Characterization of Strontium Isotopes in Groundwater in the Deep River Triassic Basin, North Carolina

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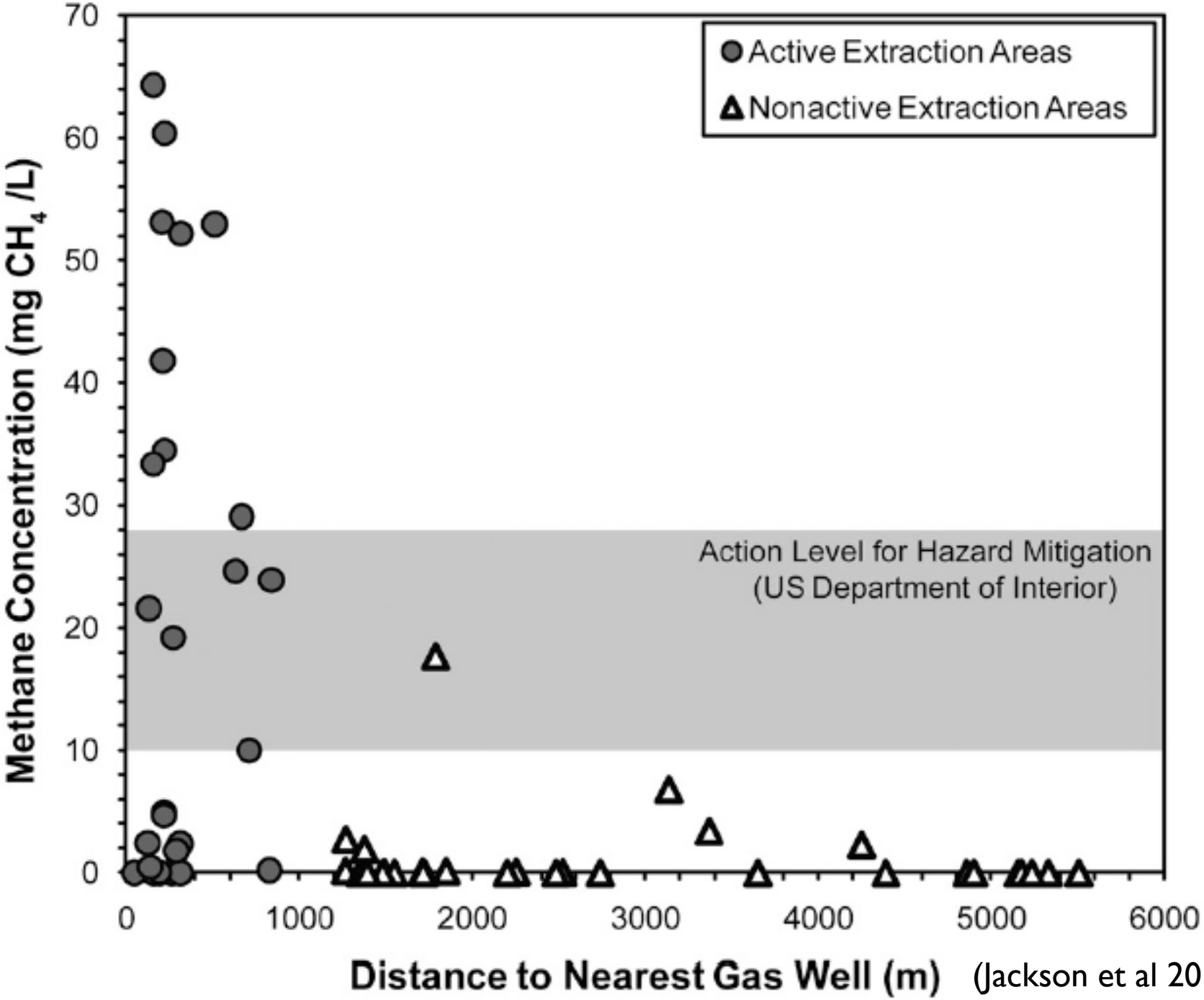
OUR DRINKING WATER MATTERS
STOP DRILLING MARCELLUS


GOT WATER??
OURS HAS: TOLUENE, ETHYLHEXANOL, XYLENE BUTOXYETHANOL, TRIMETHYIBENZ XYLENE, TRIMETHYIBENZENE...
WE CAN'T DRINK GAS OR MONEY!!


this Water


FRACKING
CAUSES
CANCER



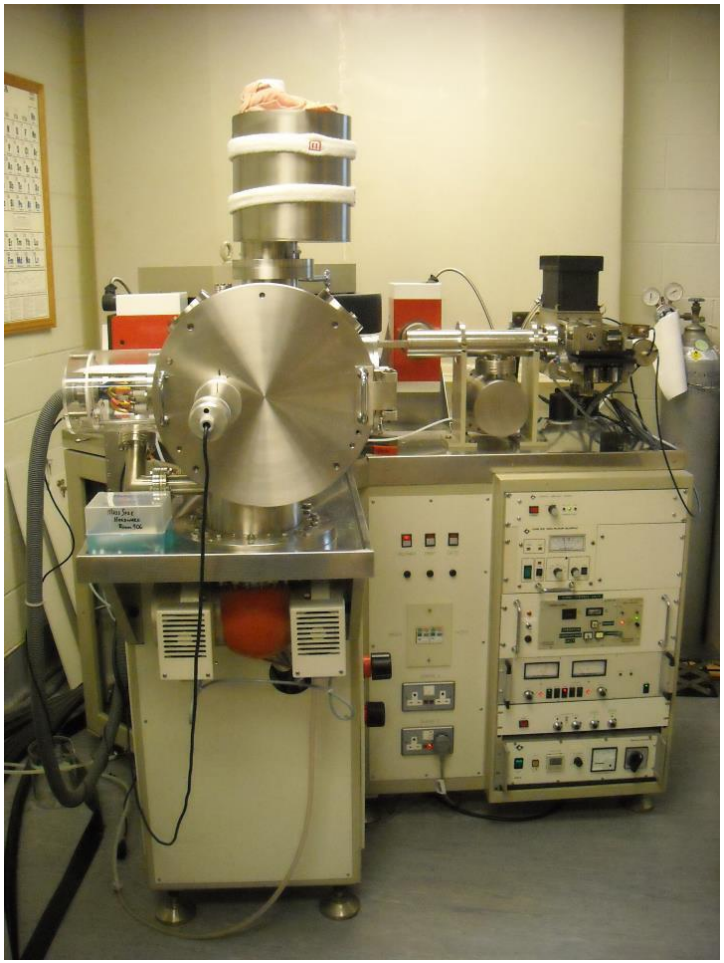
(Jackson et al 2011)

Sampling

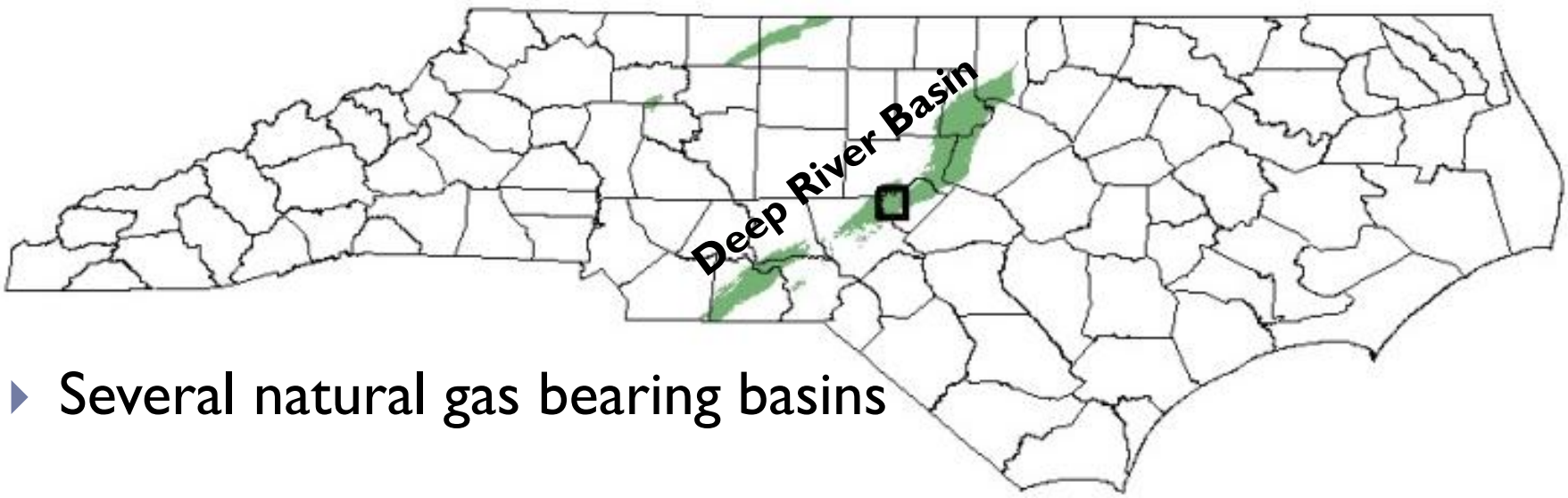
- Establish baseline water quality
- Collected groundwater from 53 private drinking water wells
- Analyzed for:
  - Major Element
  - Trace Metals
  - Methane
  - Noble Gases
  - Isotopes (C, H, Sr)

Strontium Isotopes in Groundwater

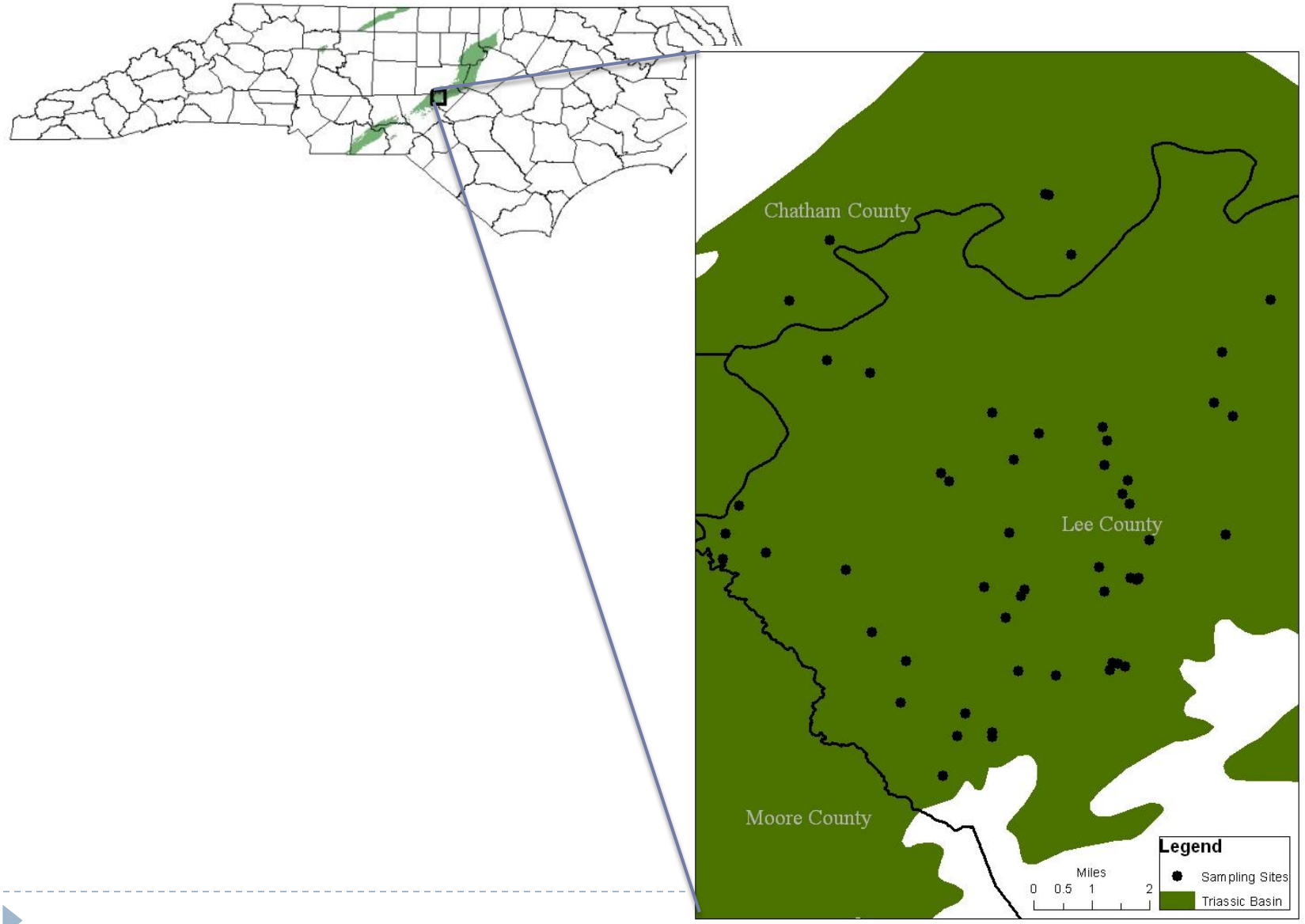
- 4 naturally occurring isotopes of Sr (^{84}Sr, ^{86}Sr, ^{87}Sr, ^{88}Sr)
- ^{87}Sr produced by decay of ^{87}Rb (half-life ~50 Ga)
- Ratio of $^{87}Sr/^{86}Sr$ varies in with age and Rb/Sr ratio of rock
- $^{87}Sr/^{86}Sr$ in groundwater primarily reflects water-rock interaction

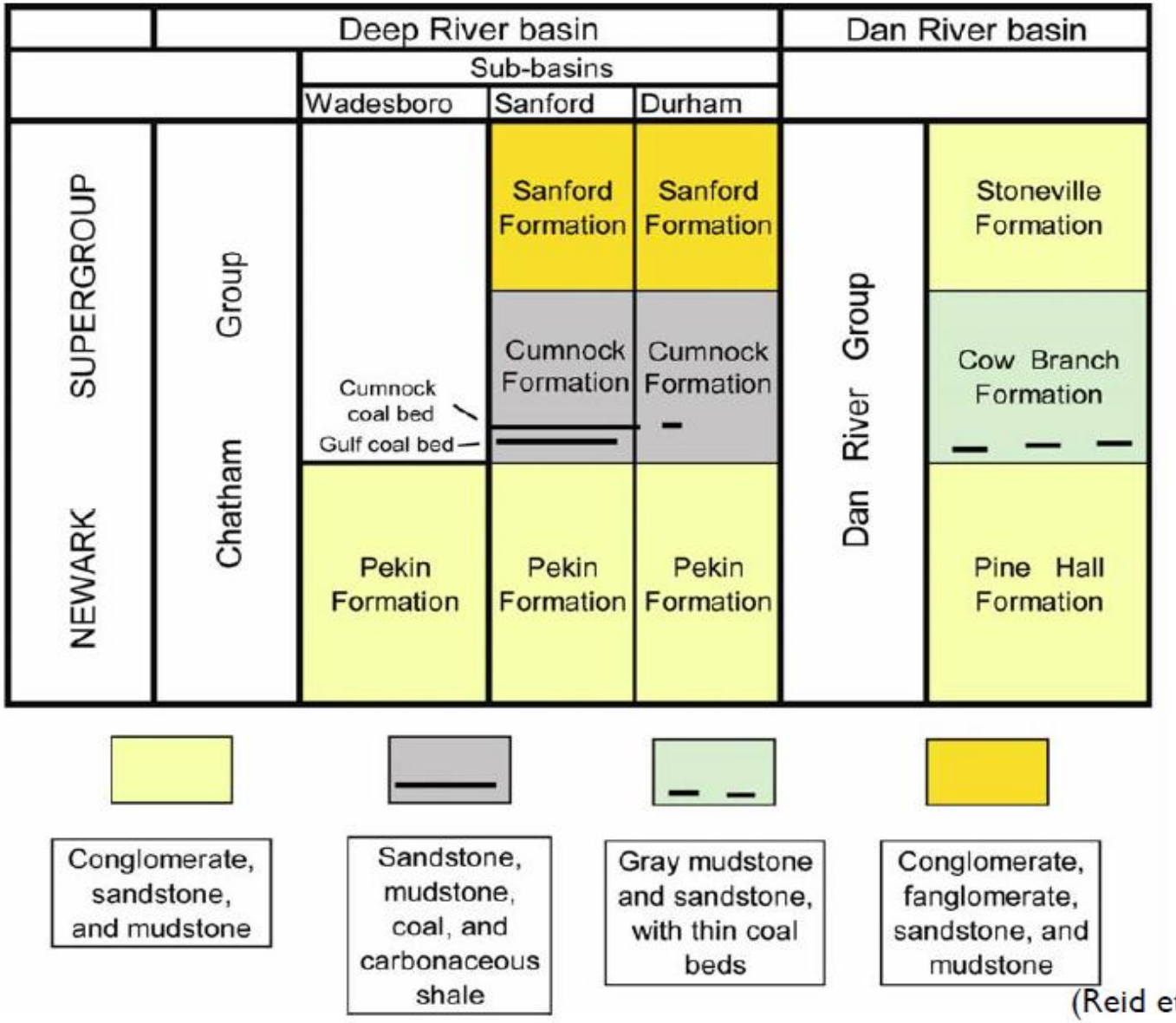


Why North Carolina?

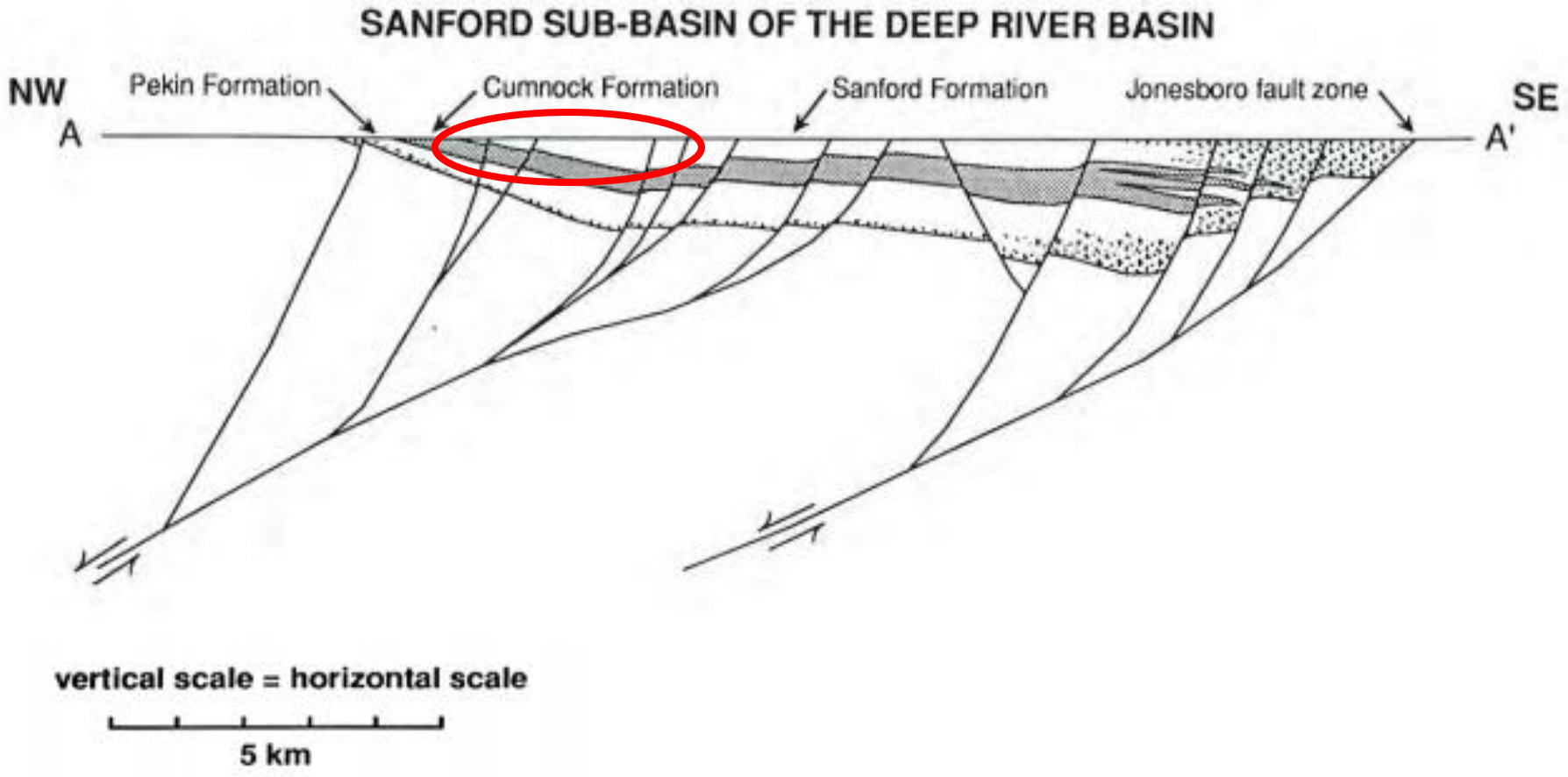


- Several natural gas bearing basins
- No drilling has taken place
- Political interest in fracking
- No significant history of oil and gas drilling

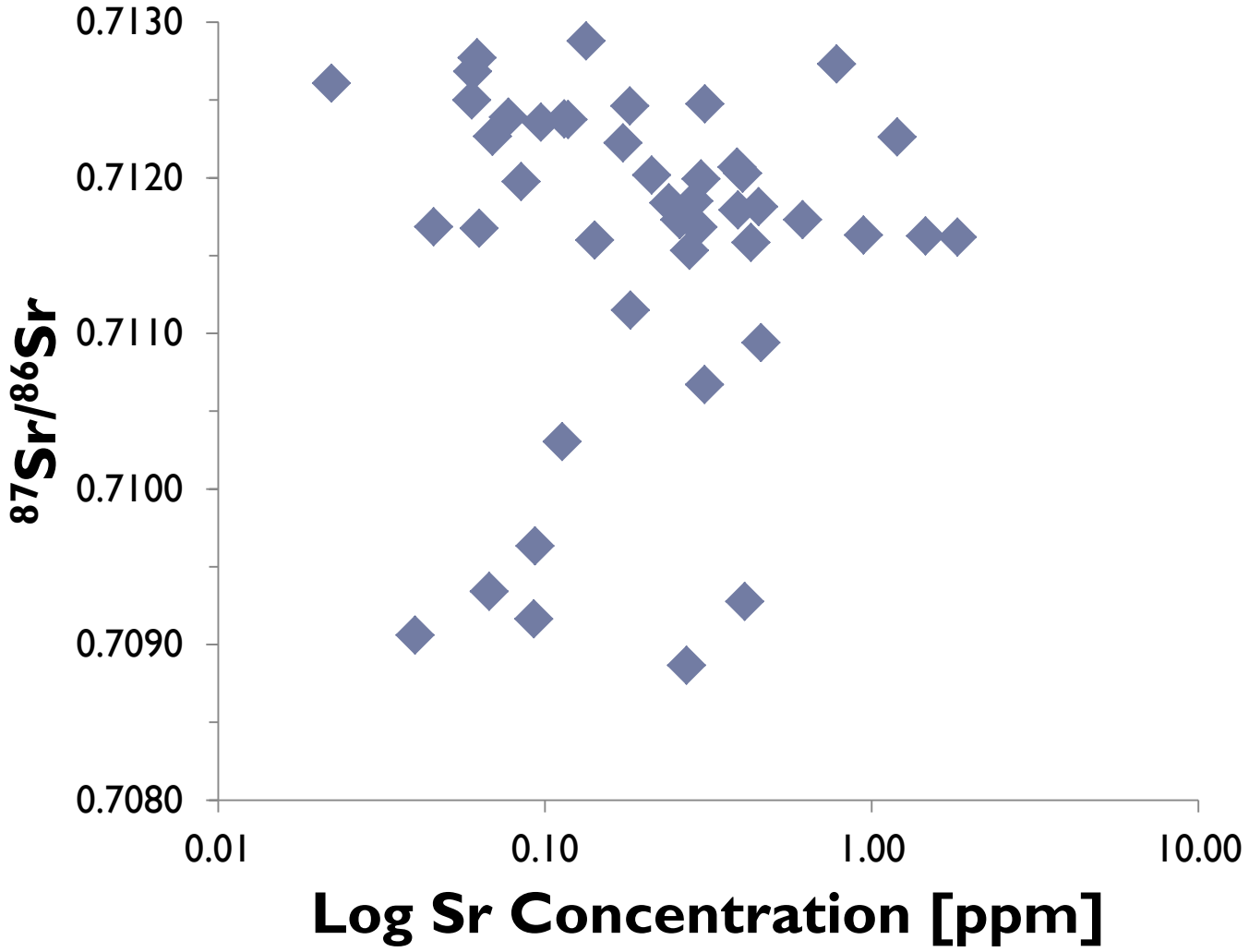

Chatham County
Lee County
Moore County
Legend
Sampling Sites
Triassic Basin
Miles
0 0.5 1 2

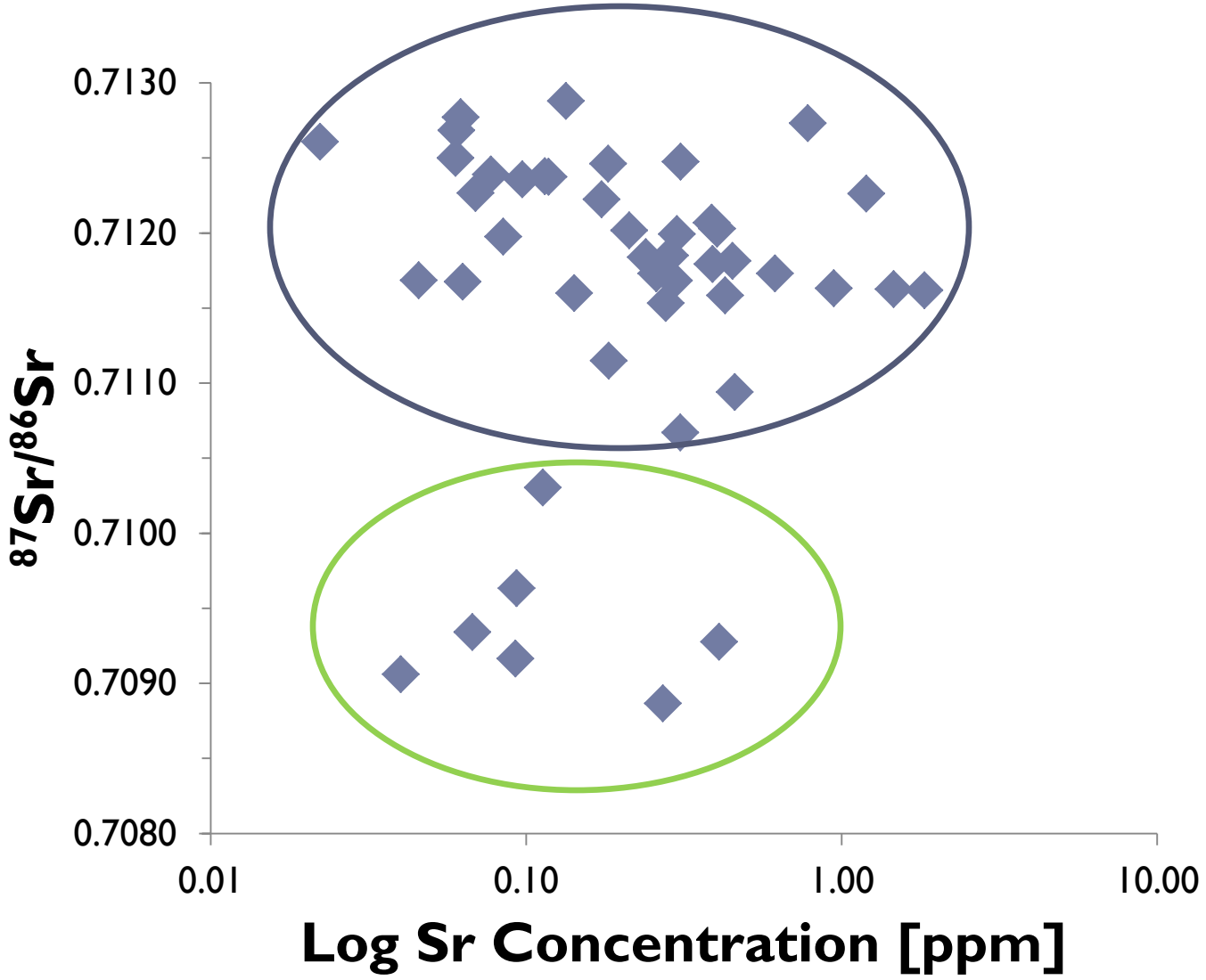


(Reid et al 2008)


SANFORD SUB-BASIN OF THE DEEP RIVER BASIN
NW
A
Pekin Formation
Cumnock Formation
Sanford Formation
Jonesboro fault zone
SE
A'
vertical scale = horizontal scale
5 km

(NC DENR 2012)


0.7130
0.7120
0.7110
0.7100
0.7090
0.7080
$^{87}Sr/^{86}Sr$
0.01
0.10
1.00
10.00
Log Sr Concentration [ppm]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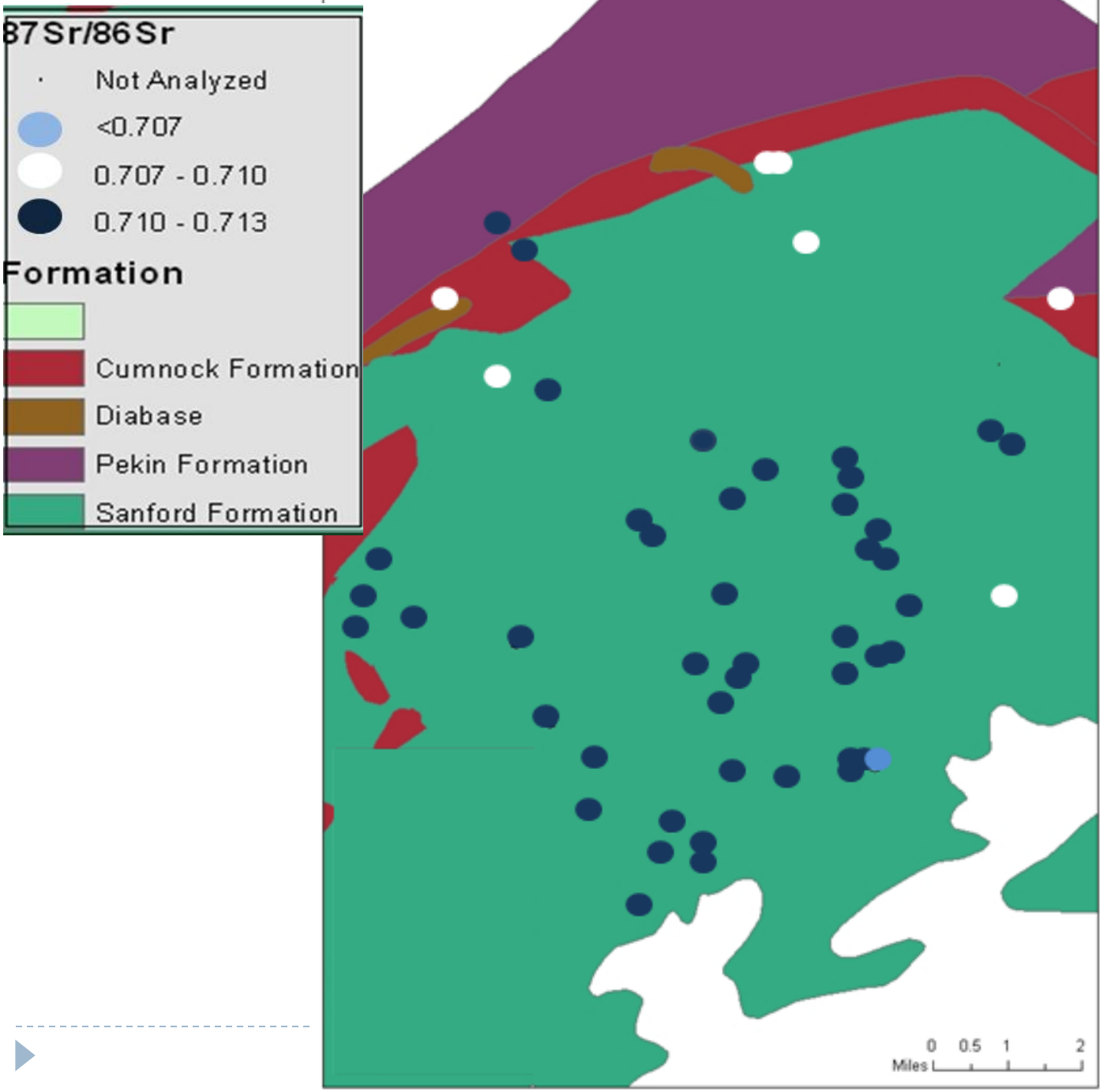
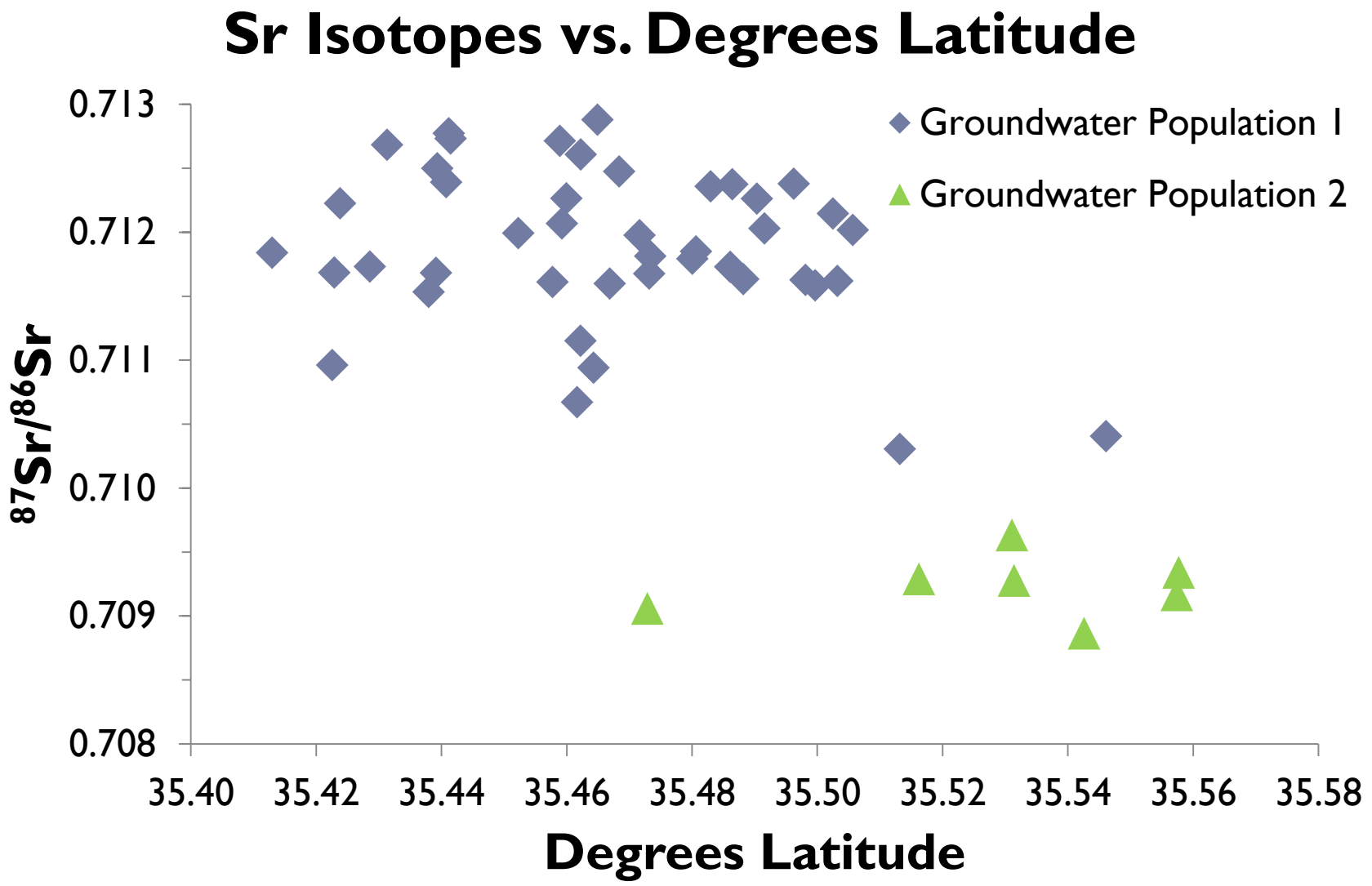
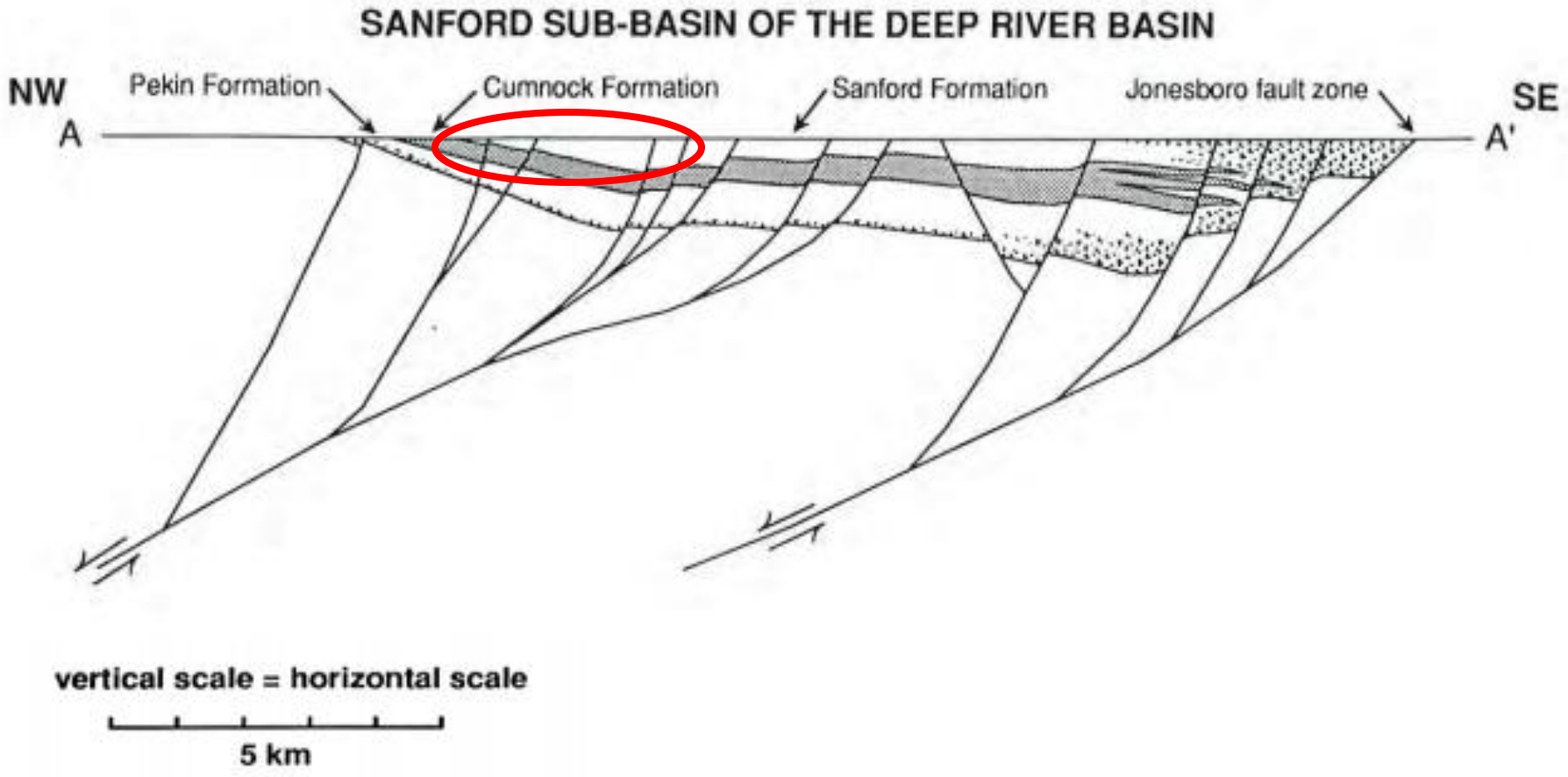

87Sr/86Sr
Not Analyzed
<0.707
0.707 - 0.710
0.710 - 0.713
Formation
Cumnock Formation
Diabase
Pekin Formation
Sanford Formation
0 0.5 1 2
Miles


Sr Isotopes vs. Degrees Latitude
0.713
0.712
0.711
0.710
0.709
0.708
87Sr/86Sr
35.40
35.42
35.44
35.46
35.48
35.50
35.52
35.54
35.56
35.58
Degrees Latitude
Groundwater Population 1
Groundwater Population 2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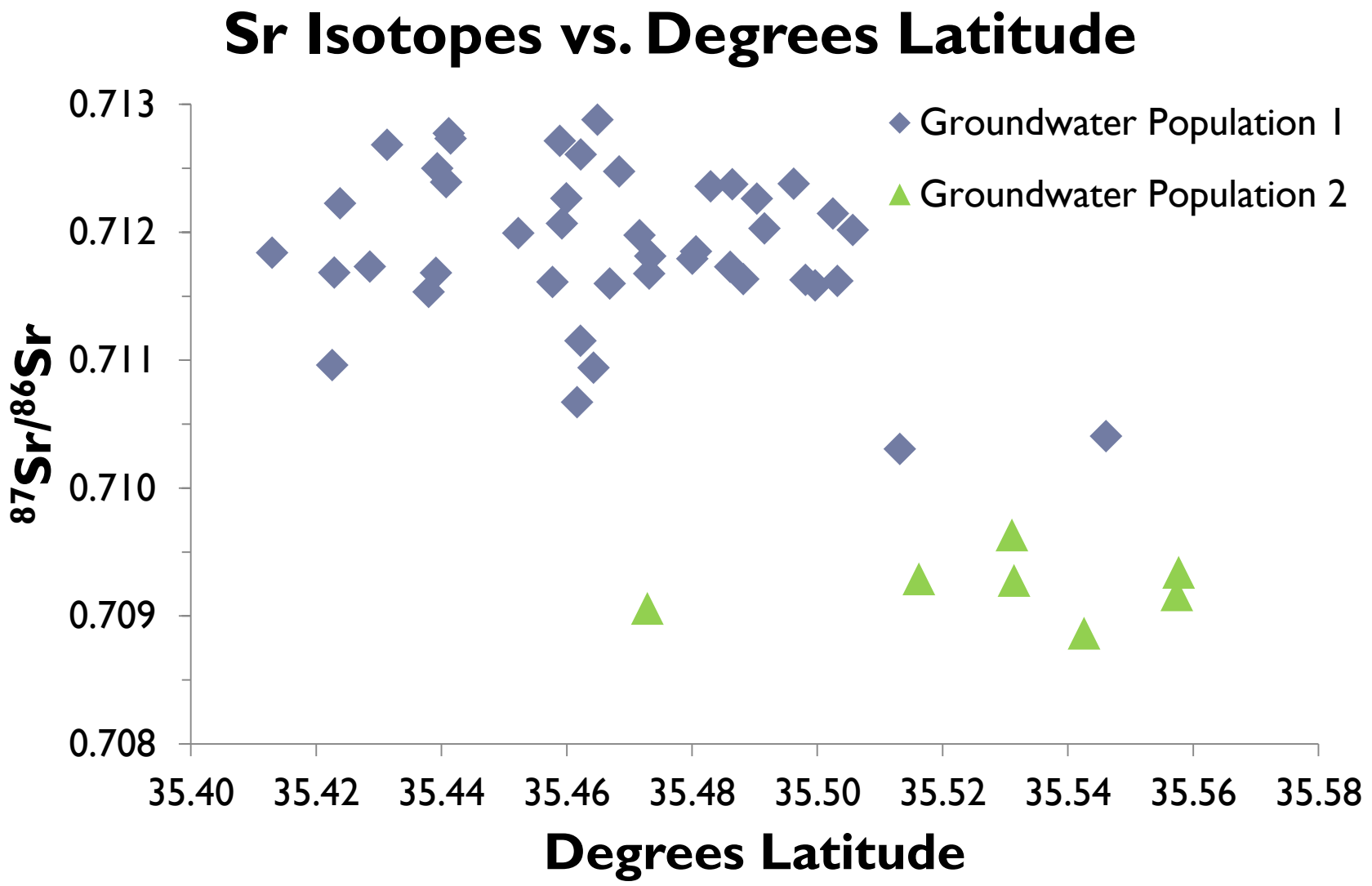
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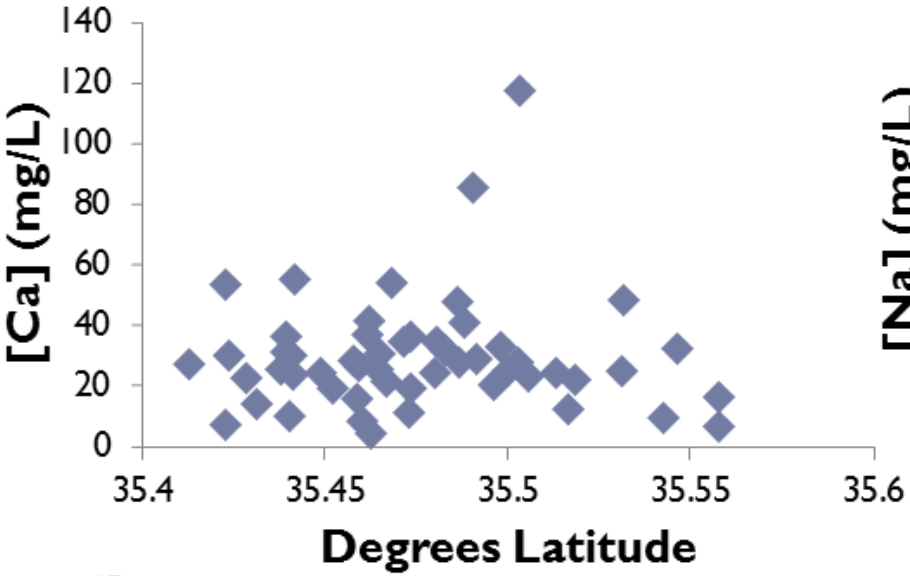
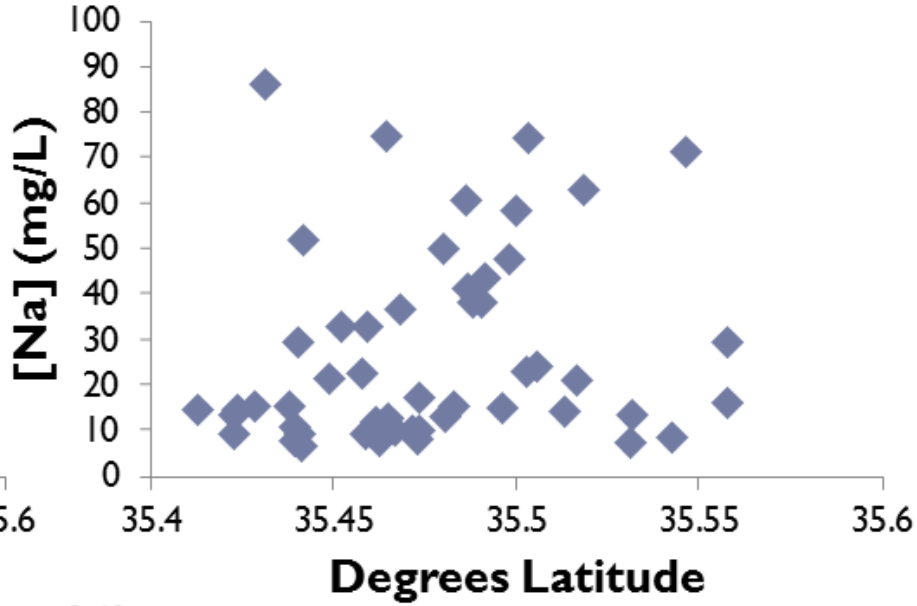
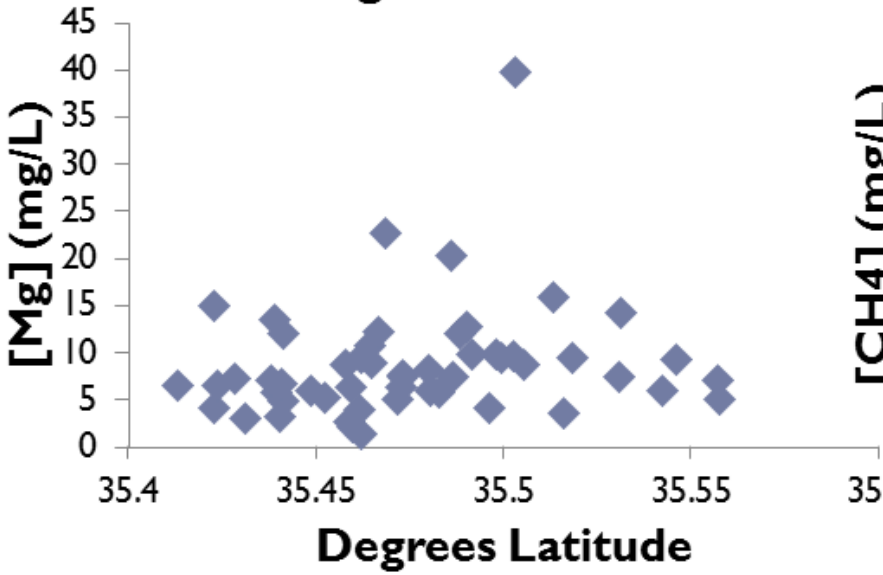
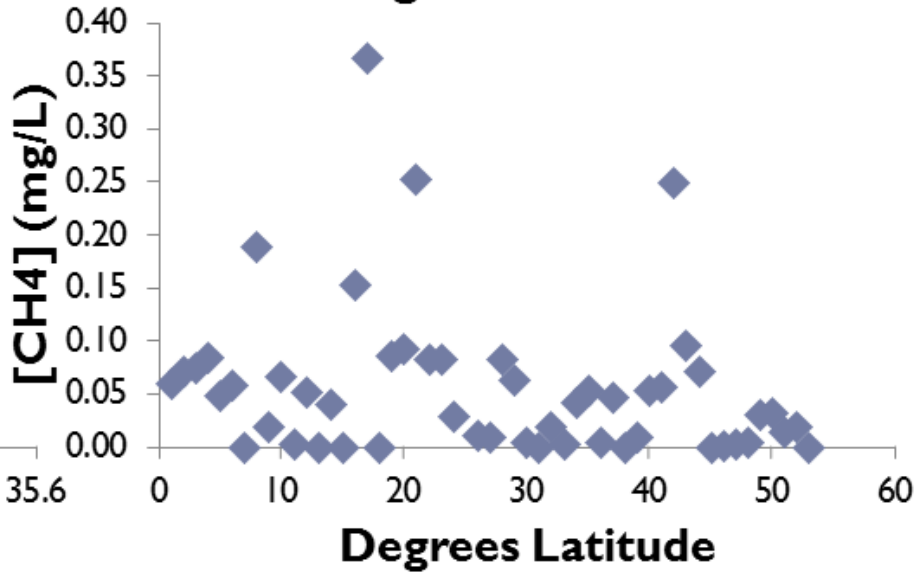

[Ca] (mg/L)
140
120
100
80
60
40
20
0
35.4
35.45
35.5
35.55
35.6
Degrees Latitude


[Na] (mg/L)
100
90
80
70
60
50
40
30
20
10
0
35.4
35.45
35.5
35.55
35.6
Degrees Latitude


[Mg] (mg/L)
45
40
35
30
25
20
15
10
5
0
35.4
35.45
35.5
35.55
35.6
Degrees Latitude


[CH4] (mg/L)
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0
10
20
30
40
50
60
Degrees Latitude

Conclusions

- Sr isotopes show a narrow range, will likely be a useful tool for studying potential groundwater contamination
- Two distinct groundwater populations
- Spatial pattern of isotopic values
- Patterns seen may reflect groundwater from the two primary formations in the area

Acknowledgements

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