Paper Number: 4277

Australia's National Virtual Core Library: Examples of integrating data across geological terranes to highlight prospectivity

Smith, B.R[1,3], Huntington, J,[2] , Bruna, P-O[3], Ayling, B[4] and Green, A[5]

[1]Rocksearch Australia Pty Ltd, Darwin, Northern Territory. Australia Email: belinda_smith@rocksearch.com.au
[2]CSIRO North Ryde, Sydney NSW Australia
[3]Northern Territory Geological Survey, Darwin, Australia.
[4]Geoscience Australia, Canberra ACT Australia
[5]OTBC Pty Ltd, Pymble, Sydney NSW Australia

The National Virtual Core Library (NVCL) is Australia's infrastructure network characterising the geology and mineralogy of the upper 2 km of the Australian continent. Drill core from geological surveys are analysed through a network of HyLogging™ systems (HyLogger 3 instruments and TSG Core software) to produce high resolution reflectance spectra and imagery that is freely accessible via the internet. The NVCL is a collaborative project between state and territory geological surveys, CSIRO and AuScope. Since the project's inception in 2007, there have been >2300 drill holes (>830,000 m of drillcore) scanned, and more than 212 publications and 143 industry collaborations. Early publications showcased results from the Visible to Shortwave Infrared (VNIR-SWIR: 380-2 500 nm) wavelength range, usually focussing on between one to five drill holes in an area. These results noted compositional and abundance changes in SWIR-active minerals (such as white mica and/or chlorite) that mapped alteration haloes around a variety of mineral deposits Australia-wide. With the addition of the TIR (Thermal Infrared: 6, 000-14 500 nm) wavelength range, it became possible to characterise anhydrous, three-dimensional silicate mineral variations and abundances.

Using NVCL data to delineate mineralogy changes to assist in the exploration for mineral deposits is well-established, with many case studies from around Australia. Since 2012, the range of uses for the NVCL data has broadened to include applications such as assisting in evaluating unconventional hydrocarbon potential, using multiple drill hole datasets (up to 25 drill holes) for individual projects, and integrating complementary datasets (eg; wireline logs) to enhance geological understanding and prospectivity analyses. One strength of the NVCL is being able to seamlessly integrate spectral data from drill holes that straddle state boundaries, such as the Georgina Basin (Northern Territory and Queensland, Australia).

Integrating other data, such as petrophysical data, gamma logs, Total Organic Carbon (TOC) and X-Ray Diffraction (XRD) results within The Spectral Geologist (TSG) software has enabled the recognition of spectral parameters that may assist in delineating zones that are prospective for shale gas. For example, organic-rich black shales can be identified by a combination of SWIR albedo, SWIR spectral contrast and SWIR slope ratio. Using spectral parameters on NVCL drill holes enhances the ability to identify prospective hydrocarbon-hosting horizons in historic drill holes.

NVCL data can also be interrogated to identify detailed variations in mineralogy, which can be used to determine mineral domains. This can be useful in picking and correlating stratigraphic boundaries between drill holes across a geological terrane. Semi-quantitative mineral data exported from TSG can be grouped to produce 'brittle mineral content', or used to estimate grain density. In the Paleo- to Mesoproterozoic McArthur Basin (Northern Territory, Australia), brittle mineral contents are being used

to populate cells in the 3D geological model as a measure of prospectivity for shale gas and base metal mineralisation. Estimates of grain density derived from HyLogger data are also being used to check that collected petrophysical measurements are representative of a sampled interval.

The growing number of available drill holes in the NVCL has led to an increase in the geological understanding of the subsurface Australian continent. With raised awareness and use of the NVCL infrastructure, this is likely to continue in the future.