Part 2 – 2010 Annual Sheriff Lecture – Student Abstracts

In the November issue of the Bulletin *a number of student abstracts were published. A number of additional abstracts were received after the issue went to press. We are publishing these abstracts as a service to our members.*

U-Pb Detrital Zircon Geochronology of Laurentian Margin Siliciclastics from Precambian Rifting to the Mid-Ordovician Taconic Orogeny

Adrian Gittens

Paleogeographic reconstruction of the Newfoundland area suggests that various arc terranes developed during the opening of the Iapetus Ocean and development of the Cambro-Ordovician Laurentian stable continental margin. These terranes were then accreted to the continental passive-margin upon initial closure of the ocean basin in the Ordovician. The origin and age of these terranes are still questionable as they may contain older Precambrian basement according to some workers and, if so, they could be interpreted as originating from Laurentia or any other landmass bordering the Iapetus Ocean at that time. Newfoundland contains the northernmost extent of the Appalachian Orogenic Belt, which first developed during the Taconian Orogeny, a product of Iapetus Ocean closure in the Ordovician. The sedimentary packages of the Humber Arm allocthon were thrust upon the autochthonous sediment of the Laurentian passive-margin and deformed during the Taconic Orogeny. Measuring U-Pb isotope ratios of detrital zircons found in the syn- and post-rift siliciclastic strata may prove to be a useful tool in determining the source ages of the zircons deposited during stable margin development and perhaps identification of the origin and timing of the arrival of allochthonous terranes that first collided with the Laurentian margin. This interpretation will be based on correlation of the determined zircon ages to known source rock age signatures within the Laurentian continent during passive-margin evolution and to known source rocks of central Newfoundland allochthonous terranes. Preliminary age distribution data for detrital zircons of the Lower Cambrian Bradore Formation show a bimodal age distribution of 585 Ma and 1005 Ma (this study) which can be interpreted as sources derived from Grenville-age local terranes (1005 Ma) as well as younger, rifting-related volcanic and plutonic sources (585 Ma). Influx from these sources may be a result of the erosion of the younger, rift-related volcanic and plutonic source rocks as well as Grenville basement, exposed as the rift shoulder was uplifted. In this case, the rift shoulder would also have acted as a barrier to the continental sediment sources derived from the interior of Laurentia, which contain older Precambrian provinces. ■

Paleoenvironmental Interpretation and Organic Geochemistry of the Agua de la Mula Member (Agrio Formation) in the Pampa Tril Area, Neuquen Basin, Argentina

Gisela Porfiri

The scope of this work is to broaden the existing paleoenvironmental and stratigraphic knowledge of the Agrio Formation using sedimentology and organic geochemistry in a sequence-stratigraphy framework. Eleven facies (F1 to F11) were recognized in the 264-m thick Late Hauterivian limestones of the Agua de la Mula Member (Agrio Formation), in the Pampa Tril area (Neuquén Province).

Outcrop facies analysis enabled the interpretation of specific paleoenvironments of deposition within a mixed carbonate-siliciclastic marine ramp. Basal facies (F1) belong to a low-energy marine environment with limited siliciclastic input evidenced by wackestones and mudstones with collapsed ammonites. In F4, the abundance of organic matter (~2% total organic carbon or TOC) and bivalves (*Neocomiceramus curacoensis*), which lived on substrates under restricted oxygen levels suggests oxygen-stratified water conditions during sedimentation. F6 is composed of low organic matter content shales with alternating levels of calcareous concretions interpreted as being deposited in a low-energy anoxic environment with high siliciclastic input. In contrast, the uppermost facies (F9 to F11), which occupy higher stratigraphic positions and have lower organic matter content, show evidence of higher energy, likely associated to a wave-dominated and well oxygenated marine environment close to the shoreline.

The organic matter analysis performed along the stratigraphic column revealed TOC contents ranging from 0.54% to 3.07%. The hydrogen index (HI) values permitted the discrimination of three sample groups that plot in the trends of kerogens types I, II, and III. The microscope study of each kerogen trend reinforced the former division and allowed the recognition of specific organic matter components (amorphous, liptinite, woody, and coaly). The abundance of amorphous organic matter in group 1

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samples, from Facies F4, demonstrates oxygen-stratified water conditions. The samples of the second group, belonging to F6, show a significant content of woody and coaly organic matter components, which represent an important terrestrial input. The thermal maturity estimation derived from measured vitrinite reflectance (%Ro) and the thermal alteration index (TAI) places the studied interval in the early oil-generation window. These results correlate to similar values obtained in nearby study areas.

The entire succession shows three cycles: two complete transgressive-regressive cycles overlying a third, incomplete, cycle at the base of the local stratigraphic column, within a succession deposited in an external mixed marine ramp setting. Each cycle comprises an initial set of retrogradational parasequences, followed by a maximum flooding surface (MFS) and a subsequent progradational parasequence set. The MFS was recognized on the basis of parasequence stacking patterns and the abundance of amorphous organic matter components, which indicate oxygen-stratified marine conditions and limited sediment input. The uppermost cycle is truncated by an erosive surface, which defines a sequence boundary, below the fluvial facies of the Lower Troncoso Member (Huitrín Formation). ■

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