Uso de la Geoquimica en el Desarrollo de Recursos No-Convencionales

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SHARMA ISOTOPE LAB

U.S. DEPARTMENT OF ENERGY

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northeast NATURAL ENERGY

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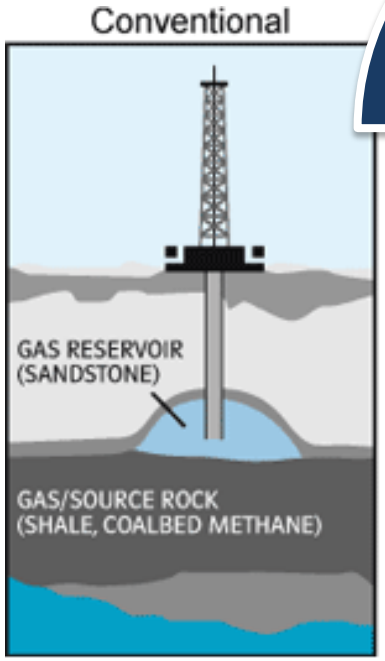
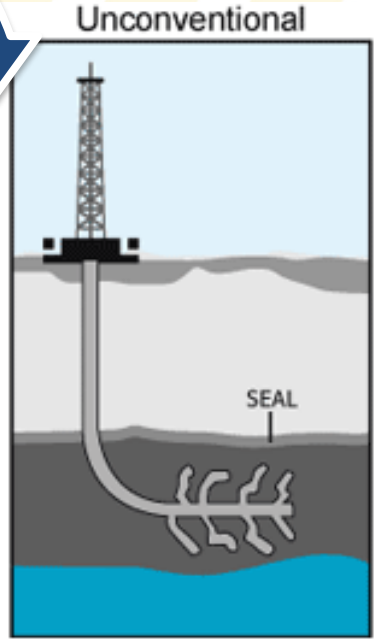
Papel de la Geoquimica



LAS OPORTUNIDADES HAN CAMBIADO

ROCA MADRE = RESERVORIO

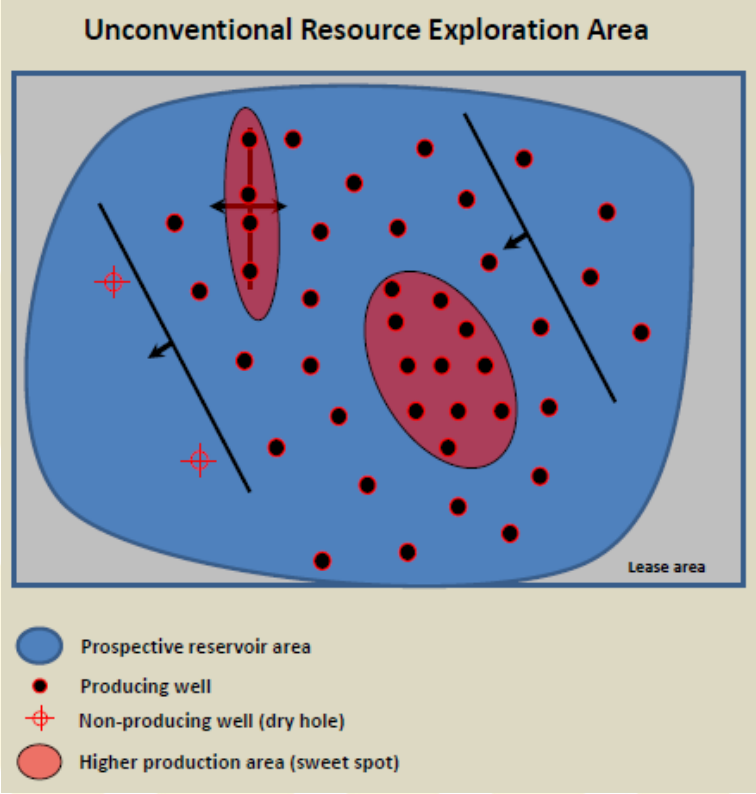
Hay que entender la heterogeneidad geologica y geoquimica de la roca madre



Aplicacion de la Geoquimica

1. Caracterizacion de al roca madre

1. Modelar las variacion de contenido organico
    - Encontrar **los mejores sitios**
    - Produccion de aceite vs gas
    - Frackabilidad
    - Efecto de porosidad/permeabilidad
2. Modelar variaciones quimicas o mineralogicas
    - Fracturas naturales/artificiales
    - Interaccion roca/fluido

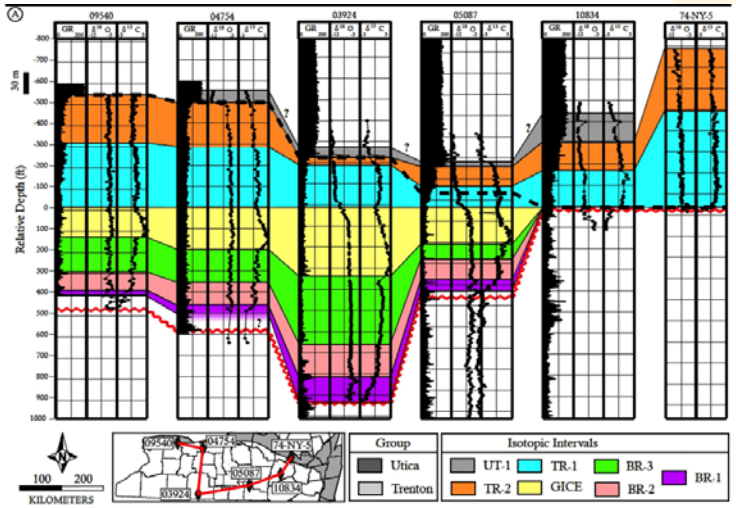


Source: Dawson Energy Advisors Ltd.

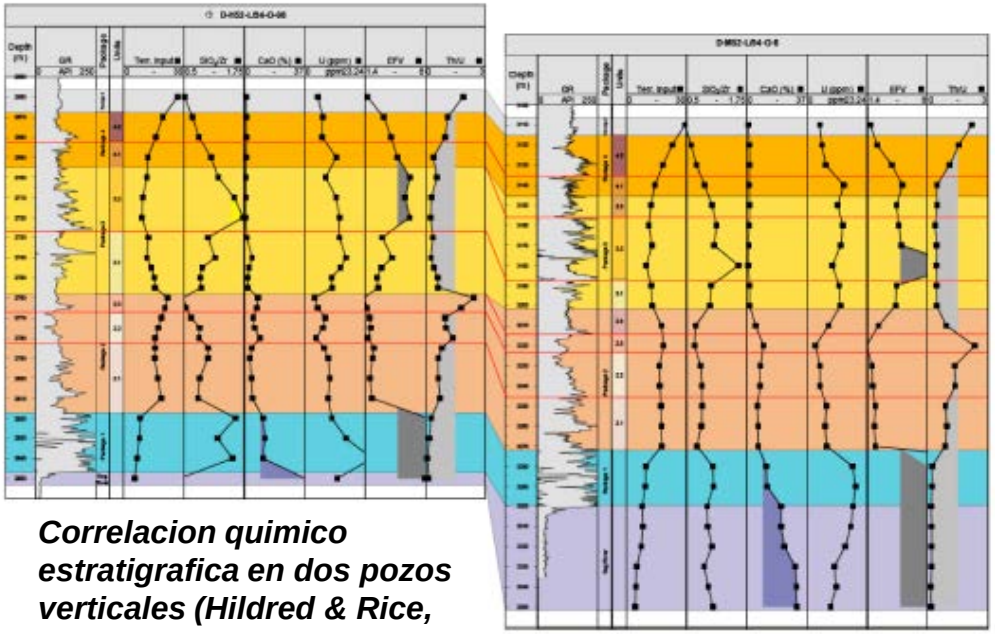
Aplicacion de la Geoquimica

2. Correlacion quimico-estratigrafica

- Contiuidad lateral y vertical de los reservorios
- Localizacion de los pozos horizontales



Correlacion del subsuelo de New York basada en $\delta^{13}C_{carb}$ (Mitzger et. al., 2013)

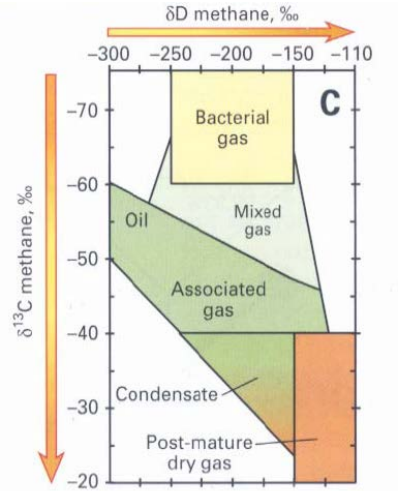


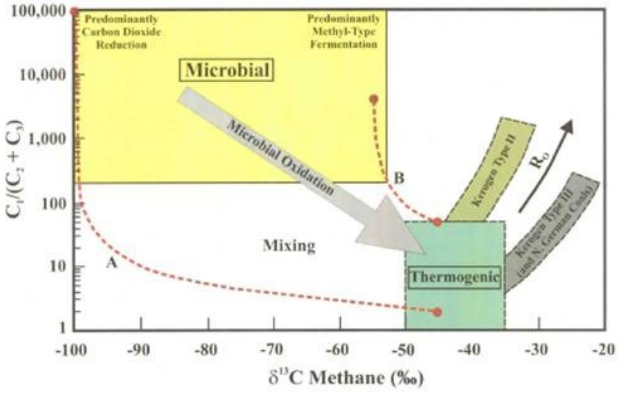
Correlacion quimico estratigrafica en dos pozos verticales (Hildred & Rice, 2014)

Aplicacion de la Geoquimica

3. Determinacion de la aislacion del reservorio

- Migracion de gas o fluido debido a fracturas
- Cuantificacion de la produccion de zonas individuales





Modified Schoell & Bernard plots

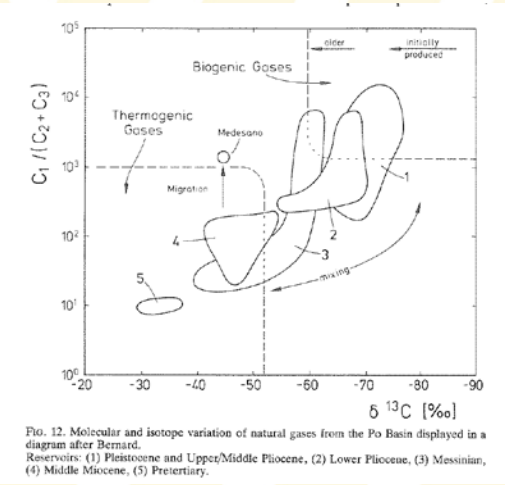
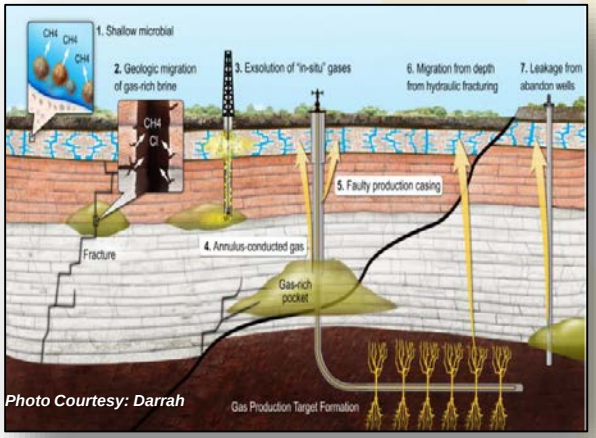


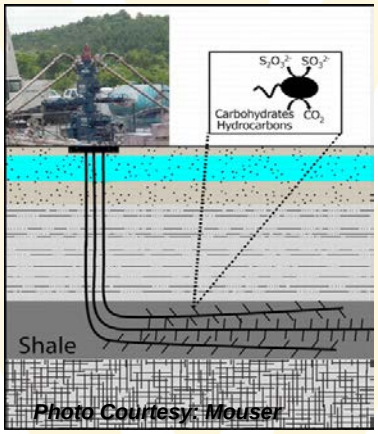
FIG. 12. Molecular and isotope variation of natural gases from the Po Basin displayed in a diagram after Bernard.
Reservoirs: (1) Pleistocene and Upper/Middle Pliocene, (2) Lower Pliocene, (3) Messinian, (4) Middle Miocene, (5) Pretertiary.

Aplicacion de la Geoquimica

4. Evaluacion del impacto ambiental

- Determinar si el gas o contaminantes en acuiferos estan asociados con produccion de hidrocarburos
- Entender las interacciones enter agua-roca-microbios despues de injectar fluidos de fracturacion

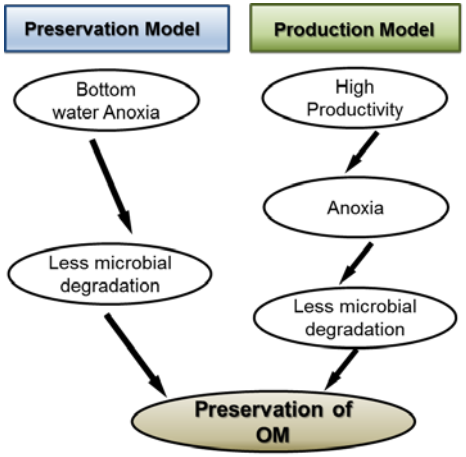


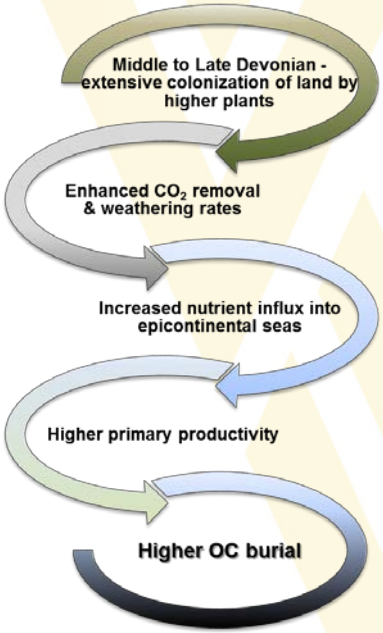


Source: ISOTECH

Caracterizacion de la Roca Madre

Cuales son los factores que controlan la calidad y cantidad de materia organica (TOC) en el Marcellus Shale?

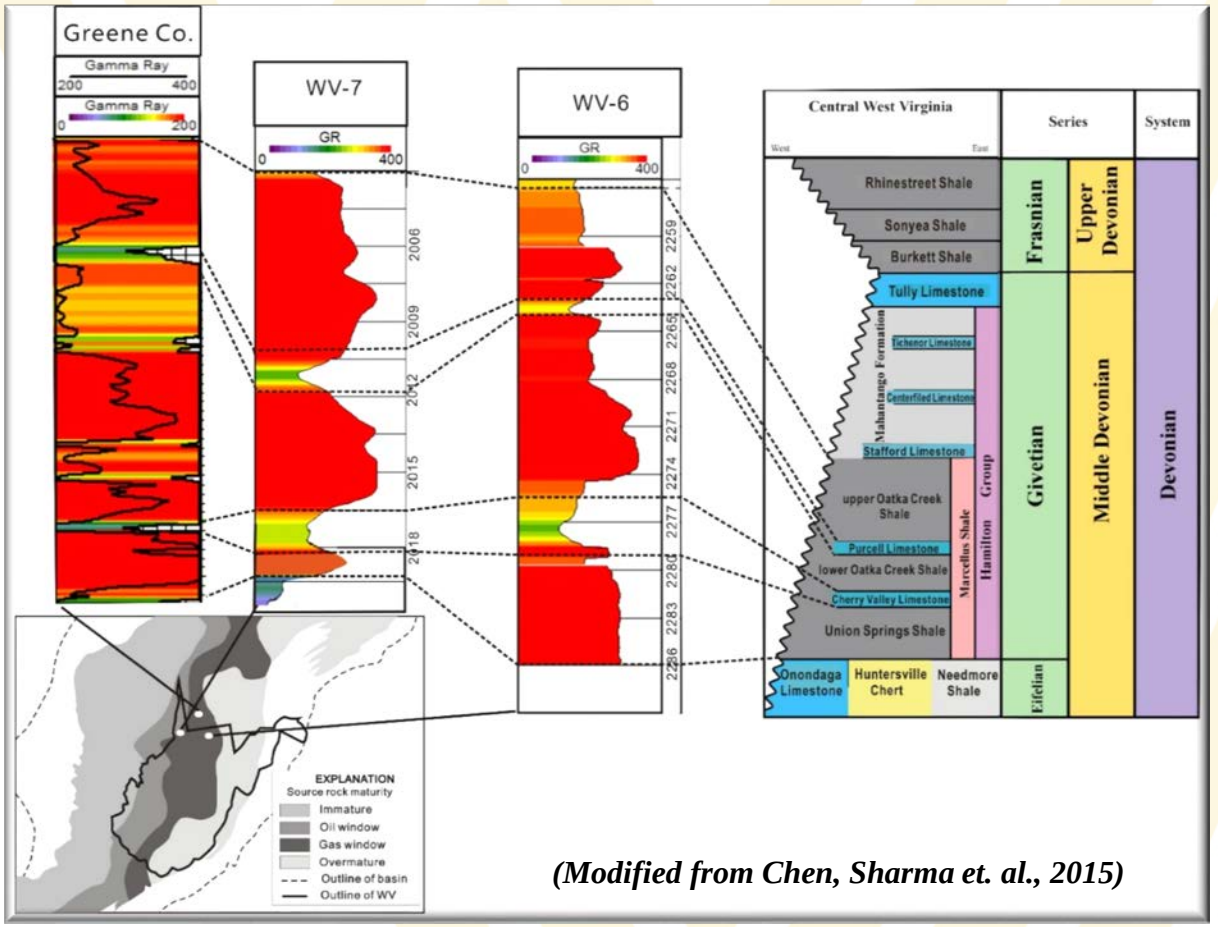




- **P** — C, N and S isotopes
- **R** — C_{org}/P_{tot} and C_{org}/N_{org} ratios
- **O** — Trace element geochemistry
- **X** — Sedimentary & petrographic features
- **Y** — Biomarkers

Caracterizacion de la Roca Madre

EJEMPLO:
Marcellus Shale
Appalachian Basin



(Modified from Chen, Sharma et. al., 2015)

Palaeogeography, Palaeoclimatology, Palaeoecology 446 (2016) 85–97

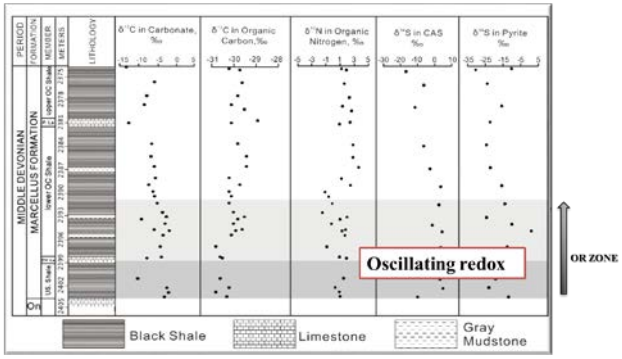
Contents lists available at ScienceDirect

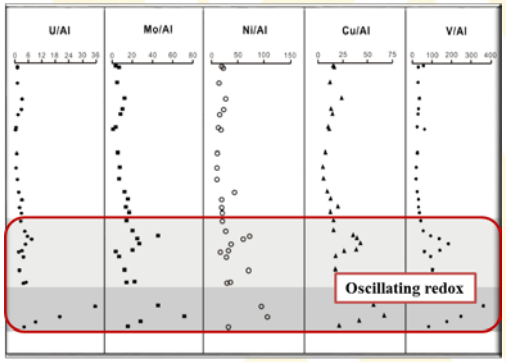
Palaeogeography, Palaeoclimatology, Palaeoecology

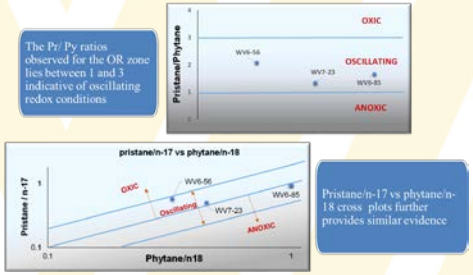
journal homepage: www.elsevier.com/locate/palaeo

Role of alternating redox conditions in the formation of organic-rich interval in the Middle Devonian Marcellus Shale, Appalachian Basin, USA

Ruiqian Chen, Shikha Sharma *,1







Cambios en la composicion isotopica de N/S & metales traza en la zona organica indican episodios de aguas oxigenadas que permitieron el regreso de nutrientes al agua marina resultando en mayor produccion y preservacion de CARBONO ORGANICO

Applied Geochemistry xxx (2015) xxx–xxx

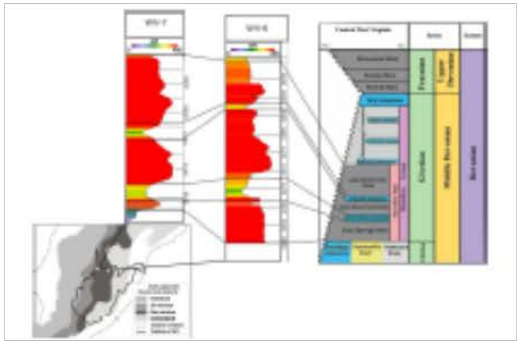
Contents lists available at ScienceDirect

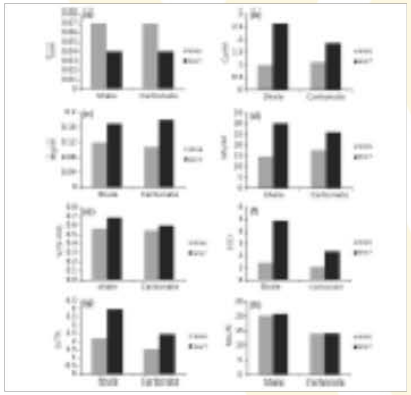
Applied Geochemistry

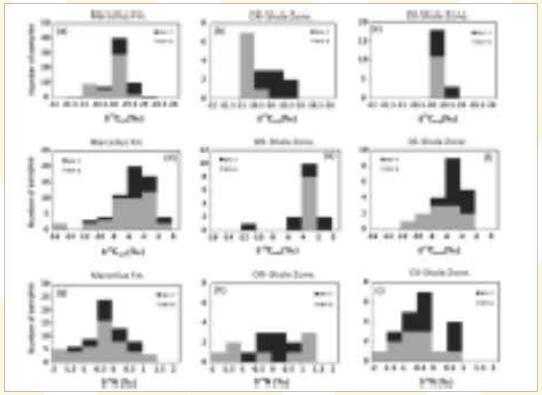
journal homepage: www.elsevier.com/locate/apgeochem

Comparison of isotopic and geochemical characteristics of sediments from a gas- and liquids-prone wells in Marcellus Shale from Appalachian Basin, West Virginia

Ruiqian Chen [a], Shikha Sharma [a,*], Tracy Bank [b], Daniel Soeder [c], Harvey Eastman [d]





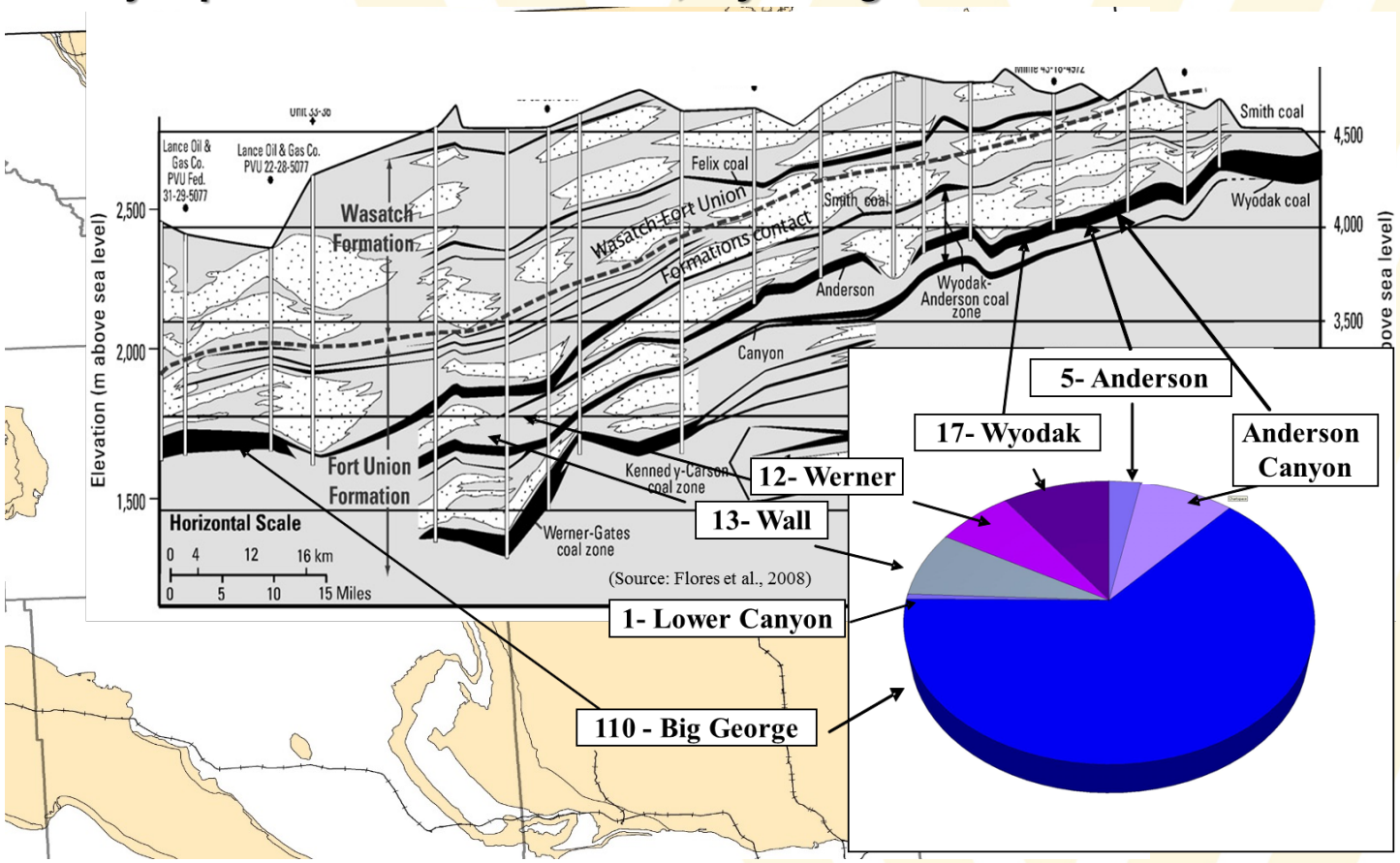


WV-6 core → basin margin → higher influx of clastic sediment & woody, terrestrial OM → generate gas

WV-7 core → open marine environment → lipid rich marine OM matter → generate gas & liquids

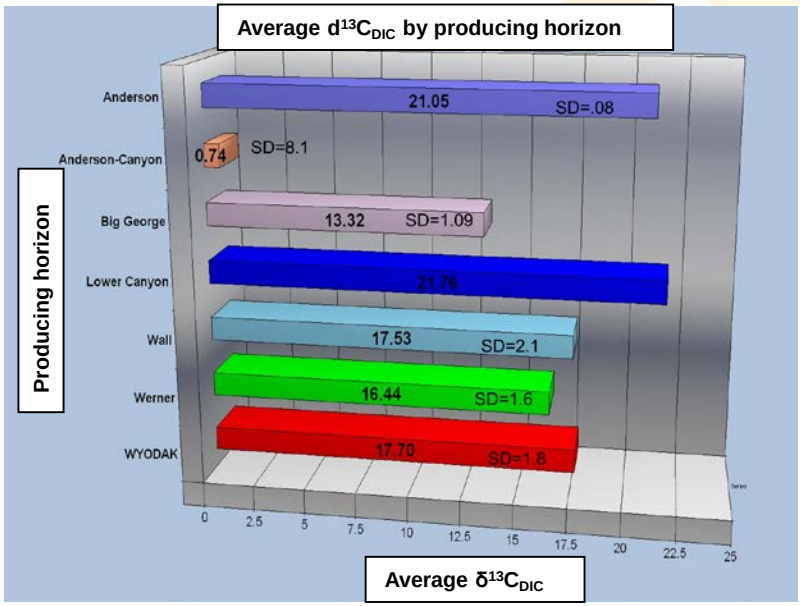
Continuidad del Reservorio

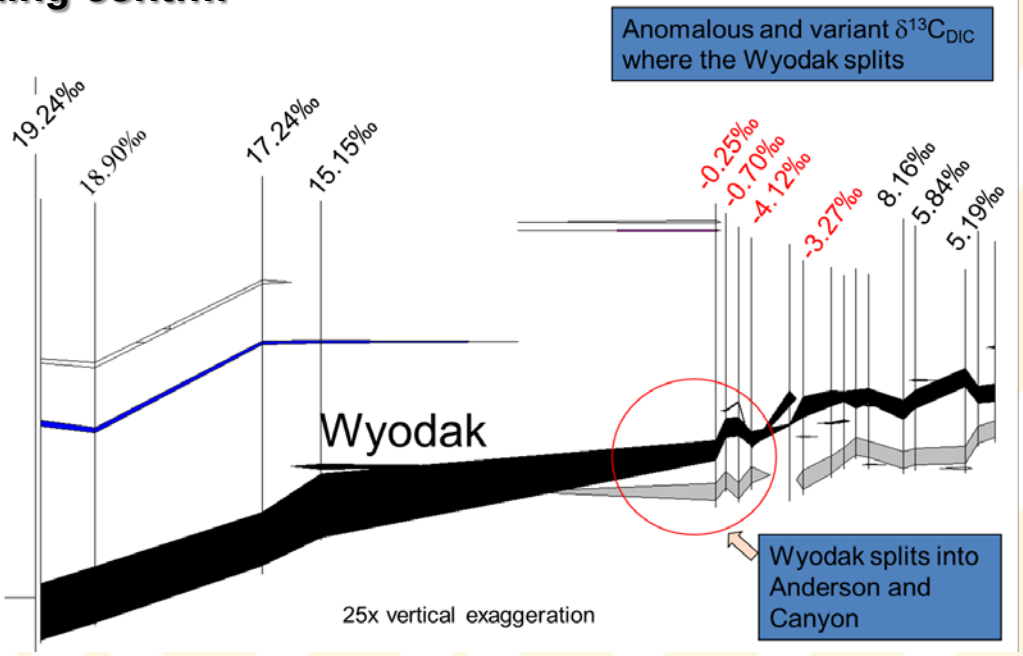
Ejemplo: Powder River Basin, Wyoming



Continuidad del Reservorio

Ejemplo: Powder River Basin, Wyoming cont….

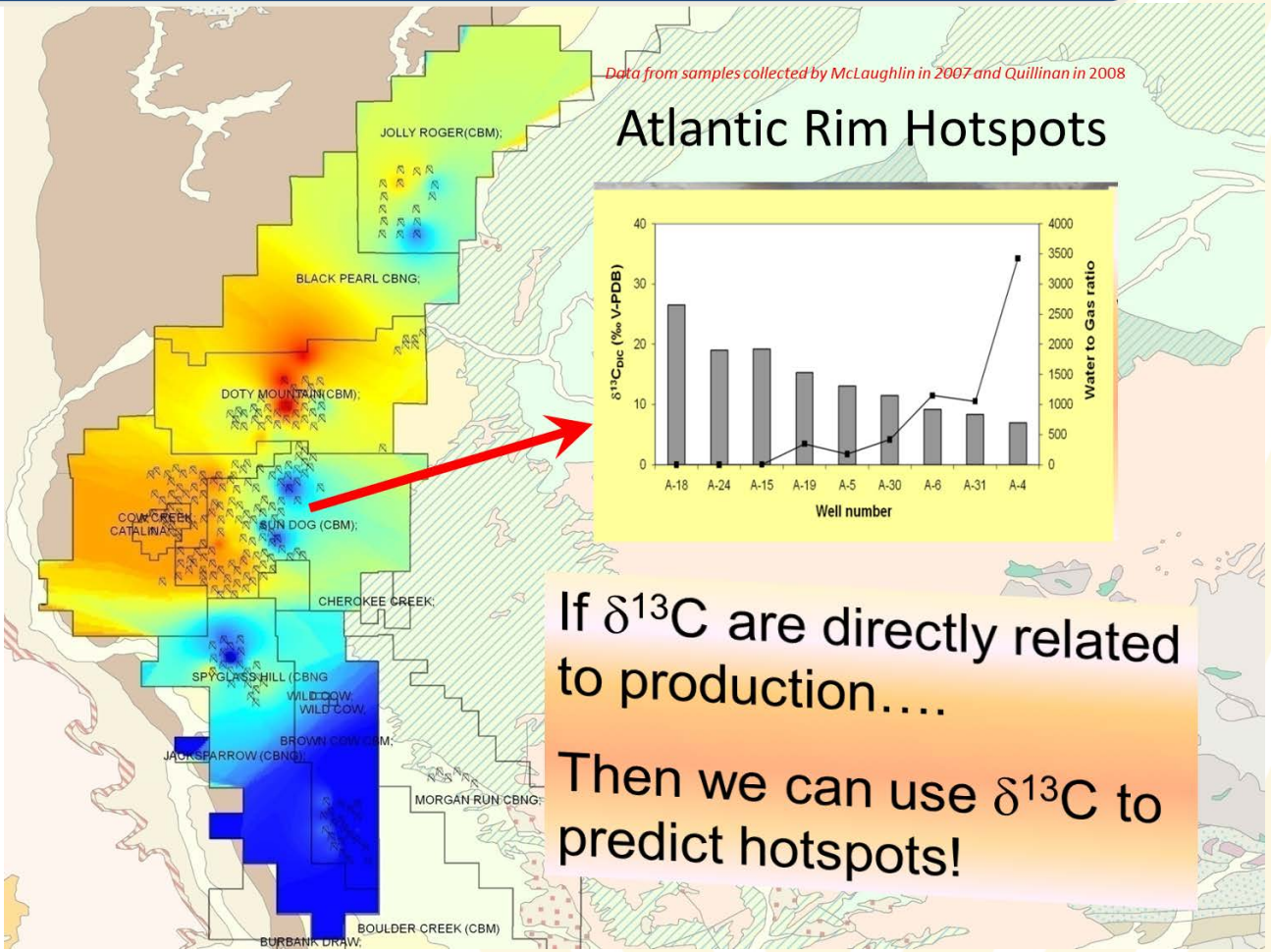




δ13CDIC del agua se puede usar para buscar la continuidad capas de carbon individuales.

Prediccion de la Proporcion Gas/Agua

Ejemplo: Atlantic Rim Basin, Wyoming



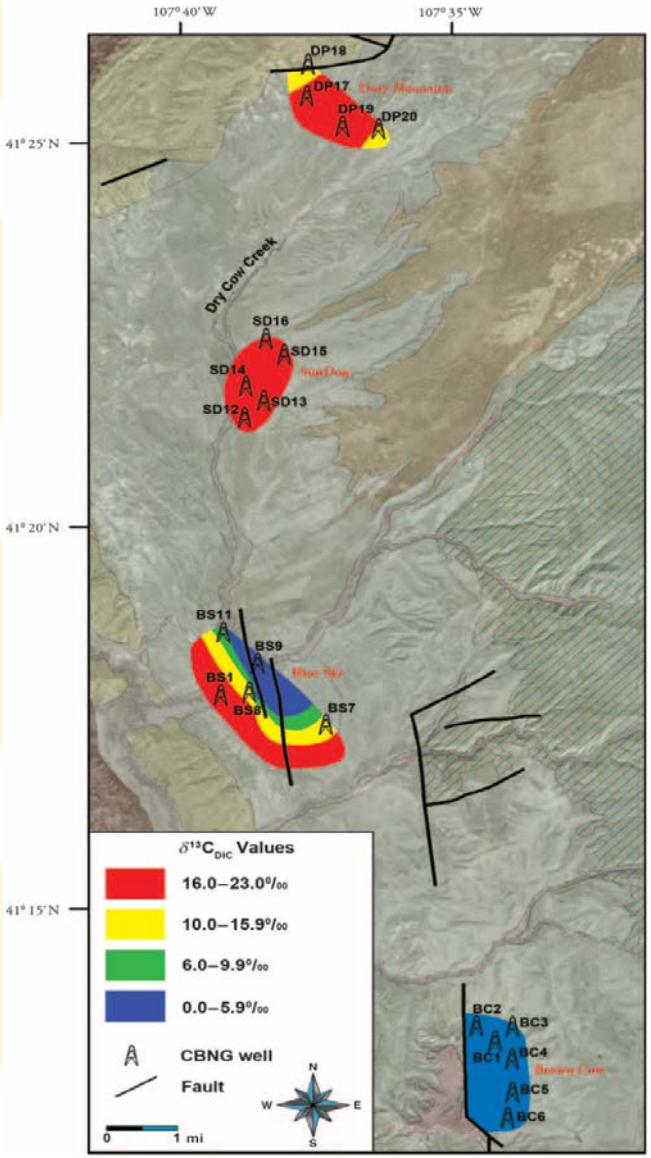
Geochemical analysis of Atlantic Rim water, Carbon County, Wyoming: New applications for characterizing coalbed natural gas reservoirs

J. Fred McLaughlin, Carol D. Frost, and Shikha Sharma

AAPG Bulletin, v. 95, no. 2 (February 2011), pp. 191–217

Valores bajos de $\delta^{13}C_{DIC}$ indican:

- Fallas sirvieron de conductos de agua fresca. Estons pozos tienen valores bajos de gas/aceite
- Pozos con cemento malo tienen valores bajos de gas/aceite



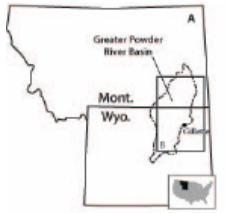
Impactos Ambientales

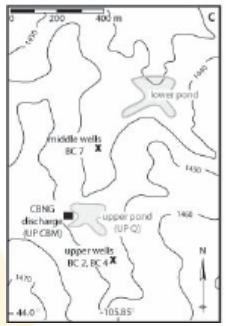
ground water

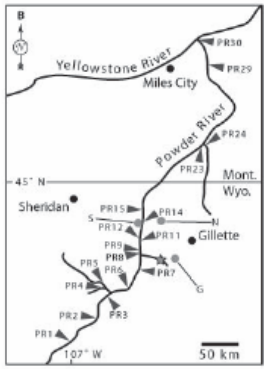
Methods Note/

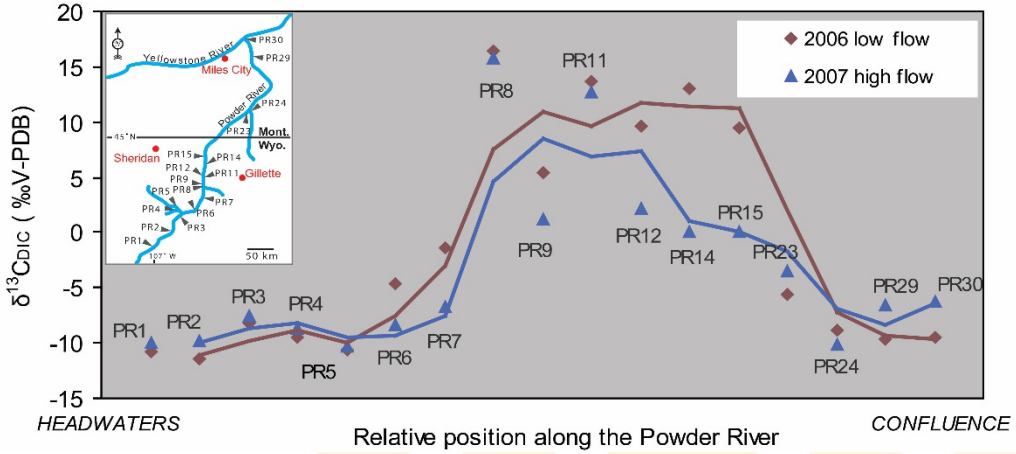
Tracing Coalbed Natural Gas–Coproduced Water Using Stable Isotopes of Carbon

by S. Sharma[1] and C.D. Frost[2]









La composicion isotopica del agua producida de capas de carbon permite detectar su presencia en las aguas superficiales y rios

Evaluando los Impactos Ambientales

PNAS

Methane contamination of drinking water accompanying gas-well drilling and hydraulic fracturing

Stephen G. Osborn[a], Avner Vengosh[b], Nathaniel R. Warner[b], and Robert B. Jackson[a,b,c,1]

www.pnas.org/cgi/doi/10.1073/pnas.1100682108

Contents lists available at ScienceDirect

Environmental Pollution

journal homepage: www.elsevier.com/locate/envpol

Surface water geochemical and isotopic variations in an area of accelerating Marcellus Shale gas development

Adam J. Pelak, Shikha Sharma*

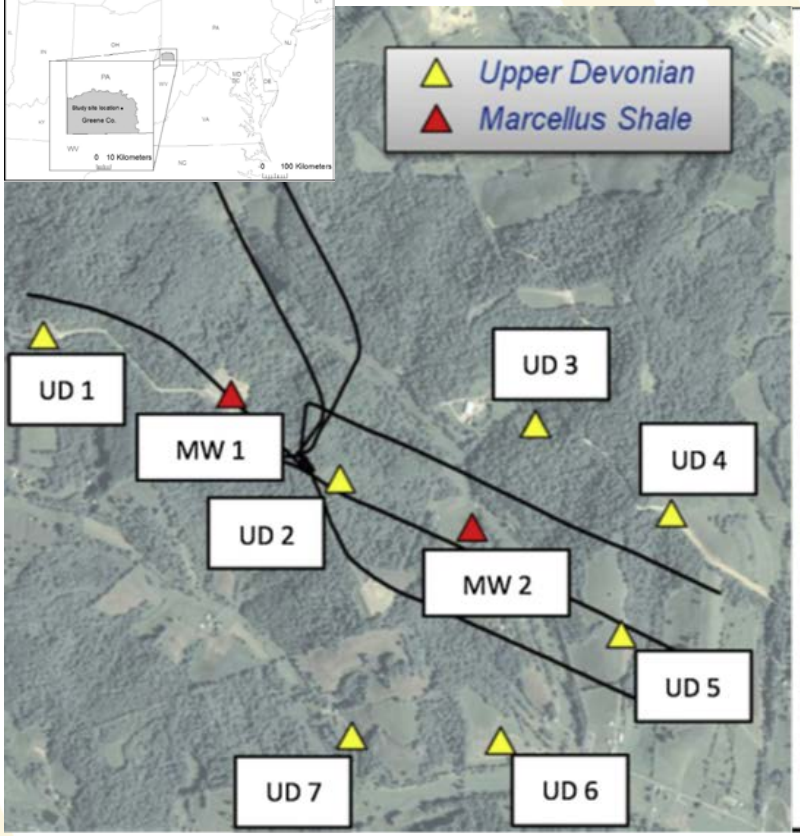
Environmental Pollution 195 (2014) 1–10

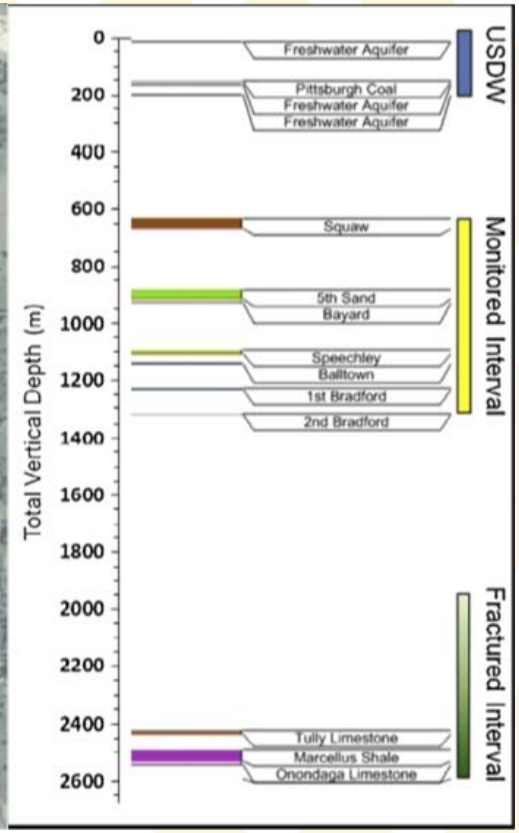
Resultados discrepantes

demuestran la necesidad de caracterizar los niveles base

Prueba de Aislamiento de Reservorio

Ejemplo: Marcellus Shale Greene County, PA

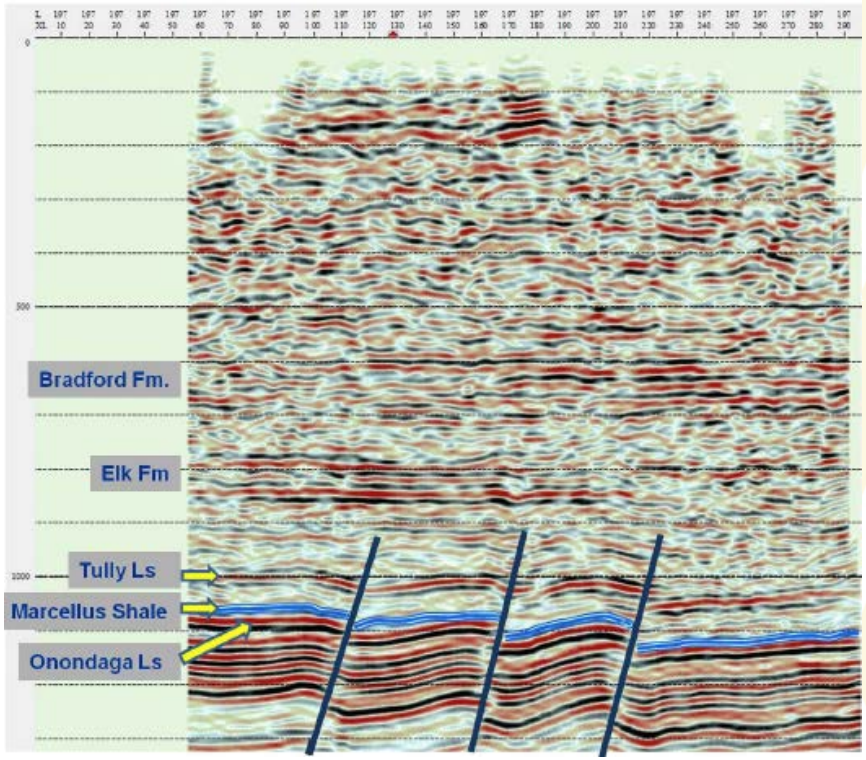




Pozos someros (~4000 pies sobre el Marcellus) sirven para monitorear cambios en conectividad hidraulica

Prueba de Aislamiento de Reservorio

Case Study : Marcellus Shale Greene County, PA



Varios metodos de monitoreo:

1) Modelaminto numerico de propagacion de fracturas

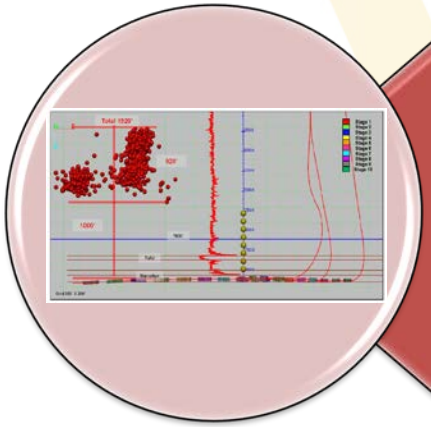
2) Monitoreo sismico a largo plazo

3) Uso de trazadores artificiales

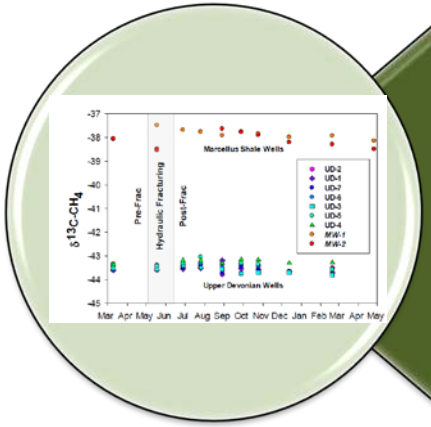
4) Monitoreo isotopico

Las fallas naturales pueden aumentar la conectividad

Prueba de Aislamiento de Reservorio



Se detectaron muchos microsismos encima de la Caliza Tully, que se creia era una barrera a la propagacion de fracturas



No hay evidencia de migracion de gas o de agua salada desde el Marcellus a los reservorios someros despues de la fracturacion hidraulica

Prueba de Aislamiento de Reservorio

NATIONAL ENERGY TECHNOLOGY LABORATORY

NETL

An Evaluation of Fracture Growth and Gas/Fluid Migration as Horizontal Marcellus Shale Gas Wells are Hydraulically Fractured in Greene County, Pennsylvania

15 September 2014

U.S. DEPARTMENT OF ENERGY

Office of Fossil Energy

NETL-TRS-3-2014

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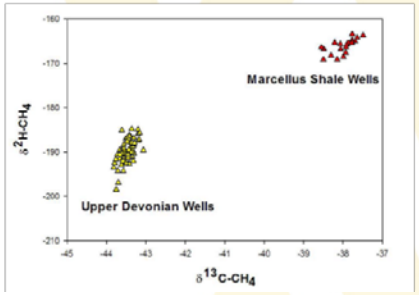
Contents lists available at ScienceDirect

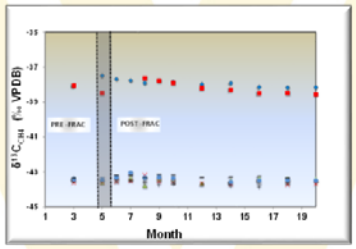
Applied Geochemistry

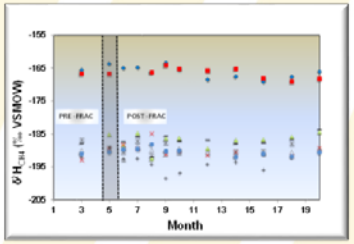
journal homepage: www.elsevier.com/locate/apgeochem

Assessing changes in gas migration pathways at a hydraulic fracturing site: Example from Greene County, Pennsylvania, USA

Shikha Sharma [a,b,*], Lindsey Bowman [a,b], Karl Schroeder [c], Richard Hammack [c]





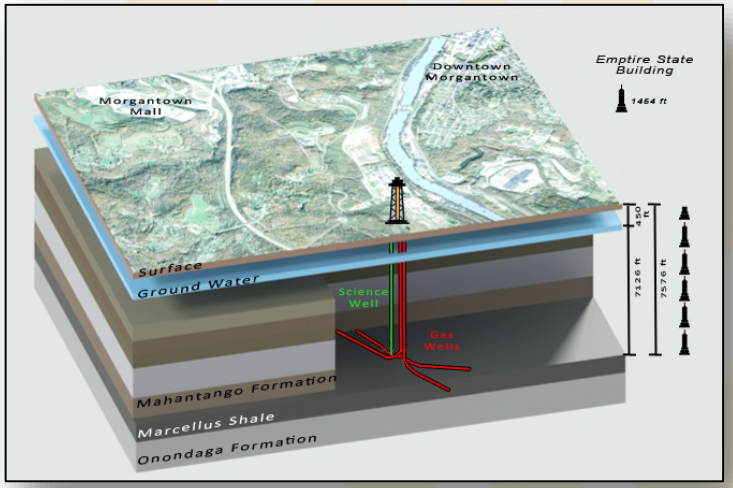


La composicion isotopica del gas es la misma antes y despues

ESTUDIOS BIOGEOQUIMICOS EN MSEEL

El objetivo del Laboratorio Energetico y Ambiental del Marcellus Shale (MSEEL) es crear un sitio de monitoreo a largo plazo para desarrollar y validar nueva tecnologia para mejorar la eficiencia en la produccion y minimizar el impacto ambiental del recurso no convencional

West Virginia University
MSEEL
Marcellus Shale Energy & Environment Laboratory
Northeast Natural Energy



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northeast NATURAL ENERGY
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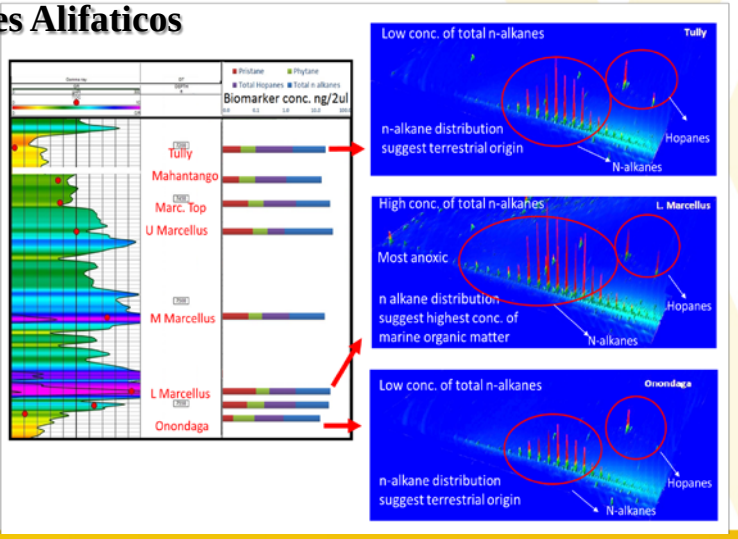
MSEEL Contd……

Controles geologicos sobre la distribucion, diversidad y function de los microbios en el subsuelo

- Produccion de gas e infraestructura de pozos
- Potencial de bloquear fracturas y poros
- Vida y adaptaciones de los microbios

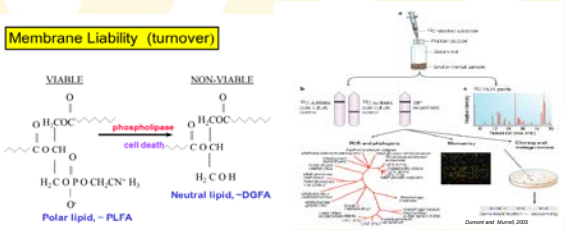
Biomarcadores Alifaticos

Vikas Agrawal
PhD. Student



CSIA & Biomarcadores de acidos grasos

Rawlings Akondi
PhD. Student



S. Pfiffner
UTK

P. Mouser
OSU

- Ratios of physiological stress DGFA/FAME lipid biomarkers
- Changes in the PLFA and DGFA profiles during nutritional & thermal stress
- CSIA will be used to identify microbial populations involved in methanogensis, methanotrophy, sulfate reduction etc.

MSEEL Contd……

Que interacciones fluido-roca-microbio existen?

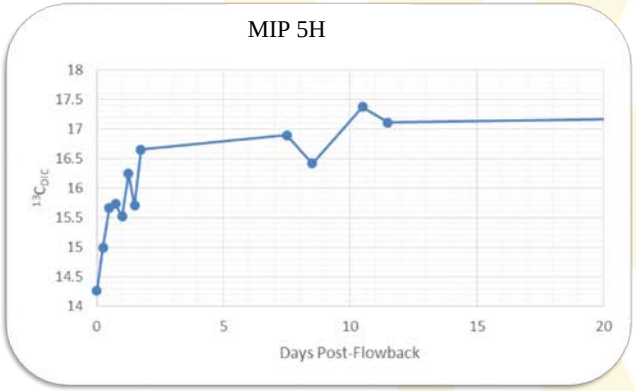
- Cambios en al quimica de aguas producidas
- Generacion de metano biogenico
- Infraestructura de pozos y acidificacion

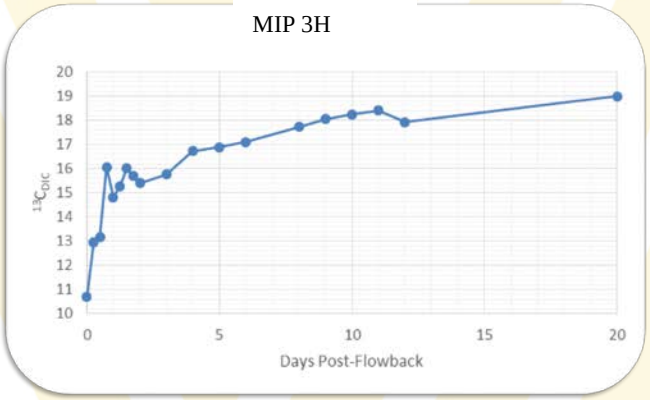
Travis Wilson
MS Student

Collaborators:

NETL — The Ohio State University

Hakala	Mouser, Wrighton
Phan	Wilkins, Cole
Crandall	Darrah





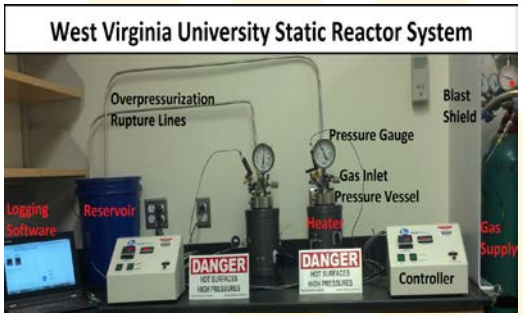
Initial $\delta^{13}C_{DIC}$ enrichment trend in wells 5H and 3H during first few hours to days indicates dissolution of carbonates in reservoir after injection of hydraulic fracturing fluids. High $\delta^{13}C_{DIC}$ values indicate carbonates were precipitated during initial phase of biogenic methanogensis in the reservoir. The C and S isotope trends will be monitored over several months to understand microbial reactions induced in the reservoir after injection of hydraulic fracturing fluids

Decodificando la estructura del kerogeno

- Cambios en la estructura del kerogeno
- Interaccion con los fluidos de fracturacion
- Efecto de los cambios del kerogeno en las aguas producidas

Vikas Agrawal
PhD. Student

Behar & Vandenbroucke, 1987



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