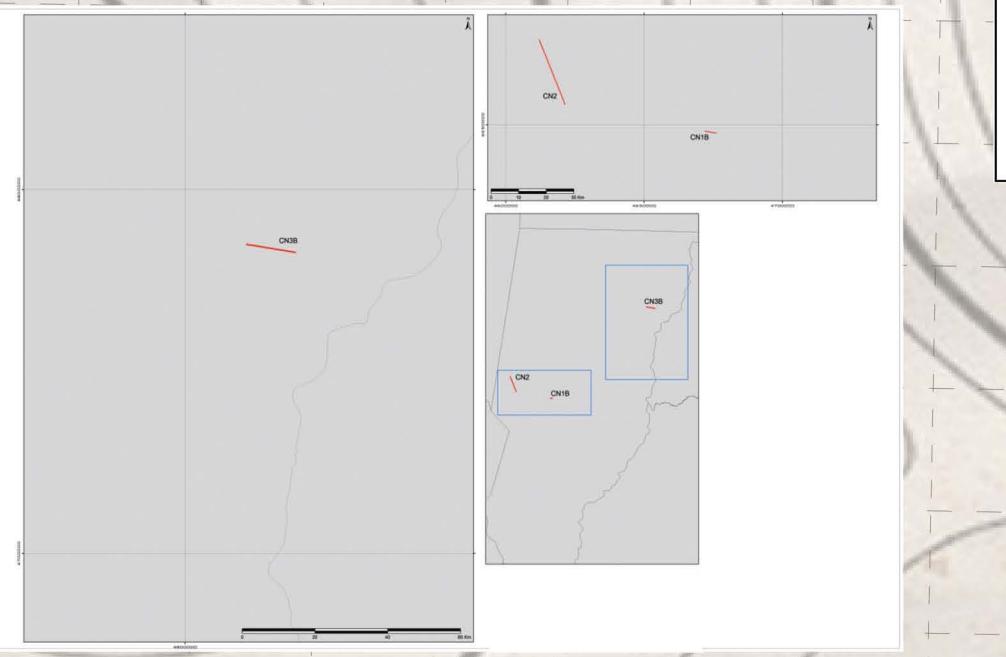
Introduction

The use of geogenic gases as tracers for faults and main structures have been tested in many sites (i.e.: King *et al.*, 1996, Ciotoli *et al.*, 1999, Giammanco *et al.*, 2009, and references therein). Geochemical tracers like carbon dioxide and radon can help to identify fault structures. In this case, we have used carbon dioxide, radon and thoron surficial fluxes in order to determine the location of them in different basins from Argentina, including the main gas producer (Neuquén Basin) in the core of shale gas/oil exploitation and a poorly explored frontier Basin (Chaco-Paraná Basin). Examples of the latter are shown, including free gas and microbial(EHMI) data.



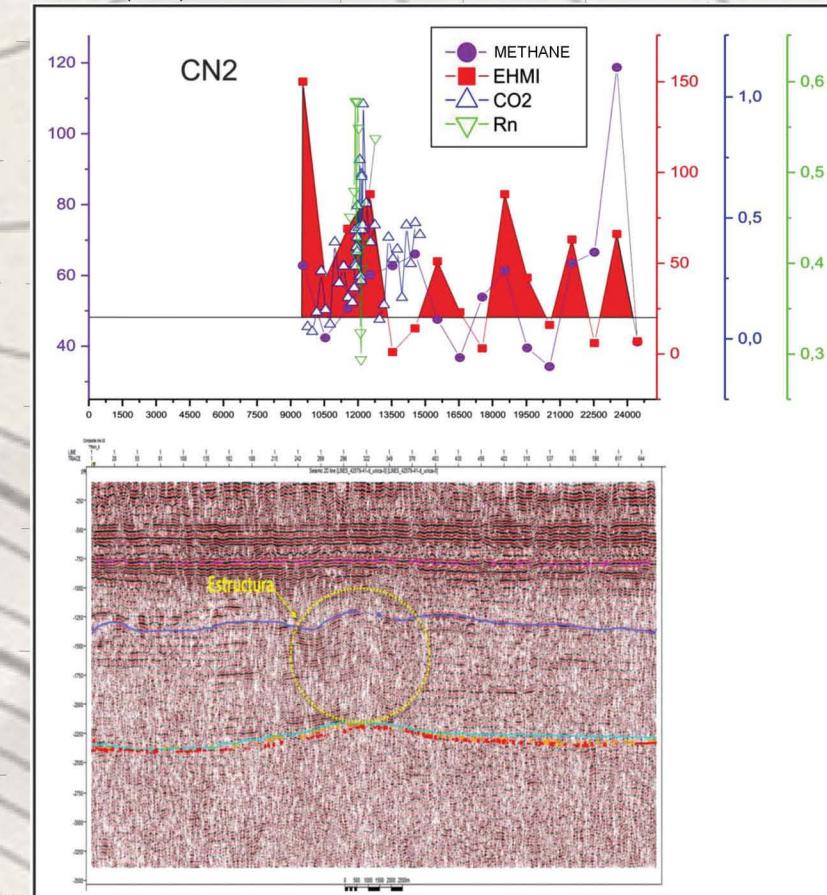
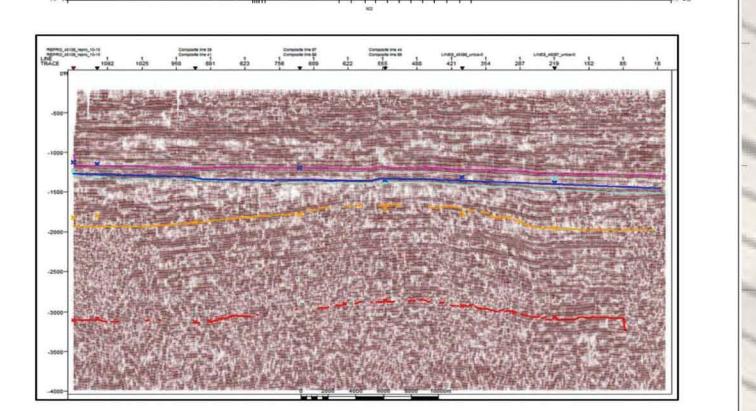
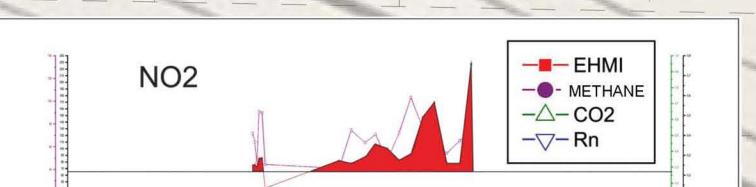
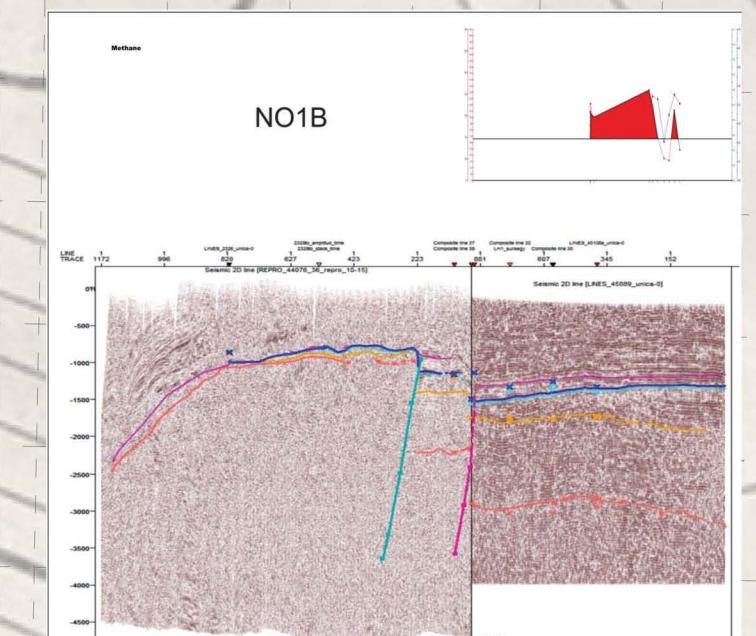
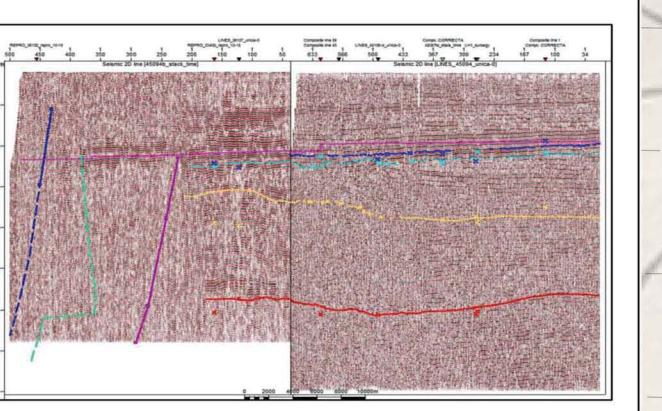
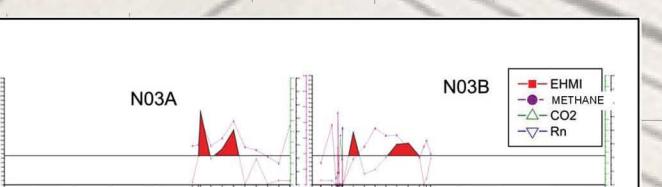
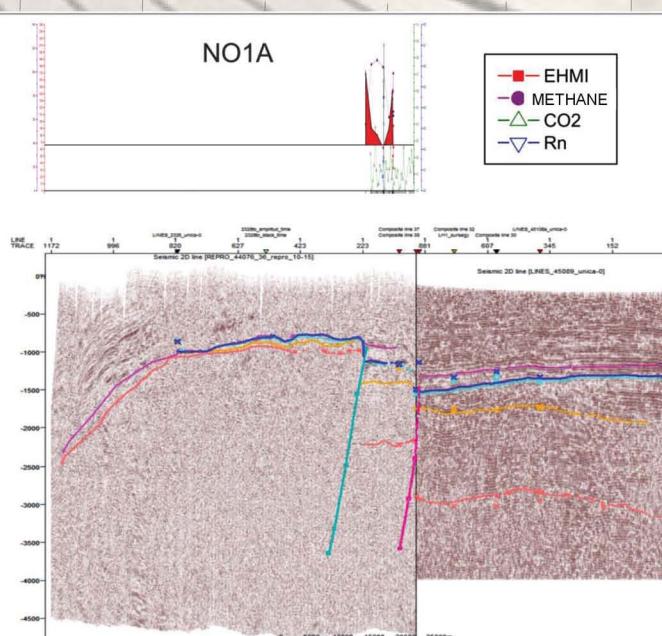
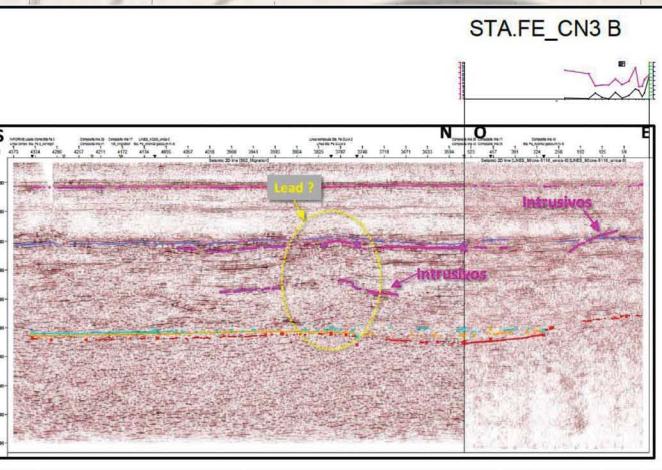
Results

Due to the differences in time to obtain reliable values of fluxes from carbon dioxide and radon-thoron, the procedure was the use of carbon dioxide as the first indicator for location of anomalous values. Threshold limit values (Reimann et al., 2005) were determined for carbon dioxide, identifying the emission anomalies in the traverses. Background values vary for different locations. Chaco-Parana basin have threshold values of $0.5 \text{ g CO}_2/\text{m}^2\cdot\text{h}$ values, and the range starts from $0.2 \text{ g CO}_2/\text{m}^2\cdot\text{h}$. In the Neuquen Basin, the threshold limit is $0.23 \text{ g CO}_2/\text{m}^2\cdot\text{h}$, with minimum values of $0.01 \text{ g CO}_2/\text{m}^2\cdot\text{h}$. On the other hand, radon fluxes start with $0.01 \text{ Bq/m}^2\cdot\text{min}$ to maximum values of $0.7 \text{ Bq/m}^2\cdot\text{min}$ for the Chaco-Parana Basin and 0.07 to $70 \text{ Bq/m}^2\cdot\text{min}$ for thoron. For the Neuquen Basin, the range for radon fluxes is 0.01 to $0.54 \text{ Bq/m}^2\cdot\text{min}$ and 1.14 to $70 \text{ Bq/m}^2\cdot\text{min}$ for thoron. Maximum values of CO_2 fluxes agree with maximum values of radon/thoron fluxes in most cases. Radon and thoron surficial emissions are correlated, although with a significant degree of dispersion (r^2 : 0.4 to 0.5 for both basins). After the surveys, the results were checked against geophysical seismic sections, which showed that maximum values coincide with the presumed location of major, deep structures. It was demonstrated that in the Neuquen Basin, first order structures act



Methodology

Ten surveys of carbon dioxide, radon (^{222}Rn) and thoron (^{220}Rn) superficial fluxes have been accomplished. Sampling points were taken along traverse lines perpendicular to the presumed fault traces, using portable instruments (PPSystems EGM-4 and Rad-7) with accumulation chambers.



as gas migration pathways and development activities must take in account this issue.

Conclusion

Carbon dioxide, radon and thoron fluxes were employed to determine the location of structures in two sedimentary basins from Argentina. The results lead to the identification of the surface expressions of them, demonstrating in both cases the ability of surficial emissions to determine the interception of deep faults with surface.

Acknowledgments

To YPF S.A. which help us to present this contribution.

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