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SOFT ROCKS CAN PROVIDE HARD ROCK ANSWERS

S. P. HALABURA
North Rim Exploration Ltd.
P.O. Box 388
Cudworth,Sask.
S0K 1B0

ABSTRACT

The portion of the province presently covered by Phanerozoic sediments is poorly understood by mineral geologists interested in the Precambrian basement largely because of the paucity of data available. Two methods of data accumulation are presently popular. Firstly, approximately 183 Petroleum and Natural Gas drillholes penetrate through the Phanerozoic into the underlying craton; of these, only 46 have had cores cut in the basement. This first method can provide broad generalizations concerning the nature of the craton and establish regional age relationships. Secondly, various geophysical techniques such as aeromagnetic and gravity surveys reveal broad patterns of cratonic segregation.

A third method of obtaining an understanding of the cratonic basement in the southern portions of the Province is available. This method involves the careful sedimentologic and stratigraphic analysis of the Phanerozoic succession itself using the techniques developed by subsurface "soft-rock" geologists in their search for oil and gas. Three primary assumptions allow the usage of subsurface techniques to understand the nature and evolution of the craton. The first assumption is that the segments which compose the craton have not been quiescent during the Phanerozoic; rather, these segments have undergone movements and structural adjustments from early Precambrian time to the Holocene. The second assumption is that epicratonic basins are predisposed to shallow water, epeiric processes of sedimentation. Such processes are sensitive to even minor variations in basin paleobathymetry. Thirdly, basins which undergo epeiric sedimentation tend to record within their sediments paleobathymetric variations through time, with dominant (i.e. basement influenced paleobathymetry) trends distinguishable from non-basement trends if care is taken in understanding the sedimentology and the depositional history of the rocks themselves. Variations in the dominant paleobathymetric and paleoenvironmental trends through time are a reflection of cratonic activity through time.

The above assumptions allow a geologist to use the Phanerozoic sediments to extract information concerning the underlying craton. Of particular interest to the geologist would be seven "soft rock" characteristics. Firstly, the shifting of sedimentary depocenters, especially in rock units known to be deposited under epeiric influences, records cratonic activity and may aid in distinguishing between individual cratonic segments. Closely allied with the first method is the second, namely the distribution of lithofacies within the epeiric unit. Patterns of erosion, especially persistent erosional trends, is the third. Careful analysis of recognizable local basement-influenced structures can reveal much information with respect to cratonic activity in space; and time. Fifthly, the various fluids contained within Phanerozoic reservoirs contain information of significance, especially the distribution of subsurface brines and the discrimination of discrete physico-chemical fluid regimes. Sixth, certain drillholes have either penetrated or closely skinned basement-involved structures; the analysis of these well cuttings, cores, and geophysical logs often reveals a wealth of information. Seventh, and final, is the process of evaporite solution. Evaporite solution is a process driven by deeper tectonic disturbance and a conduit system controlling both sedimentation and subsurface fluid circulation.

The mineral explorationist searching the portion of the Province overlain by Phanerozoic sediments would do well to consider the techniques and methods of the oil and gas explorer. By utilizing Petroleum and Natural Gas subsurface data, the minerals geologist taps into a vast wealth of useful information if the framework for the proper analysis of those sediments is in place. The most important aspect of using soft-rock data and techniques is the perception of the geologist working with such material.