# Spatial variability in ocean redox conditions during early Cambrian

CHUNFANG CAI[1*], LEI XIANG[1], YUYANG YUAN[1], LIANQI JIA[1] AND TIANKAI WANG[1]

[1]Institute of Geology and Geophysics, CAS, Beijing, P R China, cai_cf@mail.iggcas.ac.cn (* presenting author)

Lower Cambrian black shales have extensively been considered as euxinic sediments. However, recent studies suggest that euxinic conditions may have been over-estimated and ferruginous-dominated deep water and a statified redox stucture may have occurred from 742 to 542Ma [1, 2]. Interestingly, small amounts of samples from the Lower Cambrian in the Songtao section, South China show deposition in a Fe-rich as well as a euxinic enviroment [1]. However, spacial variation for the ocean chemistry during the period is unclear. Here, we analyzed about 300 samples for the total Fe content (FeT) and the abundance of Fe in highly reactive mineral species (FeHR): pyrite, Fe(III) oxides, magnetite and carbonate minerals, using the standard method [1]. These samples were collected from Lower Cambrian black shales of age about 526 to 510Ma [3] and chert and samll amounts of limestones of age about 542 to 526Ma from eight sections in South China with depositional environments ranging from inner shelf, outer shelf, slope and basin.

The results show that all the anlyzed samples except one have FeHR/FeT>0.22, indicating all deposition in an anoxic enviorment. All the chert and limestone and most of the black shale samples have FePy/FeHR<0.7, suggestive of an anoxic, Fe-rich enviorment. Only a few black shales from inner shelf at Shatan section, out shelf at Muyangxiang section and isolated topographic highs within the basin facies at Zhalagou and Tianzhu sections have FePy/FeHR>0.8, a product of a euxinic condition. Black shales and cherts from basin facies at Lijiatuo and Siduping sections show a characteristic of a ferruginous condition, however, a few euxinic sediments were found in the basin facies from Songtao section. Thus, it is very likely for a statified redox ocean to occur during early Cambrian, similar to Ediacaran ocean, as proposed by Li et al. (2010) [2].

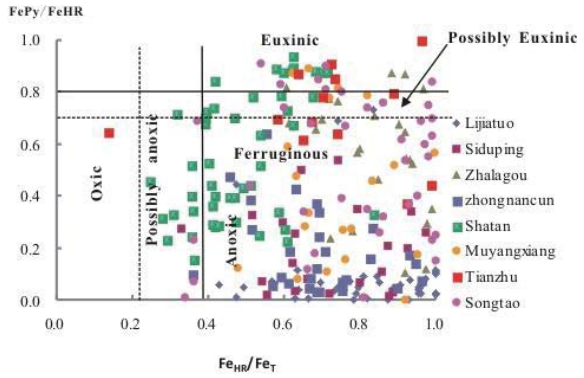


**Figure 1:** Relationship between FePy/FeHR and FeHR/FeT ratio

[1] Canfield et al (2008) *Science* **321**, 949-952. [2] Li et al (2010) *Science* **328**, 80-83. [3] Jiang et al (2012) *EPSL* **317-318**, 96-110.

# Geochemistry of mafic to felsic sequences in the SW border of Ossa-Morena-Zone (OMZ), Portugal

RITA CALDEIRA[1,2*] AND LUISA RIBEIRO[1,3]

[1] LNEG – UGCG, National Laboratory of Energy and Geology, Dept. Geology and Geol. Mapping, Portugal, rita.caldeira@lneg.pt (* presenting author)

[2]CeGul – Geology Center, Faculty of Science,Lisbon University, Portugal.

[3]Geoscience Center, Coimbra University, Portugal

The Beja Igneous Complex (Portugal), located at the SW margin of the Ossa-Morena-Zone (OMZ) in the SW Iberian Variscides, comprises three main units: the LGS - Beja Layered Gabbroic Sequence (gabbros and anorthosites), the CAC - Cuba-Alvito Complex (gabros, diorites and quartzodiorites) and the BPC - Baleizão Porphyry Complex (rhyolites, dacites and granophyries). This Carboniferous Complex has been attributed to a volcanic continental arc related to the closure of a back-arc basin. We studied mafic to felsic outcrops occuring at the Torrão - Alvito – Alcáçovas regions, that have been included by some authors in the CAC and in the BPC.

From the geochemical and mineralogical points of view the studied rocks are sub-alkaline ranging from tholeiitic (Torrão) to calc-alkaline (Alvito - Alcáçovas). The most relevant geochemical features (e.g. TiO2 < 1.9 %, Nb/Y < 0.31, La/Nb > 2, LILE/HFSE enrichment patterns and Nb, Ta, Ti, P negative anomalies) are distinctive of orogenic signature, typical of a subduction zone related continental arc. Beside the tholeitic character of Torrão samples, evidenced by trace element ratios and clionopyroxene composition disciminative plots, they show some other distinctive features i.e. they don't fall in the same liquid line of descend as the others and their normalized REE patterns show lower LREE/MREE than MREE/HREE [$(La/Sm)_N$ = 1.36 and $(Sm/Yb)_N$ = 2.31) while the Alvito – Alcaçovas samples have $(La/Sm)_N$ = 2.41 and 3.39 $(Sm/Yb)_N$ = 1.80 and 1.47. The Alvito – Alcaçovas observed compositional variations are consistent with fractional crystallization + crustal contamination/assimilation evolution from intermediate magmas to the acid magmas that originated the dacites and rhyolites. The integration of these results with other already published for the units of the Beja Massif, geographic information and known stratigraphic/geochronologic information suggest that the Torrão gabbros cannot be included in the same geodynamic stage as those of the CAC. Instead, given their geochemical afinity, they are closer to a earlier stage attributed to Beja Layered Gabbroic Sequence. The Alvito gabbrodiorites and Alcaçovas porphyries are respectively associated with the CAC and the BPC, resulting from a latter period of the Ossa-Morena southwest margin evolution related to a subduction zone linked to the closure of an open basin (South-Portuguese Zone)