ORGANIC GEOCHEMISTRY OF EARLY-MATURE TO OVER-MATURE CRETACEOUS SOURCE ROCKS FROM THE EASTERN CORDILLERA (COLOMBIA)

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Whilst the mid-Cretaceous La Luna Formation, covering open marine Equatorial Atlantic settings of Venezuela (Maracaibo Basin) and northern-central Colombia (Middle Magdalena Valley; MMV), has been intensely studied, far less is known about the palaeo-environment, distribution and quality of time-equivalent source rocks in the Eastern Cordillera (Colombia). To fill this gap in knowledge, a new field campaign encompassed by Ecopetrol, has generated a database that provides new insights into spatio-temporal variations of organic matter (OM) type, quantity and maturity throughout the Cretaceous in the basin, enabling comparison with the La Luna Fm.

Within the Eastern Cordillera, lateral and vertical changes of OM type/quality are reconstructed from molecular parameters such as Pr/Ph, TAR (Bourbonniere and Meyers, 1996), C35/C34 hopanes, sterane distributions, diasterane/sterane, tricyclic terpanes distributions and dibenzothiophene to phenanthrene ratios. In combination, they indicate a large variety of palaeo-environments, from oxic/siliciclastic to anoxic/marine carbonate-rich. In the more distal carbonate shales, a series of extended tricyclic terpanes up to C36 have been found, previously reported from the La Luna in the MMV (Zumberge, 1984) and in marine to lacustrine/saline sediments from the Brazilian marginal basins (de Grande et al., 1993). Despite the presence of these components, some differences are noticed between the distal shales of the Eastern Cordillera and La Luna formation (as in Zumberge, 1984 or Rangel et al., 2000) such as C29/C30 hopane and sterane/hopane ratios, or key nutrient (N and P) concentrations; whilst the former could be explained by maturity alteration or degradation processes affecting the rocks of the Eastern Cordillera, the latter seem to reflect an overall lower primary palaeo-productivity in our study area.

Of special interest is also the wide range of maturities of the OM in the study area: while for some samples (Equivalent Vitrinite Reflectance EqVR ~0.7%) it is possible to obtain biomarker-based parameters (see above), others show greater maturity and therefore have a significantly reduced biomarker inventory. This study includes samples from the late oil window (EqVR 1.1-1.2%), condensate/wet gas window (EqVR 1.5-1.8%) and catagenesis stage. We present novel proxies based on the distribution of different diamondoid isomers, such as methyladamantanes, ethyladamantanes, methyldiamantanes and polycyclic aromatic hydrocarbons (chrysene, pyrene and benzofluoranthene), which seem to differentiate between terrestrial and marine source types despite the advanced stages of maturity.

References

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