From zircon date to process rate: Interpreting zircon U-Pb dates in igneous petrology and stratigraphy

JÖRN-FREDERIK WOTZLAW[1] AND URS SCHALTEGGER[1]

[1]Section of Earth and Environmental Sciences, University of Geneva, CH-1205 Geneva, Switzerland (joern.wotzlaw@unige.ch; urs.schaltegger@unige.ch)

The precision of single crystal zircon U-Pb dates achievable by isotope dilution thermal ionization mass spectrometry (ID-TIMS) often exceeds our ability to interpret them in the context of magmatic processes. Closing this gap is presently one of the big challenges in high-precision U-Pb geochronology. Recent developments of analytical protocols allowing the analysis of various isotopic ratios and trace element concentrations in tandem with ID-TIMS U-Pb geochronology (e.g., Schoene *et al.* , 2010; Wotzlaw *et al.* , 2013) significantly improved our ability to link the timing of zircon crystallization to specific episodes during the lifetime of a magmatic system. With this contribution, we aim to highlight the potential and limitations of high-precison U-Pb geochronology in petrologic and stratigraphic applications.

We present high-*n* zircon U-Pb datasets of individual eruptive units from large-volume magmatic systems to investigate patterns of zircon crystallization during magma evolution from assembly to eruption. These data-sets display age distributions that point to discrete events of zircon crystallization that can be linked to the thermal evolution of the magmatic systems prior to eruption. When combined with isotopic and chemical information from the same crystals, individual zircons provide snapshots of the chemical and physical state of the magma at the time of zircon crystallization, allowing us to construct time-integrated petrogenetic models. However, in stratigraphic applications, where the desired age information is that of ash bed deposition, the pre-eruptive magmatic history recorded by zircons is a fundamental limiting factor. We use zircon U-Pb dates from ash beds intercalated with astronomically tuned sedimentary sequences in the Mediterranean to test the accuracy of zircon U-Pb derived age models. We evaluate various approaches to estimate ash bed deposition and construct continuous age models employing different fitting algorithms aiming to find a solution to minimize the residual offset between radioisotopic and astronomical time.

[1] Schoene, B., Latkoczy, C., Schaltegger, U., Günther, D., 2010, *Geochimica et Cosmochimica Acta* 74, 7144-7159. [2] Wotzlaw, J.F., Schaltegger, U., Frick, D., Dungan, M., Gerdes, A., Günther, D., 2013, *Geology (in press)*.

The research of sulfur early diagenesis cycle drived by AOM and methane-seep environment in the Cold Seep Area, northern South China Sea

DAIDAI WU[1] AND NENGYOU WU[2]

[1]Key Laboratory of Renewable Energy and Gas Hydrate of Guangzhou Institute of Energy Conversion,
Chinese Academy of Sciences, Guangzhou 510640, China; (wudd@ms.giec.ac.cn)

[2] Key Laboratory of Renewable Energy and Gas Hydrate of Guangzhou Institute of Energy Conversion,
Chinese Academy of Sciences, Guangzhou 510640, China; (wuny@ms.giec.ac.cn)

Abstract : The South China Sea is located at the junction of three tectonic plates: the Eurasian, the Pacific and the Indian-Australian. The northern continental slope, the South China Sea, is well known for its prospect of oil, gas, gas hydrate resources. Four areas including Taixinan Basin, Northeast Dongsha, Baiyun depression and Qiongdongnan Basin were identified as the most favourable conditions for gas seep or gas hydrate to occur, and were discovered geological, geochemical and biological evidences for cold seeps. In the seabed Cold Seep Area, the sulfate reduction drives by the organic matter oxidation, but mainly drives by anaerobic methane oxidation (AOM). However, the research of AOM-driven sulfate reduction and its important contribution to the sulfur early diagenesis cycle and sulfur buried needs to be studied. In this parper, the sediment cores and cold seep carbonates were collected from the Dongsha and Shenhu Cold Seep Area, northern South China Sea.The main geochemistry characteristics research contains the chemical composition of pore water, the microstricture fo sulfates and sulfides authigenic minerals, the distribution and content of intermediate state of sulfur and organic matter sulfide, sulfur and carbon stable isotope fractionation with comprehensive methods such as geochemistry, mineralogy, isotope geochemistry, numerical calculation methods,etc. The target is to identify the sulfate reduction drives by organic matter oxidation or AOM, obtain the proportion of sulfate consumption by AOM in the pore water, the sulfur isotope fractionation characteristics and constraints; establish a sound sulfur cycle path in marine sediment, quantitative assessment the diagenesis burial flux of iron sulfide and sulfate minerals in marine sediments and react the cold seep sedimentary environment characteristics.

Acknowledgments : Funding was provided by the National Natural Science Foundation of China (No. 41003010) and (No. 41273022).

DOI:10.1180/minmag.2013.077.5.23