

AI-driven insights for simplified and optimized well interpretation in the Magallanes Basin

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The Austral-Magallanes Basin, a prolific hydrocarbon province shared by Argentina (Austral) and Chile (Magallanes), has been a hub of hydrocarbon production in southern South America since the 1940s. The Basin initiated during the Middle to Late Jurassic on a Paleozoic basement and records a complex history of sedimentation spanning from the Late Jurassic to the Late Cenozoic. A recent exploration well in the Magallanes Basin was analyzed using innovative technology that integrates high-resolution imaging and artificial intelligence (AI) algorithms with elemental data. This cost-effective methodology may help to simplify or improve the geological and stratigraphic interpretations by enabling the rapid identification of sedimentary packages and lithotypes from drill cuttings, which can be used for the development of a more comprehensive formation evaluation study.

In this study, 160 drill cuttings were analyzed at 20 m intervals. Data collected included high-resolution image analysis, X-ray fluorescence (XRF), and X-ray diffraction (XRD). Utilizing AI algorithms and patented workflows, color extraction analysis combined with key elemental data and ratios, led to the identification of distinct lithotypes, which were subsequently grouped into sedimentary packages, providing a robust framework for sedimentary and stratigraphic interpretations.

The analysis generated two siliciclastic rock domains, each divided into 3 gross lithotypes with common characteristics. These lithotypes were further subdivided into 14 detailed lithotypes (7 per domain) based on calibrated brightness (a patented workflow) and Si/Ca

elemental ratios. Additionally, 3 sedimentary packages were defined, emphasizing clay species differentiation, anoxic indicators, and mineralogical trends.

Key findings include the clustering of clay species (upon Th vs. K trends), the presence of green minerals at specific intervals, and distinctions between detrital and non-detrital silica, all of which provide insights into sediment provenance and diagenetic processes.

Finally, the use of color hue extraction facilitated the identification of some formation tops and/or bottoms, based on the detection of key minerals from the high-resolution images, which helped refine stratigraphic boundaries.

This novel approach based on the digital analysis of drill cuttings, provides an efficient, quantitative and standardized workflow that may potentially improve reservoir characterization and exploration processes. It may support more effective well planning by accurately identifying target zones, improving understanding of formation architecture and refining static models as additional wells and data become available. In exploration, this methodology has the potential to define stratigraphy in a near real-time scenario, delivering exceptional insights into subsurface geology and contributing to a more timely decision-making process, ultimately reducing risks and costs.



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AAPG ICE 2025, RIO