Monday, March 29, 2010

Westchase Hilton • 9999 Westheimer
Social Hour 5:30–6:30 p.m.
Dinner 6:30–7:30 p.m.

Cost: $28 Preregistered members; $35 non-members & walk-ups

To guarantee a seat, you must pre-register on the HGS website and pre-pay with a credit card.
Pre-registration without payment will not be accepted.
You may still walk up and pay at the door, if extra seats are available.

HGS North American Dinner Meeting

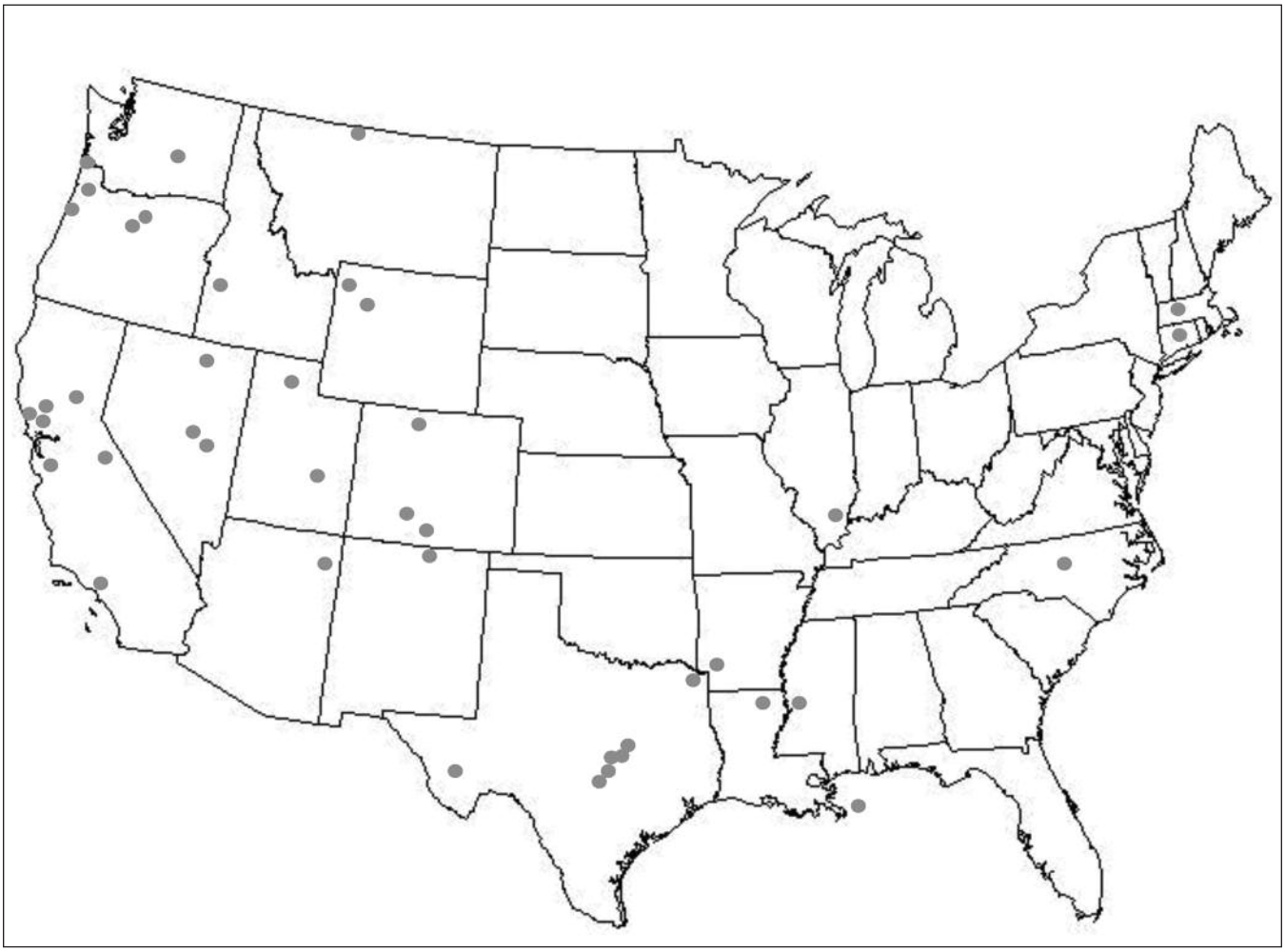
Steve Schutter

Hydrocarbons Associated with Igneous Rocks (North America and Worldwide)

Explorationists generally disregard igneous rocks and their immediate surroundings, condemning the surrounding sediments as overmature and the igneous rocks themselves as nonporous crystalline masses. However, these are misconceptions, and there is opportunity in moving beyond them. The maturation effect of the igneous activity is often overrated. Most shallow igneous intrusions are volumetrically too small to affect a large volume of rock and even flood basalts cool too quickly to have a marked effect. Most thermal effects are due to regional heating or hydrothermal circulation.

Porosity in igneous rocks may be due to fracturing, particularly fracturing developed during cooling. Some extrusive rocks are also vesicular or may have a clastic texture. However, retrograde metamorphism can also provide significant porosity by creating

HGS North American Dinner *continued on page 27*



HGS North American Dinner continued from page 24

what is essentially a vuggy texture. Combinations of these can produce effective reservoir rock.

Igneous rocks can also provide their own traps. Variations in porosity can produce a pseudo-stratigraphic trap. However, thick intrusive bodies (such as laccoliths and plugs) and volcanic cones can also provide trapping structures. Dikes can block migration pathways. Syndepositional sedimentary and igneous facies may also provide traps, as well as post-emplacement draping over non-compacting igneous bodies.

While generally not considered to be source rocks, extrusive igneous terrains are often lake-prone, and thus may provide source rocks for subsequent igneous rocks. Migration in igneous areas is predominantly normal. But, CO_2-dominated systems and those subject to supercritical steam may both be present and they may have distinctive favorable peculiarities. Since they are nonpolar fluids, they are considerably more effective than water-dominated systems at mobilizing hydrocarbons, and the conventional "rules of thumb" for organic matter type, richness, and maturity may not apply.

Exploration methods need to be as variable as the igneous reservoirs … Due to the lack of "rules" and systematic study, currently the best approach to exploration in and around igneous rocks is to look for analogs.

Exploration methods need to be as variable as the igneous reservoirs. Some igneous rocks contain abundant iron, and have a strong magnetic signature. Others do not. Some igneous rocks are much denser than the surrounding rock; others are not. Notably, one of the earliest plays in Texas, the "serpentine" trend, was instrumental in developing many of the early geophysical techniques. Likewise, log results may be so variable as to be ambiguous. Some characteristics may be recognizable, but the nature of the igneous rocks and their relationships must be considered.

Due to the lack of "rules" and systematic study, currently the best approach to exploration in and around igneous rocks is to look for analogs. The search for analogs cannot be limited to one area or continent, but a global view is needed. Analogs from around the world have applicability to possible plays in North America. Thus, an extensive reference list of possible analogs should be considered.

More broadly, the presence of hydrocarbons in or around igneous rocks in a basin may indicate the presence of an effective hydrocarbon system in that basin. There are still basins in the world where leaking hydrocarbons may indicate the potential of the basin. Also, large areas of productive sedimentary basins are covered by volcanics, both flood basalts and ash-flow tuffs. Exploration models can complement and enhance geophysical methods in such areas. ■

Useful References

DeJarnett, B. B., 2007, Oil in a basaltic reservoir? West Rozel Field, Box Elder County, Utah: Houston Geological Society *Bulletin*, v. 50, n. 3 (November), p. 35, 37.

Schutter, S. R., 2003, Hydrocarbon occurrence and exploration in and around igneous rocks: in Petford, N., and McCaffrey, K. J. W., eds., Hydrocarbons in crystalline rocks, Geological Society of London, Special Publication 214, p. 7-33. Discussion.

Schutter, S. R., 2003, Occurrences of hydrocarbons in and around igneous rocks: in Petford, N., and McCaffrey, K. J. W., eds., Hydrocarbons in crystalline rocks, Geological Society of London, Special Publication 214, p. 35-68. List of occurrences.

Biographical Sketch

Steve Schutter received his graduate degrees in geology from the University of Iowa, where he worked on the depositional environments of Ordovician and Pennsylvanian shales. He went to Exxon Production Research, where he worked on Paleozoic eustasy and the stratigraphic expression of salt tectonics, as well as on several regional studies. This was followed by work for Subsurface Consultants and now at Murphy International E&P. In addition to Paleozoic eustasy and the depositional environments of shales, he has published on hydrocarbons associated with igneous rocks.