

QUARTZ PROVENANCE IN THE MESOZOIC OF THE EASTERN SCOTIAN BASIN - INTEGRATION OF SCANNING ELECTRON MICROSCOPE-CATHODOLUMINESCENCE (SEM-CL), HOT-CATHODE CATHODOLUMINESCENCE (HCL), AND PETROGRAPHIC MICROSCOPE TO INTERPRET PROVENANCE OF SANDSTONES

Oliveira, C.E.S.¹; Pe-Piper, G.²

¹Universidade Federal Rural do Rio de Janeiro; ²Saint Mary's University

The provenance of quartz, the predominant framework mineral in sandstone reservoirs, is an important exploration tool in petroleum basins. Several techniques have been used to analyse and interpret the provenance of detrital quartz over the years. An integrated approach of scanning electron microscope-cathodoluminescence (SEM-CL), hot-cathode cathodoluminescence (HCL), and petrographic microscopy using grain-by-grain comparison was used to interpret provenance of sandstones in the Bandol-1 well in the eastern Scotian Basin. Information provided by SEM-CL features, HCL colours and colour shift, and optical properties such as extinction, fluid inclusion trails and polycrystallinity were combined to distinguish different quartz types. The integration of the three techniques reduces uncertainties inherent to each individual technique. The three techniques were compared and all the characteristic features for each quartz type under the three different microscopes were summarized in detail. This study suggests that the integration of SEM-CL, HCL, and petrographic microscope analysis on the same individual quartz grains demonstrated to be effective in distinguishing quartz types. Our analyses showed that the integration of SEM-CL and petrographic microscope appears to be enough to differentiate between major quartz types such as plutonic and metamorphic quartz, while HCL analyses are important to support and confirm the classification of distinct quartz types that was done by using SEM-CL and petrographic microscope. In addition, HCL analyses are very useful for our attempt of assigning detrital quartz to a specific metamorphic grade. Previous detrital mineral and geochronological studies of the same samples were also used for comparison and better understanding of potential provenance sources. Newfoundland can be considered the main possible source area for Bandol-1 well, since Upper Jurassic deltas in the eastern Scotian Basin prograded from Newfoundland. The Mid-Devonian granite in the Gander terrane of southern Newfoundland, the tourmaline granite in southwest Newfoundland, and the granite mostly K-feldspar in Dunnage terrane and southeast of Gander terrane are the potential source of plutonic quartz to Bandol-1. Whereas the low-grade metamorphic rocks located mainly in the central Newfoundland are the potential sources of low- to medium-grade metamorphic quartz type. At the same time, the Paleoproterozoic gneiss rocks in the Humber terrane are the potential sources of medium- to high-grade metamorphic quartz. The integration of the three techniques (SEM-CL, HCL, and petrographic microscopy) is considered extremely useful to interpret quartz provenance of sandstones in other petroleum basins. It can be used, for example, in Brazilian basins.

KEYWORDS: QUARTZ, PROVENANCE, CATHODOLUMINESCENCE.