

## DETRITAL ZIRCONS FROM A LATE PALAEOZOIC ACCRETIONARY COMPLEX OF SW IBERIA (VARISCAN BELT): HISTORY OF CRUSTAL GROWTH AND RECYCLING AT THE RHEIC CONVERGENT MARGIN

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In this study we present new U-Pb ages of detrital zircons from greywackes and quartzites of the Pulo do Lobo Anticline (PLA) that have been interpreted to represent a Late Paleozoic accretionary complex in SW Iberia. The PLA separates the Ossa Morena Zone, which has a North-Gondwana affinity throughout Late Ediacaran and Early Paleozoic times, from the South Portuguese Zone, which is considered to be underlain by Laurussia basement. The PLA stratigraphy most likely represents a synorogenic basin that records the closure of the Late Paleozoic Rheic Ocean and the amalgamation of Pangaea. The youngest formations of the PLA contain upper Devonian microfossils.

The results obtained indicate that the detrital zircons from the PLA represent a wide range of Precambrian and Paleozoic crystallization ages. Recycling of older sedimentary units of the Late Ediacaran active margin (Cadomian/Pan-African orogenies) as well as of the Early Paleozoic rifting and passive margin (Rheic Ocean) stages, accounts for the older populations with North-Gondwana affinity (Cambrian, Neoproterozoic, Paleoproterozoic and Archean, with a gap of Mesoproterozoic-age). However, the Mesoproterozoic detrital zircon ages found in the greywackes of the Pulo do Lobo Formation (< 7%) that do not correspond to any substantial source within North-Gondwana, could come from recycled sedimentary deposits or from denudation of Grenville-age basement (Laurussia?). The more recent formations present in the northern limb (Ferreira-Ficalho Group) of the PLA show a significant age cluster in the upper Devonian (c. 378 Ma), whereas on the southern limb (Chança Group), samples have from base to top of the stratigraphic sequence: a minor age cluster in the middle Devonian (c. 390 Ma), a significant age cluster in upper Devonian (c. 380 Ma) and very significant age cluster in the upper Devonian (c. 372 Ma). The presence of middle-upper Devonian detrital zircons in combination with very low abundances of Mesoproterozoic detrital zircon suggests that the PLA sedimentary rocks were not derived from exotic sources but rather have a North-Gondwanan origin. The zircon population in the interval c. 390-380 Ma has no identified corresponding magmatic or stratigraphic source in SW Iberia. Considering that, during the development of the upper Devonian basins of SW Iberia, Laurussia basement was not exposed and that there was no magmatic arc on the North-Gondwana margin, we suggest that the c. 390-380 Ma detrital zircons are most probably derived from denudation of a (intra-oceanic) magmatic arc related to the closure of the Rheic Ocean.

## THE ATOMIC STRUCTURE AND HYDROGEN BONDING IN WILCOXITE, FROM RICO, COLORADO

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Wilcoxite  $MgAl(SO_4)_2 \cdot 7H_2O$  is a secondary sulfate mineral that occurs in hydrothermal systems containing significant amounts of fluorine. The mineral sample was collected from abandoned mine workings east of Rico Colorado. Wilcoxite occurred within a timber crib that protected the material from direct exposure to rain and snow but not from changes in the humidity and temperature of the atmosphere. It is remarkable that this highly hydrated mineral has remained stable under these conditions. Cell dimensions are  $a = 6.644(1) \text{ \AA}$ ,  $b = 6.749(2) \text{ \AA}$ ,  $c = 14.892(3) \text{ \AA}$ ,  $\alpha = 79.664(4)^\circ$ ,  $\beta = 80.113(4)^\circ$ ,  $\gamma = 62.487(3)^\circ$ ,  $V = 579.6(2) \text{ \AA}^3$ , P-1. The atomic structure of wilcoxite consists of isolated sulfate tetrahedra, magnesium-containing octahedra and aluminum-containing octahedra connected through hydrogen bonding involving additional water molecules. Wilcoxite has 1.5 water molecules per sulphur tetrahedron that do not participate in the formation of an aluminum

or magnesium-containing octahedra. The water molecules held within the epsomite ( $MgSO_4 \cdot 7H_2O$ ) structure are lost if the relative humidity drops below 50% at 298K. In fact hexahydrate ( $MgSO_4 \cdot 6H_2O$ ) loses water to form starkeyite ( $MgSO_4 \cdot 4H_2O$ ) at 40% RH at 298K. The fact that wilcoxite, with such a high water content, is stable when the magnesium sulfate with which it coexists has become starkeyite indicates that these water molecules are more tightly bonded within the wilcoxite structure. If epsomite crystals are warmed slightly they slowly become translucent and then an opaque white powder. Wilcoxite, however, behaves quite differently. Williams and Cesbron (1983) describe this break down. "If a hot or bright light source is employed, crystals dissolve in their own waters of crystallization". Wilcoxite does not dehydrate but melts when warmed. This behaviour is similar to the incongruent melting of meridianite on warming above 2° C. The details of the hydrogen bonding within these structures will be discussed.

## GOSSAN HILL, VICTORIA ISLAND, NORTHWEST TERRITORIES: AN ANALOGUE FOR MINE WASTE REACTIONS WITHIN PERMAFROST AND MINERAL PERSISTENCE IN THE SUB-SURFACE OF MARS

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Gossan Hill is located within the Minto Inlier on northwestern Victoria Island, Northwest Territories (N 71.36697° W 114.95155°). From above, the hill stands out because of the topographic relief of 75m and the orange-brown colour of the surficial rocks. The hill is underlain by inter-bedded carbonate and sulfate-evaporite sedimentary rocks of the Kilian formation in the upper part of the neoproterozoic Shaler Supergroup. The sedimentary rocks were intruded by diabase sills of the 723 My Franklin igneous event which crop out ~1km to the south of Gossan Hill. The surface of the hill is marked by areas of concentric colour zonation up to 3 meters across, with light grey centers surrounded by a yellow-orange ring which is, in turn, surrounded by a red-orange colour that covers the rest of the surface of the hill. Trenches dug into these areas reveal that the central zone contains quartz and pyrite ± native sulfur in a loose aggregate of sand-sized grains. This is surrounded by a zone dominated by gypsum and quartz with some jarosite. Beyond this, the surrounding surface consists of quartz, hematite and amorphous iron oxides. The radial arrangement of the mineral assemblage indicates an increase in oxidation of sulfur from the center outward. Analysis of isotopic composition of the sulfur is underway to assess the involvement of bacteria in the formation of the Gossan Hill deposit. The soft friable nature of these deposits and the topographic relief of the hill indicate a post-glacial (Pleistocene) age of formation. Crustal flexure, as the result of isostatic rebound after the loss of the ice sheet, could have created fluid migration pathways from the sulfate-evaporite deposits in the lower part of the Kilian Formation. Permafrost has maintained this disequilibrium mineral assemblage since the cessation of fluid flow. Extraction of the permafrost ice from the central zone yields a liquid with a pH of 2.0. The observed long-term persistence of pyrite encased within the acidic permafrost indicates that oxidation and dissolution reactions common in mine waste are slowed if not stopped in such an environment. Water ice just below the Martian surface would also preserve such mineral disequilibrium for very long periods of time. No region exists on Earth where ice has existed continuously for millions of years, but on Mars, some sub-surface ice may be very old and could be a repository of ancient fluid compositions and reactive mineral assemblages.

## REGIONAL POTASSIC ALTERATION CORRIDORS SPATIALLY RELATED TO THE 1750 Ma NUELIN SUITE IN THE NORTHEAST THELON BASIN REGION, NUNAVUT – GUIDES TO URANIUM, GOLD AND SILVER?

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Shallow granitic intrusions commonly generate mineralized, hydrothermally altered zones in porous roof rocks. Typically the alteration involves potassic metasomatism, which can be revealed as enhanced K/Th