

CO₂ adsorption in coals as a
function of rank and
composition: A task in USGS
research on geologic
sequestration of CO₂

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Project Tasks

1. Adsorption Properties of Coals
Research + Mendenhall Post-doc
2. Storage capacity of subsurface traps
Research
Assessment
3. CO₂ Sequestration in Deep Aquifers
Research
4. GIS of point-source CO₂ emissions (GEODE)
Assessment

Brief history

“Scoping Project” in FY99; Formal 4-year project in FY00

Coal Task

1. Initiated by Ron Stanton as collaborative effort with CBM studies of low rank coals.
2. Presented by Hal Gluskoter at NETL Seq. I for Stanton
3. Additional bituminous coals and anthracite added by Gluskoter, with assistance by Maria Mastalerz, Indiana Survey
4. Presented by Gluskoter at AAPG, GSA, SME

All isotherms measured by Marc Bustin.

Additional coal activities

1. Organic geochemistry of CO₂-coal interactions

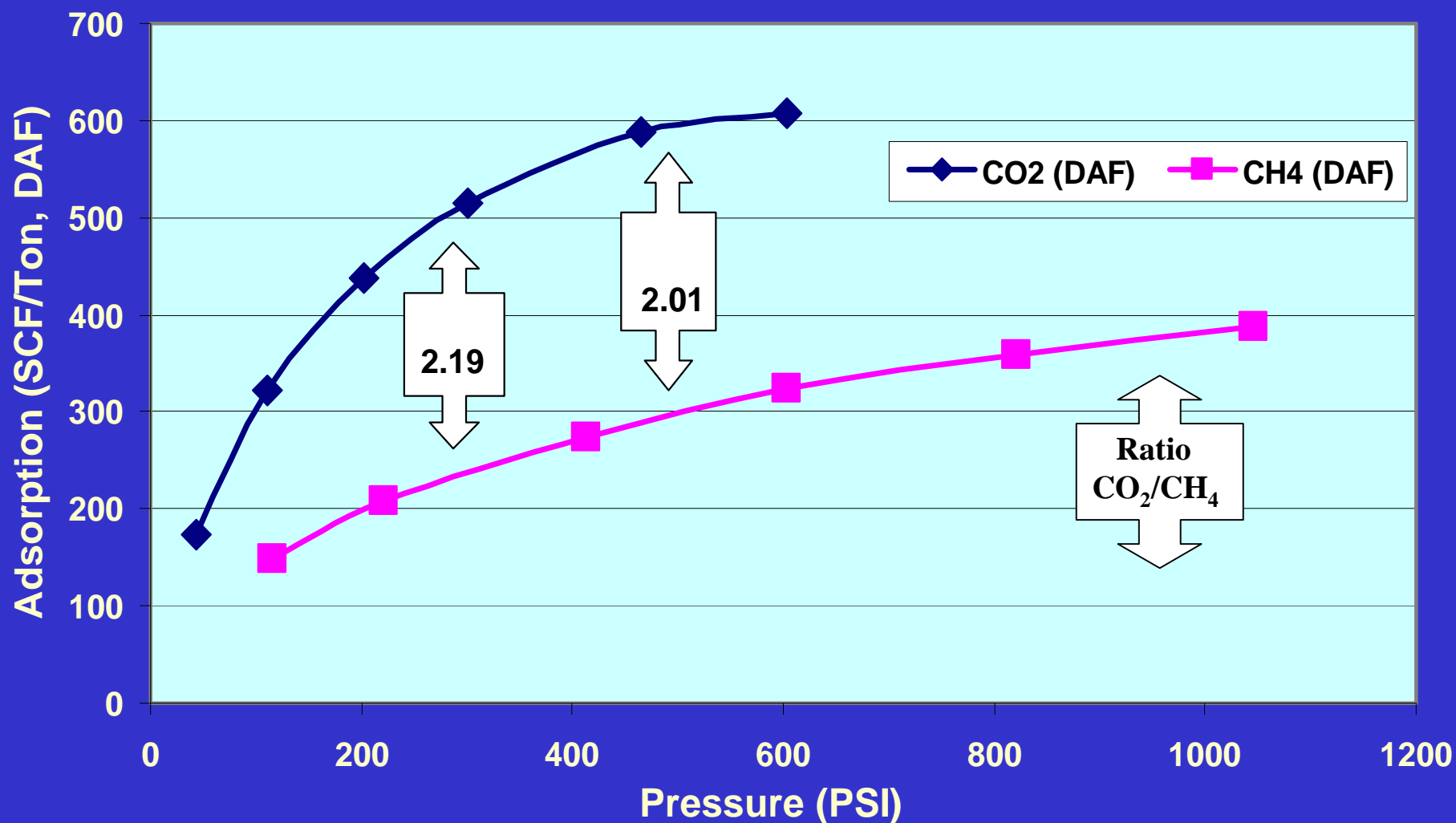
Mendenhall Post-doc: Jon Kolak

2. Molecular and isotopic studies of CO₂ -CH₄ partitioning in coals in a whole-core flow apparatus

Maria Mastalerz and Arndt Schimmelmann, Indiana Survey and Indiana Univ., co-PI's.

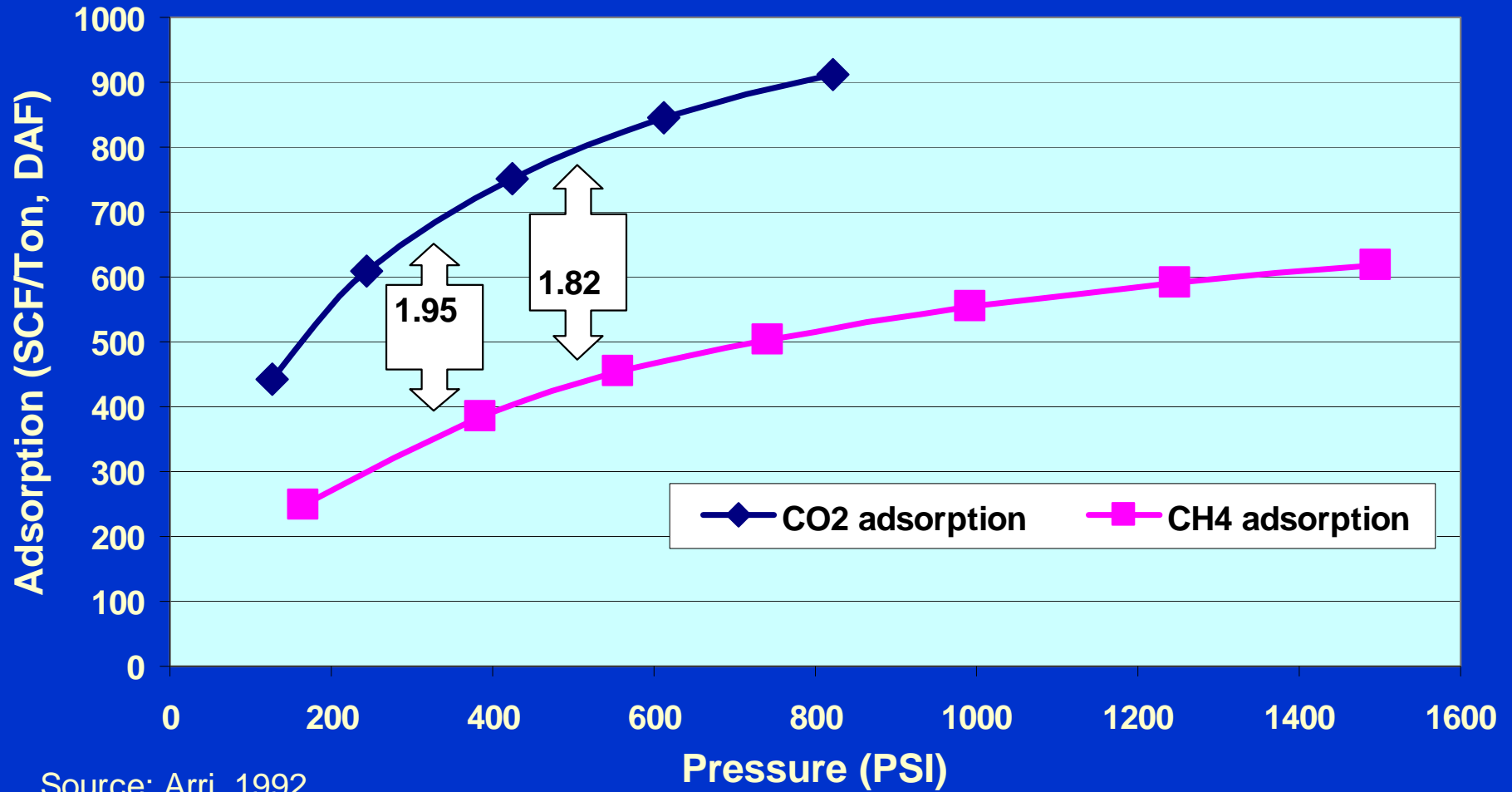
3. NETL round-robin collaborator with Marc Bustin

Methane and Carbon Dioxide Adsorption Bituminous Coal, Appalachian Basin



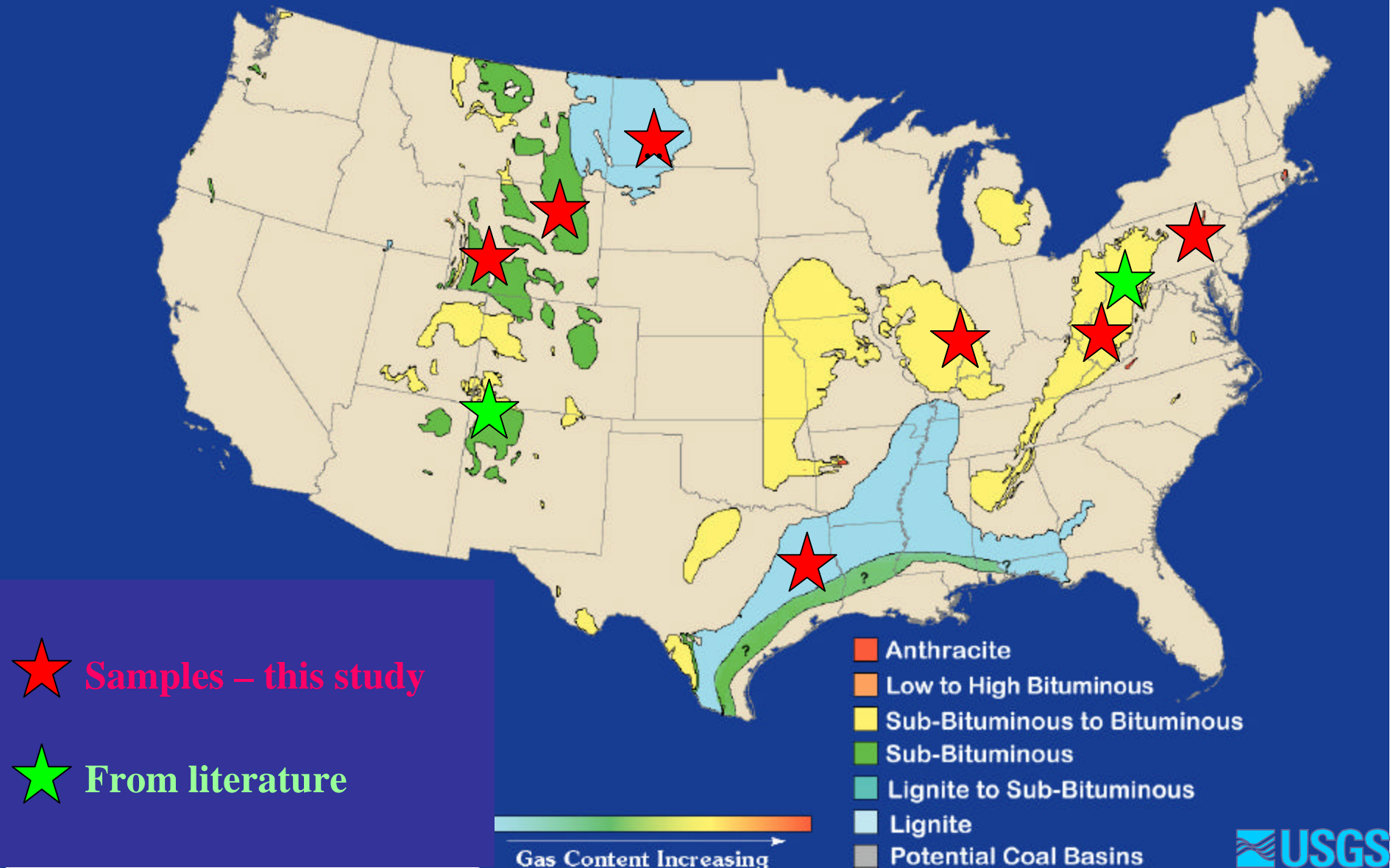
Source: Greaves, 1993

Methane and Carbon Dioxide Adsorption, Bituminous Coal San Juan Basin

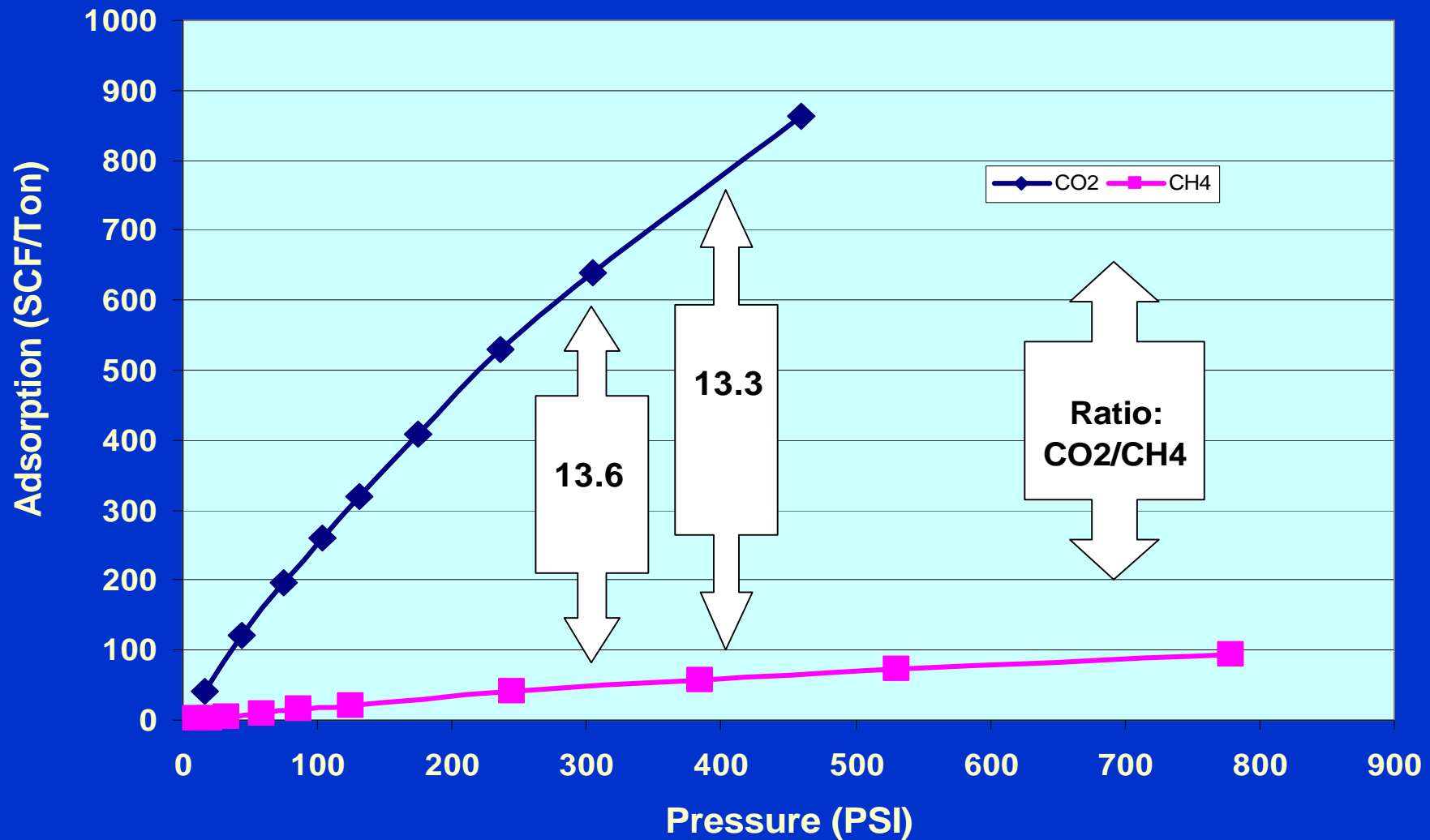


Source: Arri, 1992

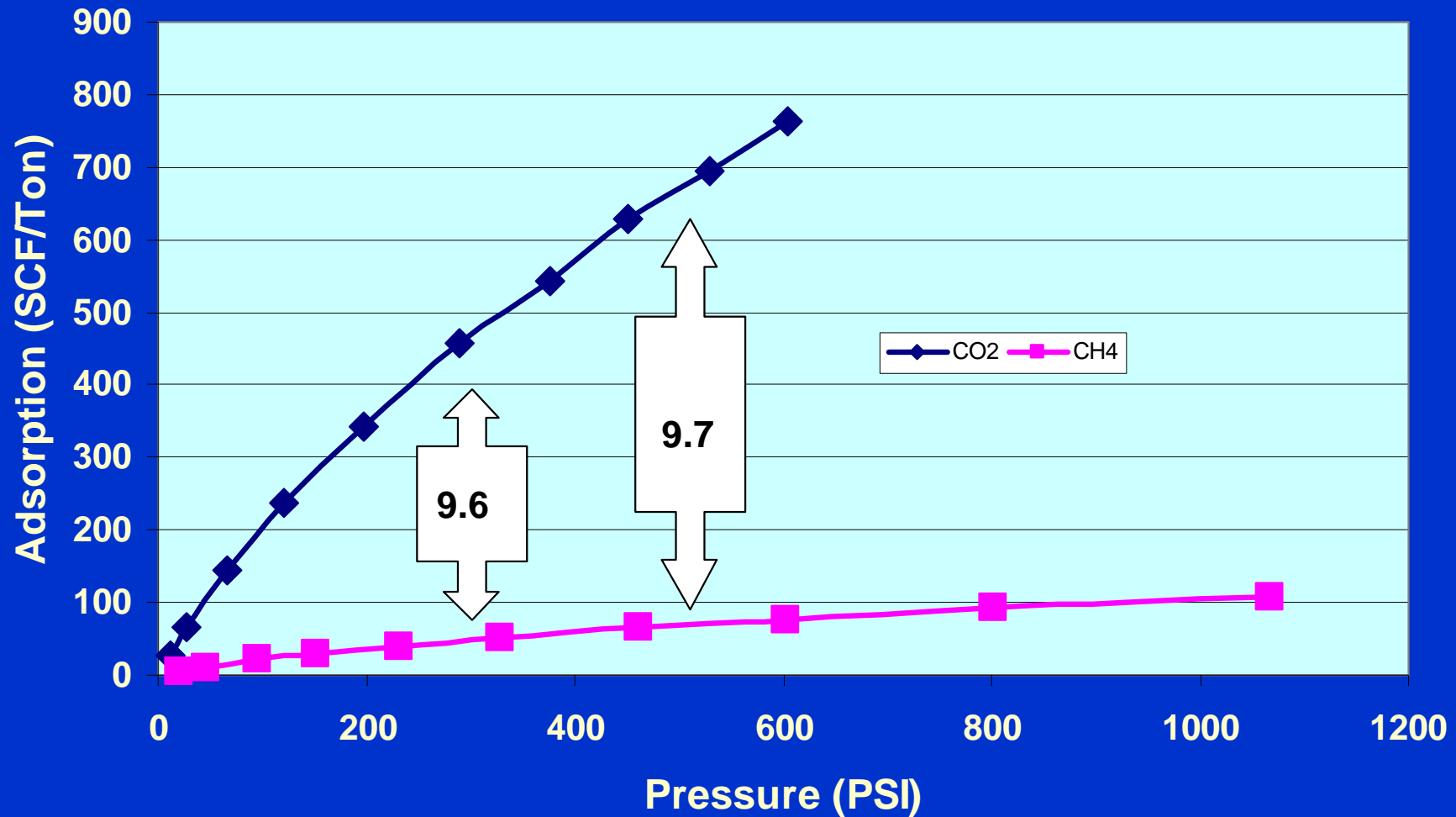
General Rank of Coal in Major Coalbed Methane Areas and Location of Samples



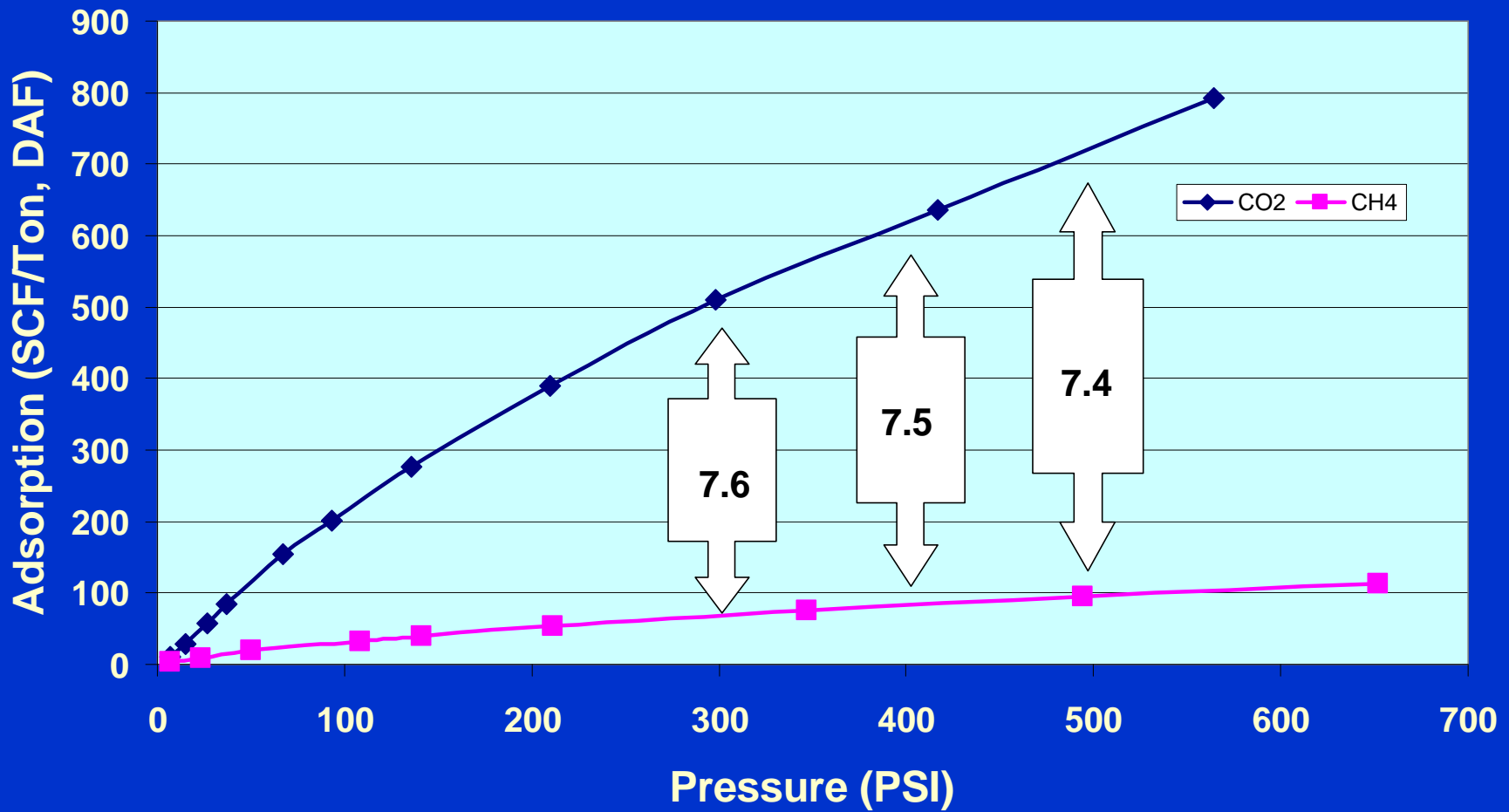
Carbon Dioxide and Methane Adsorption North Dakota Lignite



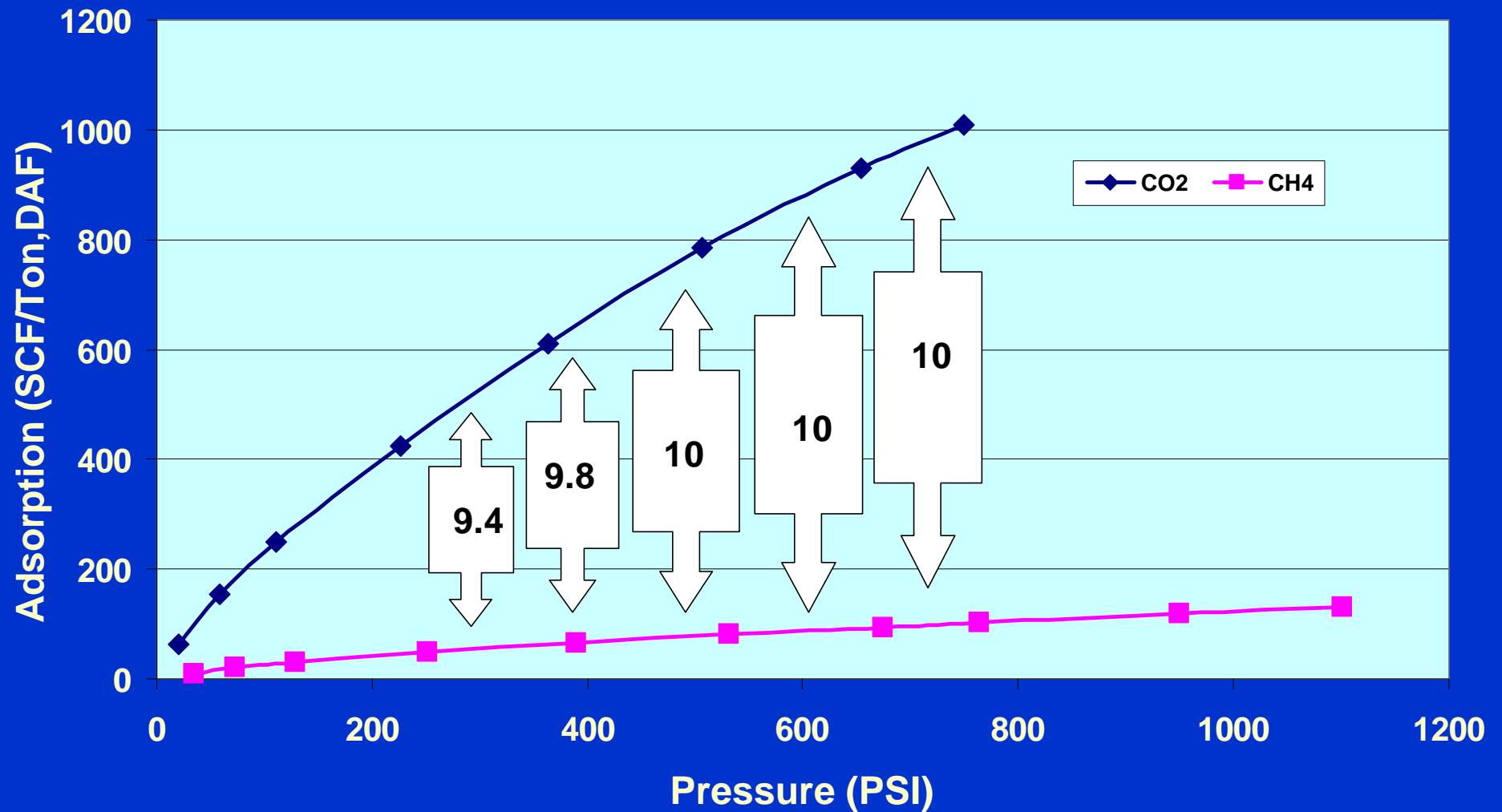
Carbon Dioxide and Methane Adsorption - Subbituminous Coal, Powder River Basin



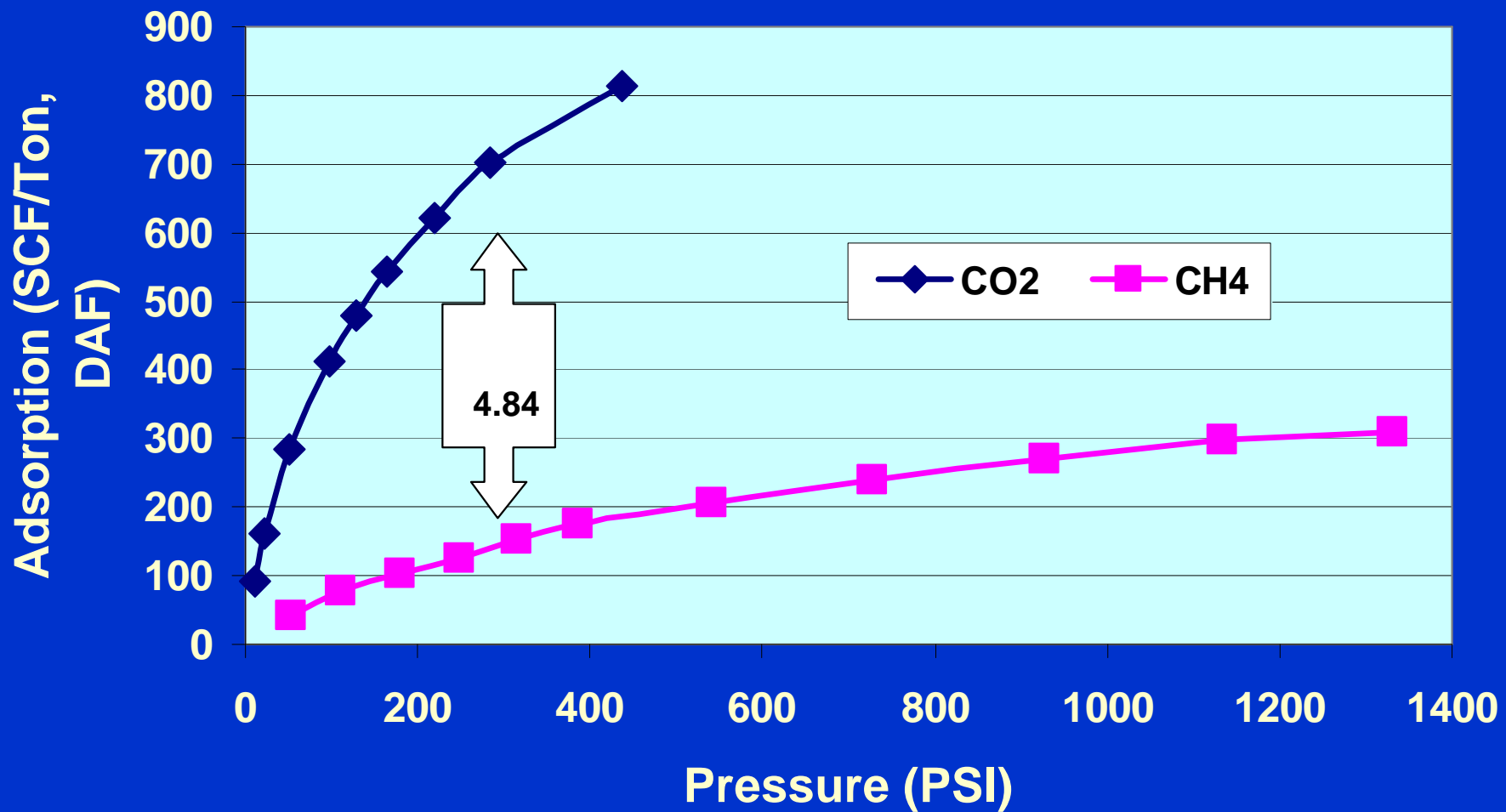
Carbon Dioxide and Methane Adsorption Subbituminous Coal, Powder River Basin



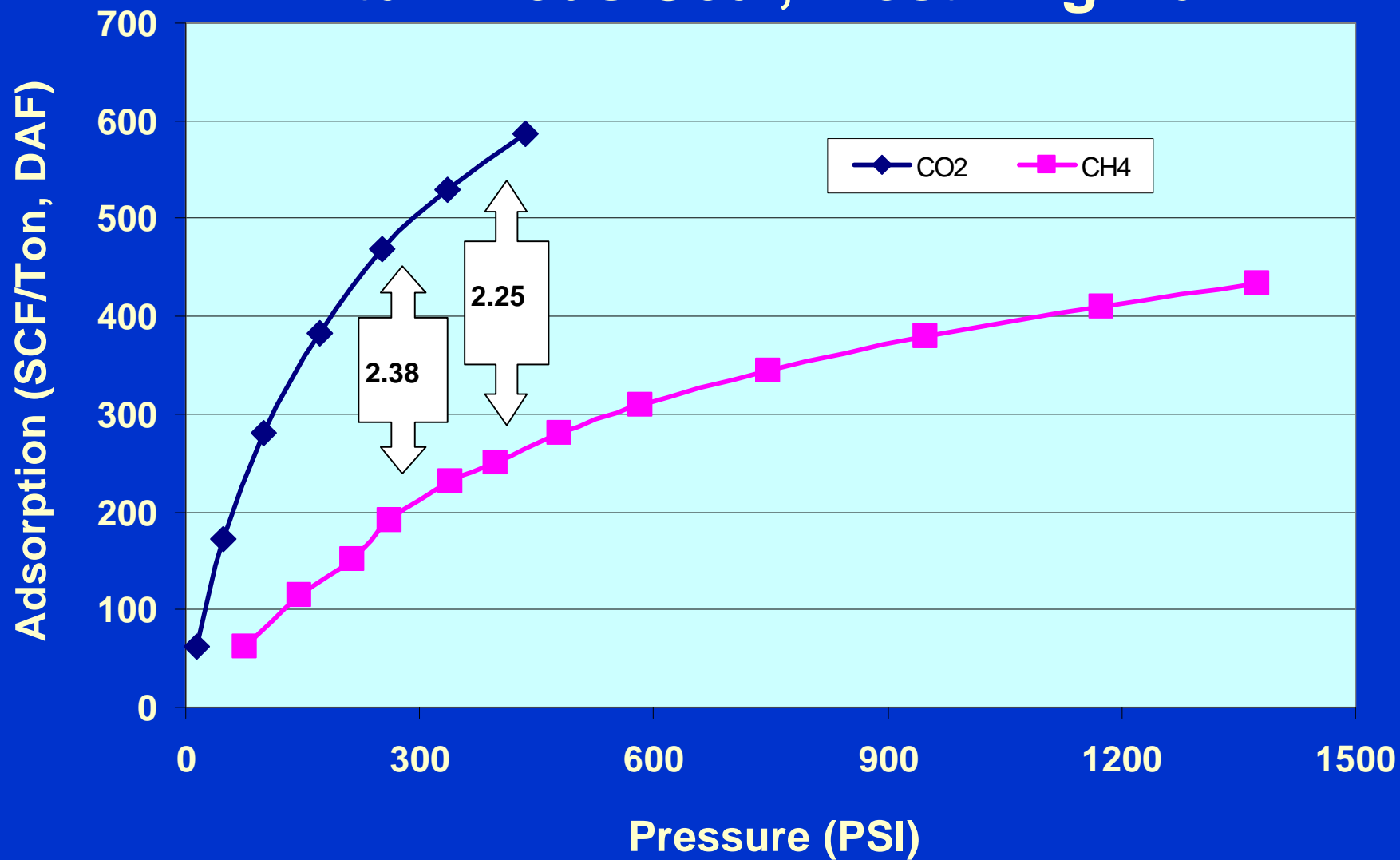
Carbon Dioxide and Methane Adsorption Subbituminous Coal, Texas Gulf Coast



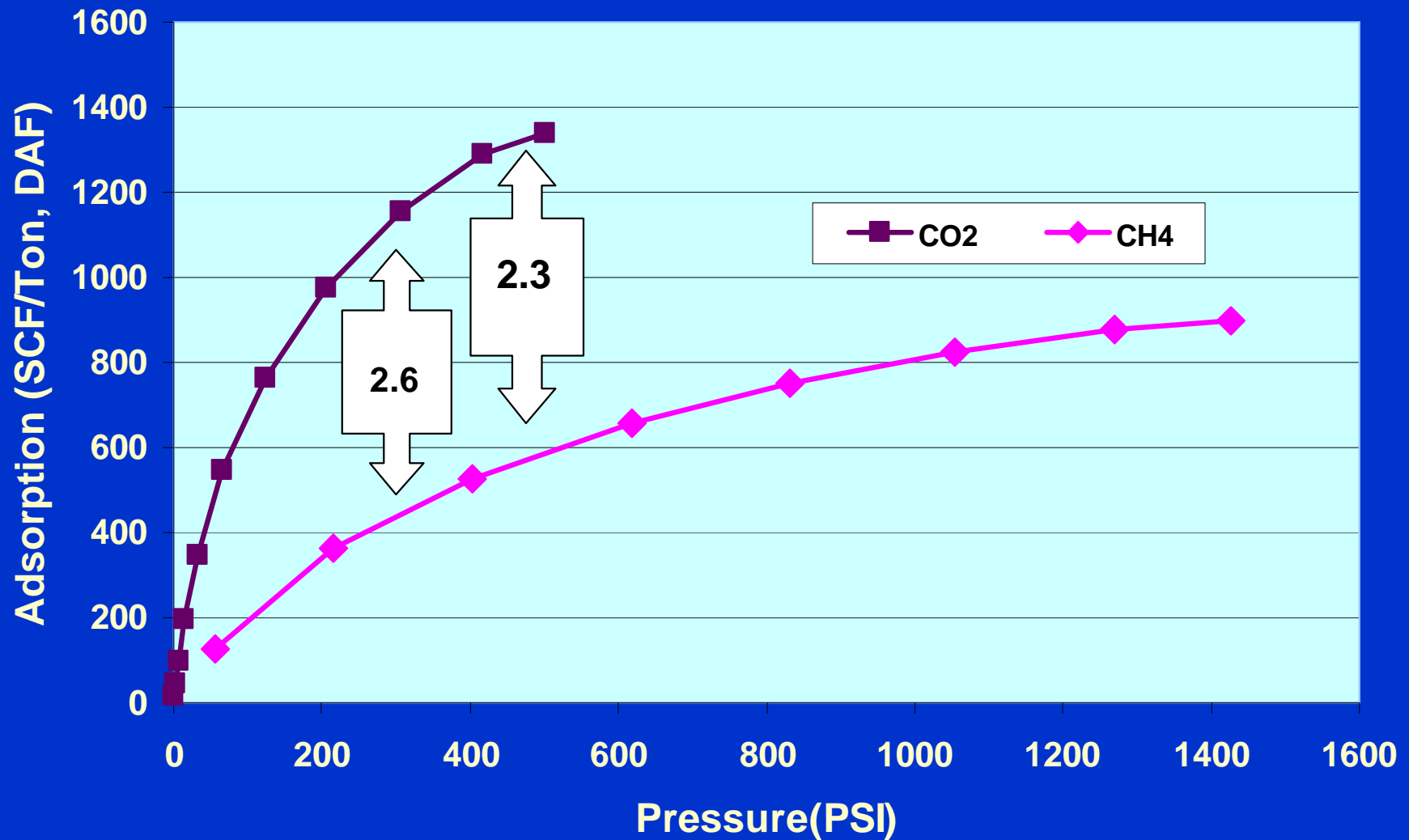
Methane and Carbon Dioxide Adsorption - Illinois Basin hvBb



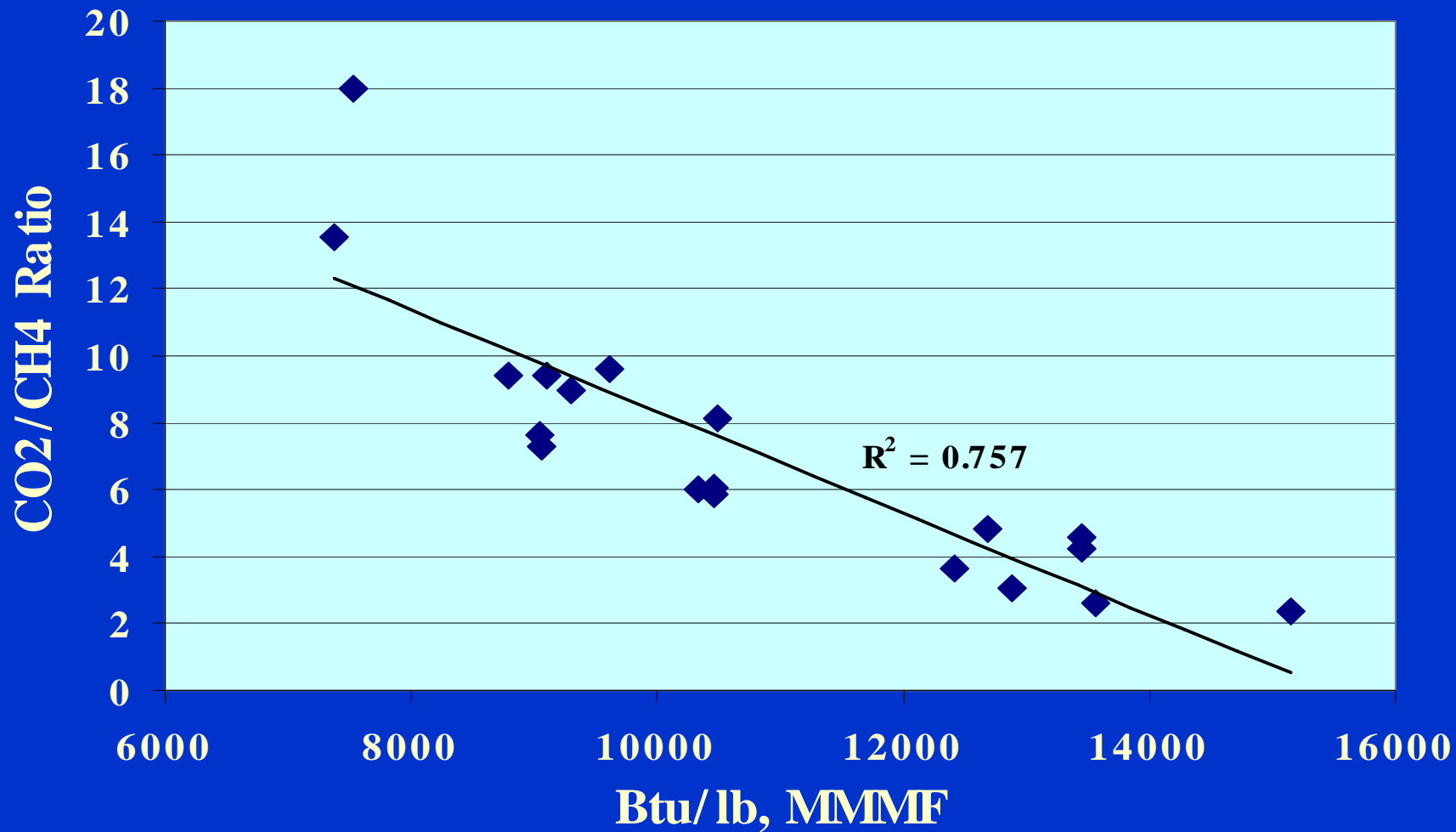
Methane and Carbon Dioxide Adsorption Bituminous Coal, West Virginia



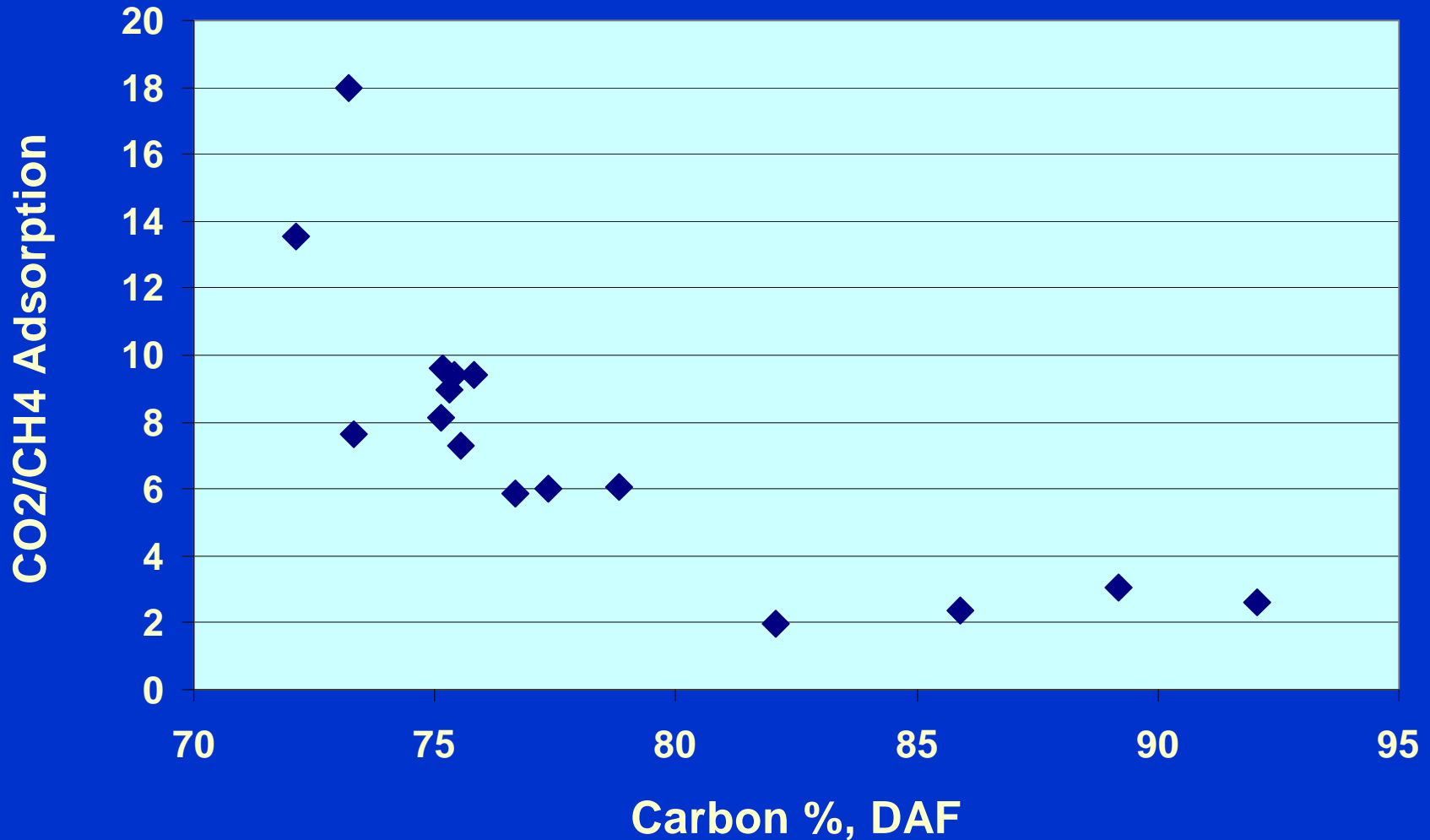
Carbon Dioxide and Methane Adsorption Anthracite - 7-Foot Seam



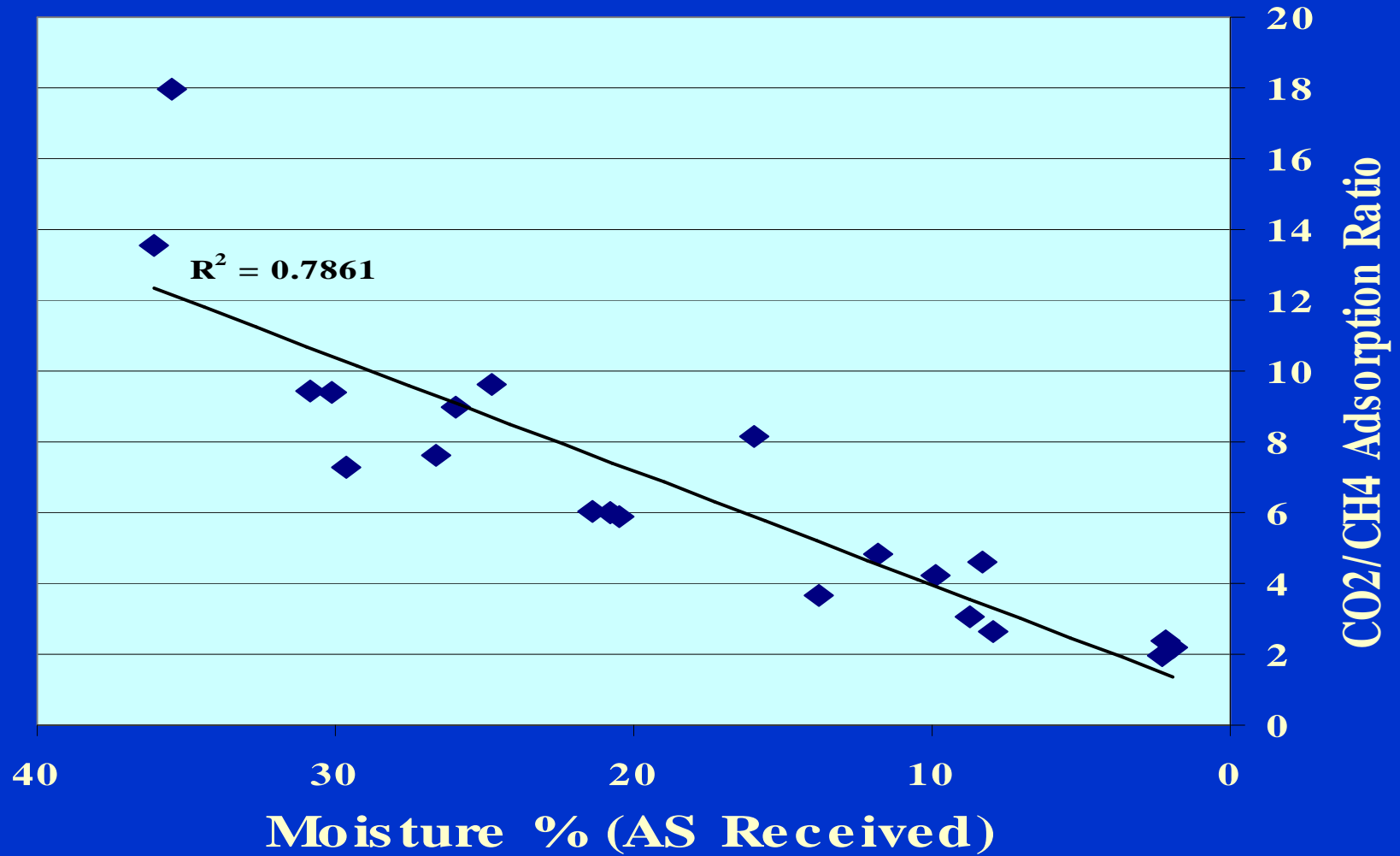
Adsorption Ratio VS Calorific Value



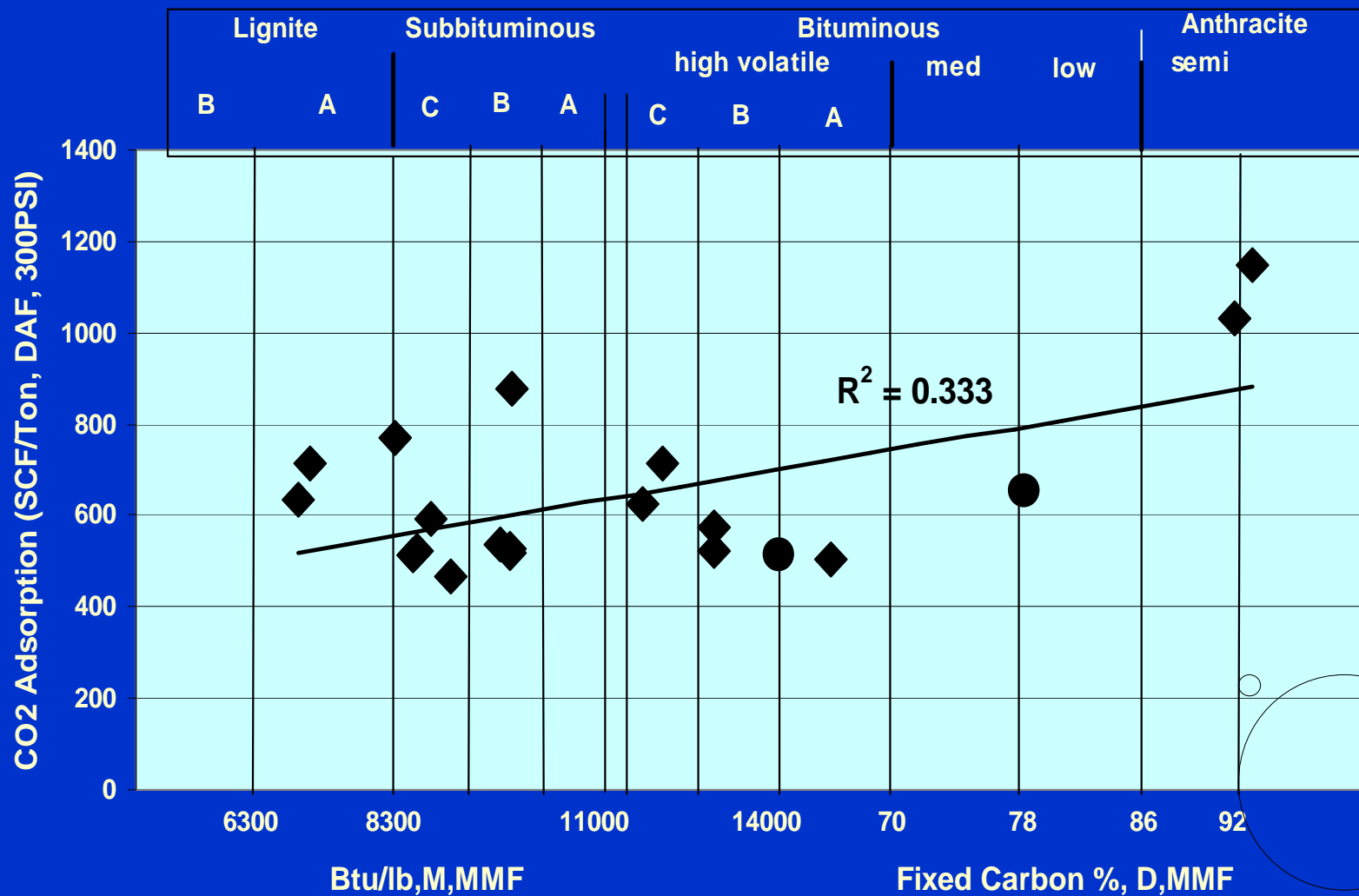
The Ratio of Carbon Dioxide Adsorption to Methane Adsorption Versus Carbon (DAF)



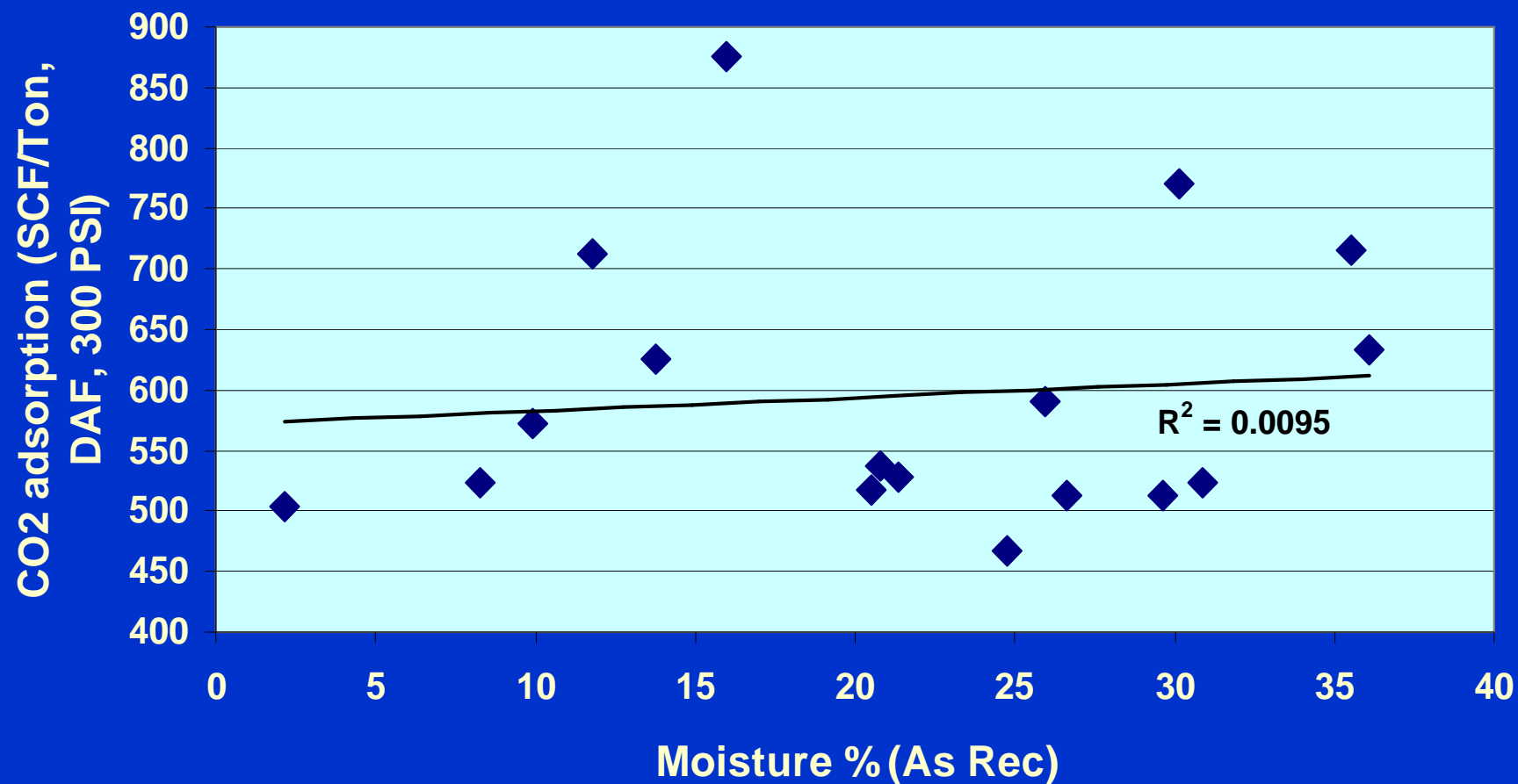
Adsorption Ratio VS Moisture



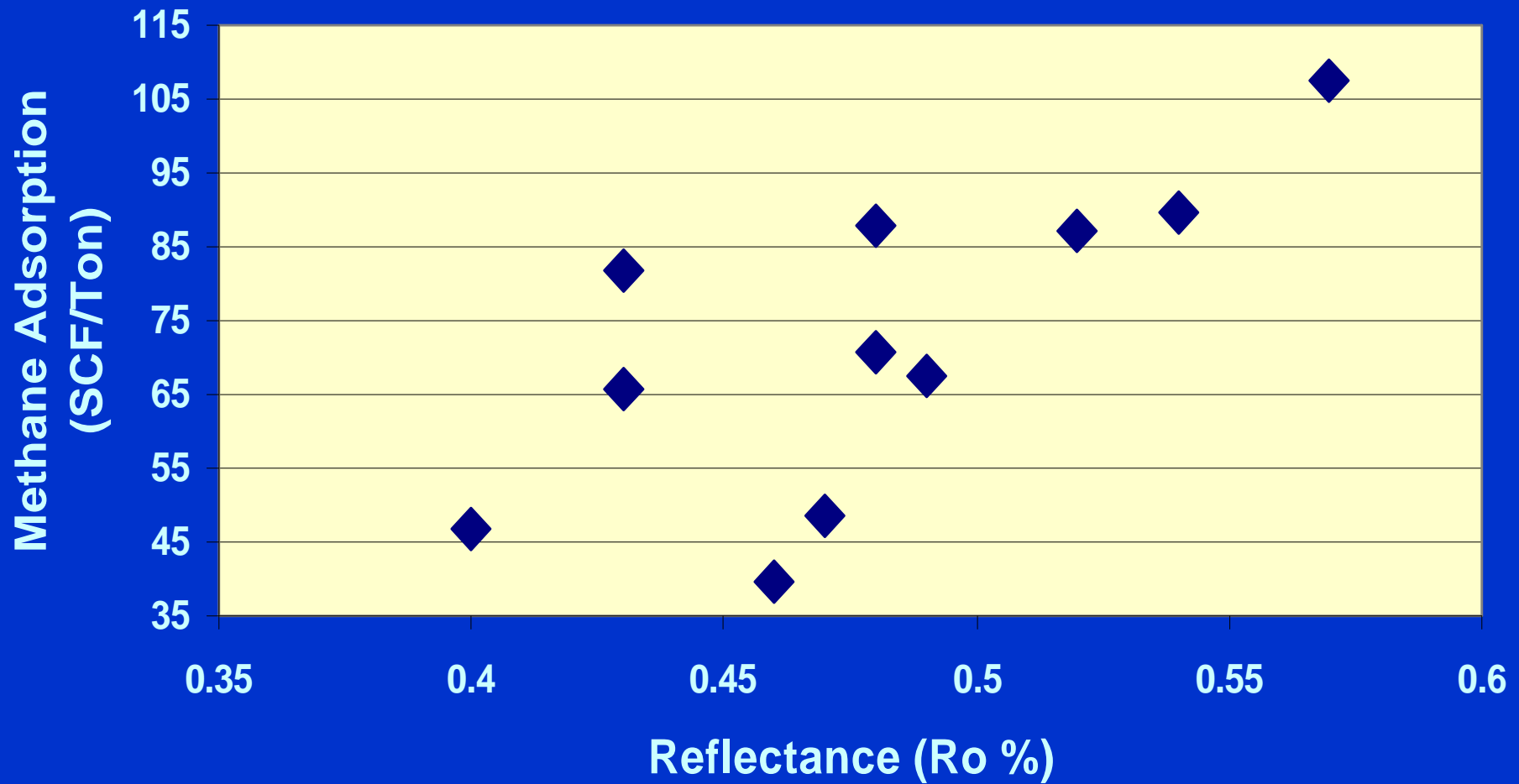
CO2 Variation with Coal Rank



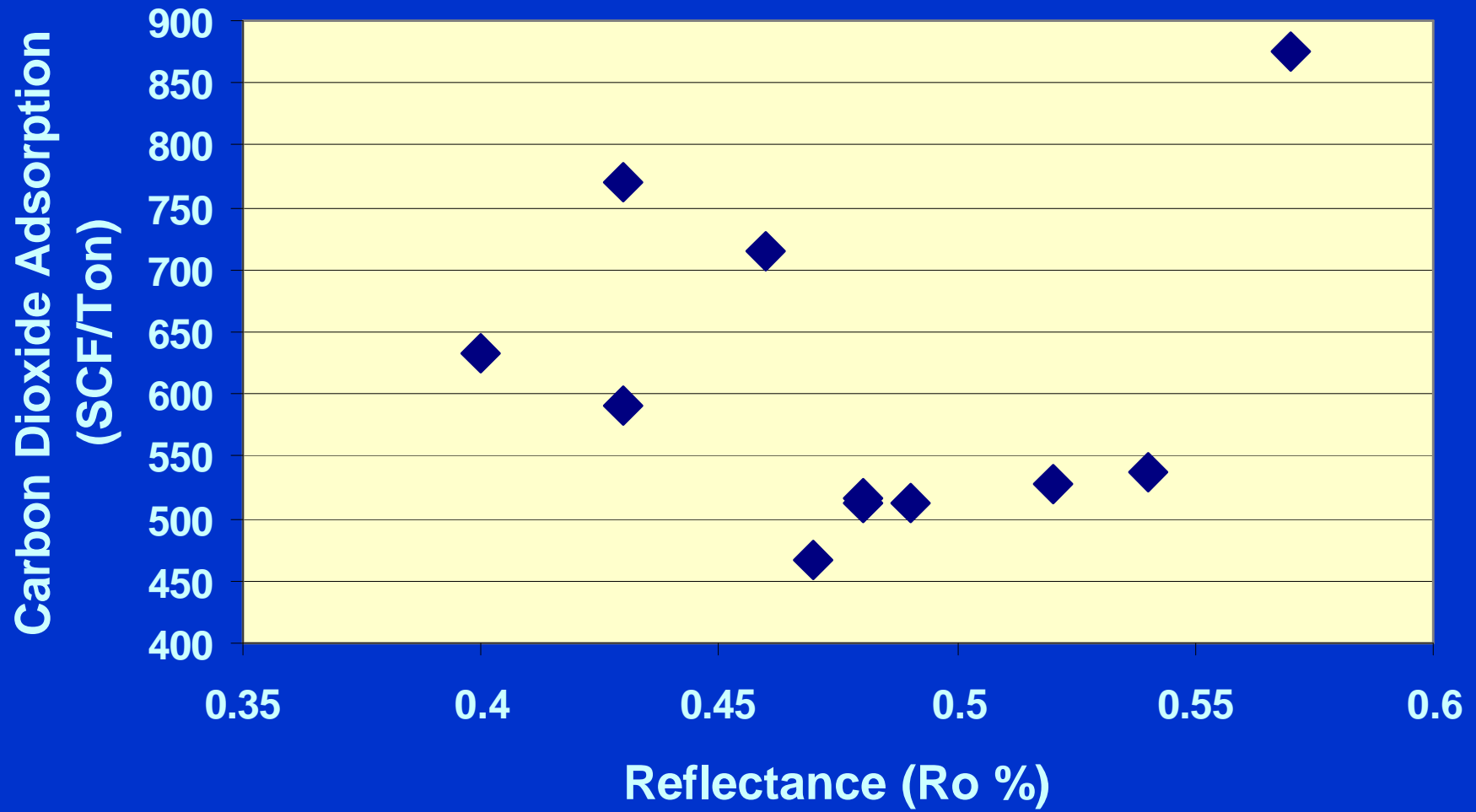
CO2 VS Moisture



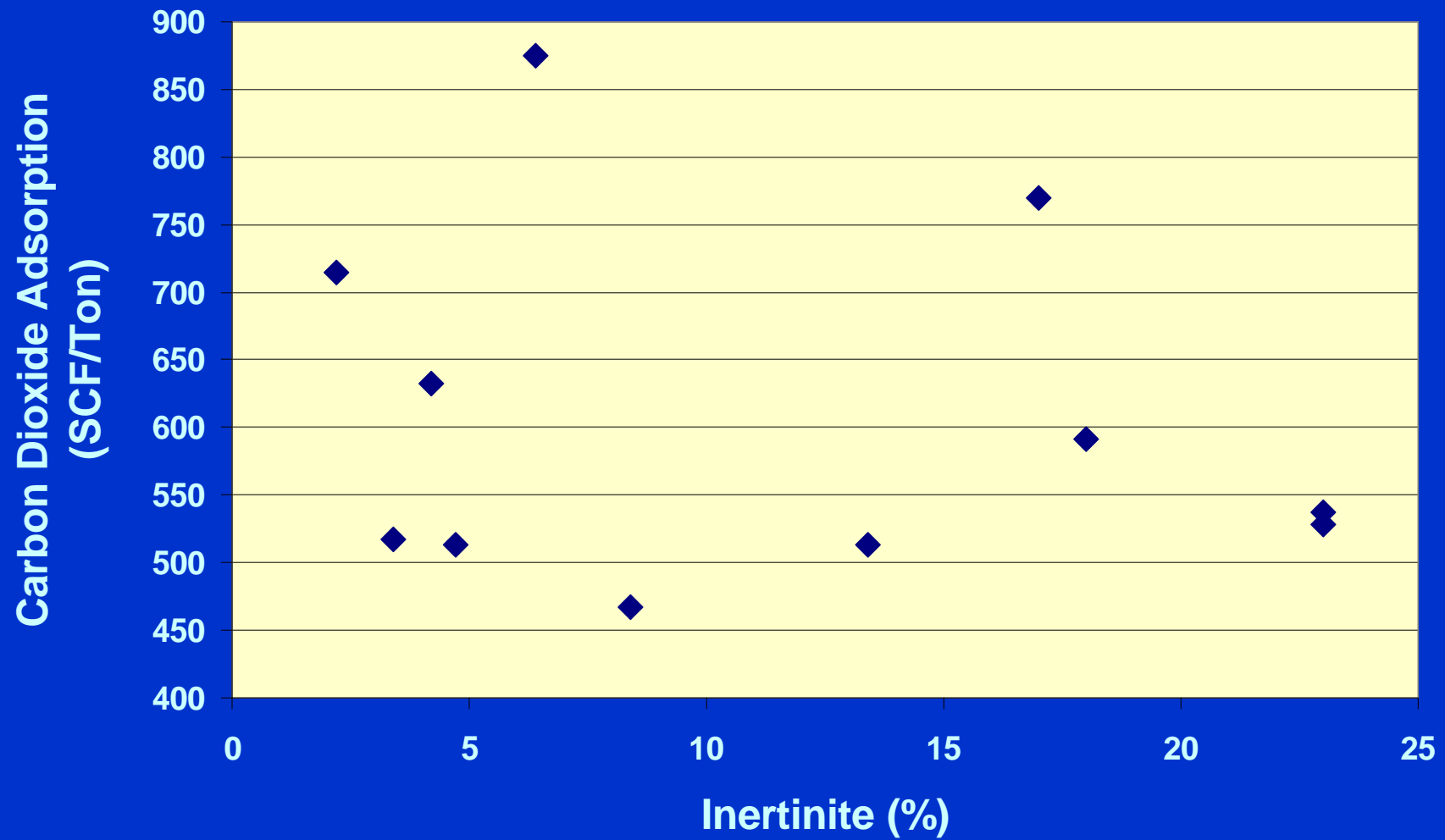
Reflectance VS Methane Adsorption: Low Rank Coals



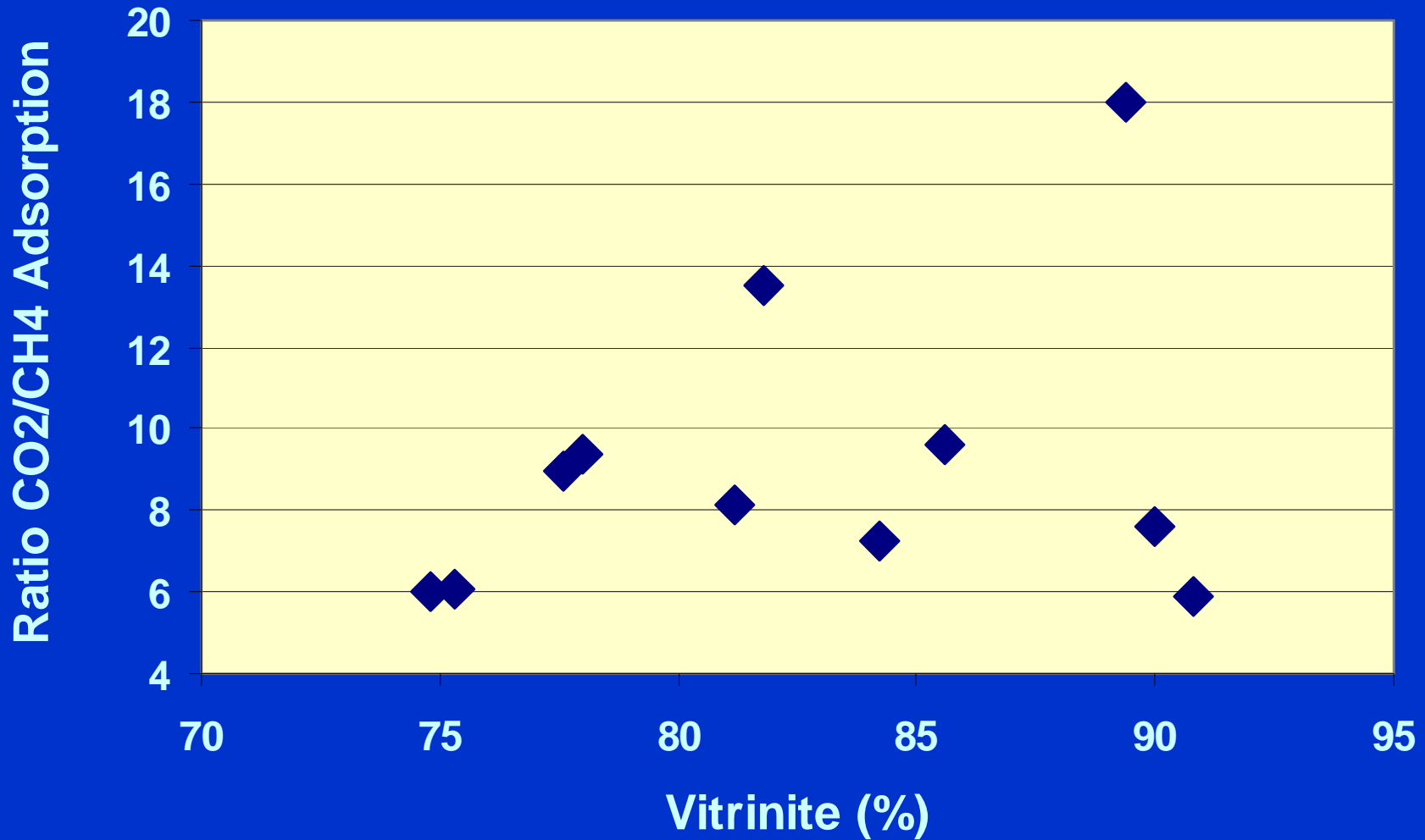
Carbon Dioxide Adsorption Versus Reflectance: Low Rank Coals



Inertinite In Low-Rank Coals VS Carbon Dioxide Adsorption



Ratio of Carbon Dioxide Adsorption to Methane Adsorption Versus Vitrinite: Low Rank Coals



Conclusions

1. No obvious correlation of CO₂ adsorption with rank and composition. Much more work necessary.
2. Apparent correlations of CO₂ /CH₄ ratios with rank and composition are controlled by CH₄ adsorption.
3. CO₂ adsorption appears to be high (>500 SCF/ton) for all coal ranks and compositions examined.
4. All of the above for apply to coals at shallow depths (about 700 ft). Clear need for new work at pressures relevant to “unmineable” coal (3000 ft or 1500 psi).
5. CO₂ /CH₄ >> 2 in low rank coals, good for sequestration, but not good for ECBM