Goldschmidt 2000
September 3rd–8th, 2000
Oxford, UK.

Journal of Conference Abstracts
Volume 5(2), 508

Radiogenic Ar Concentrations of De-Carbonated Sediments Around South Africa

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Due to variations in the age, history and geochemistry of the continental sources, radiogenic isotopes that derive from long-lived parents are excellent as tracers of the sources and the transport processes leading to deposition of terrigenous sediments in marine sediments. We have previously reported striking, climate-correlated variation in the $^{87}Sr/^{86}Sr$ of the terrigenous fraction from core RC11-83 (41.07ºS-9.72ºE, 4718m), from the southern Cape Basin. Additionally, core top mapping of detrital $^{87}Sr/^{86}Sr$ ratios shows that high Sr isotope ratios are derived from sediment transported southward along east coast of Africa, following the path of the Agulhas Current. The Cape Basin is far to the west of the Agulhas Retroflection, where the bulk of Agulhas Current enters the Antarctic Circumpolar Current. However, a portion of the Agulhas Current leaks into the Atlantic, where it is swept northward in the Benguela Current to the Equatorial and North Atlantic. Comparison with the clay mineral distributions in the South Atlantic indicates that the general pattern may have a surface current control [1].

Variations in intensity and direction of ocean currents are important paleoclimatic signals, yet they are elusive to track down. In particular, the Agulhas Leakage may be an important means for return of heat and salt to the North Atlantic and thus an important positive feedback for the "great ocean conveyor" during warm climatic cycles [2].

The work presented here is a survey of $^{40}Ar^*$ concentrations from a selection of 20 samples around South Africa for which we have detrital $^{87}Sr/^{86}Sr$ data for the core tops. Hurley et al. [3] made a pioneering survey of K/Ar ages of terrigenous marine sediments, and found a range of ages from 80 Ma in a Pacific core to as old as 464 Ma in a North Atlantic sample. The range of % K that he measured was 0.94 to 6.1, with most being 2-3. Their conclusions were that (1) the K bearing phases were largely detrital, (2) there are regional differences that may prove useful in mapping average long-term atmospheric or oceanic circulation, and (3) down core variations from the Atlantic may highlight the potential utility in stratigraphic correlation and paleoclimatology. Since this early work little effort has been devoted to the K/Ar system in terrigenous sediments. A notable example of the utility comes from research on the North Atlantic Heinrich layers (e.g., [4]), where ambient values in the range of 300-400 Ma in agreement with Hurley et al. [3], and an increase to ca. 1 Ga in the Heinrich layers H1, H2, H4, and H5 were found.

We have been testing the applicability of CO_2 laser fusion of 3 to 5mg samples for extracting and measuring the $^{40}Ar^*$ concentration of de-carbonated sediment samples. One test was to make a down core record of a second North Atlantic core, and we obtained results identical to those reported [4]. We estimate the precision and accuracy of the method to be about 10%, which we think can be improved with refinements to the method.

A positive correlation between the K-Ar and Rb-Sr systems of terrigenous sediments can be expected, as Rb and K tend to be enriched in the same minerals, and Ar and Sr tend to be lost during relatively mild geologic events, including weathering. Concentrations of $^{40}Ar^*$ from <63 m, de-carbonated sediments from around South Africa range from $2x10^{-10}$ to $1.5x10^{-9}$ moles per gram. For an assumed K of 3%, these results yield a range of apparent ages of 37-266 Ma (56-386 Ma for 2%). There is a generally positive correlation between $^{87}Sr/^{86}Sr$ and $^{40}Ar^*$ in these Southern Ocean sediments, and apparently separate trends between Atlantic and Indian Ocean samples. Indian Ocean samples have higher $^{40}Ar^*$ concentrations for a given $^{87}Sr/^{86}Sr$ than do Atlantic samples. Some notable exceptions to these generalities need to be reproduced, but may provide further understanding of the sedimentary system in this region. The map pattern of $^{40}Ar^*$ is similar to that of $^{87}Sr/^{86}Sr$. These results provide further support for our interpretation from the regional pattern of $^{87}Sr/^{86}Sr$ that the Agulhas Current is a major means of transporting radiogenic Sr and Ar into the Cape Basin, and thus these proxies can be applied to understanding changes in the past.

Petschick R, Kuhn G & Gingele F, *Mar. Geol*, **130**, 203-229, (1996).

Gordon AL, *JGR*, **91**, 5037-5046, (1986).

Hurley PM, Heezen, BC, Pinson, WH & Fairbairn, HW, *GCA*, **27**, 393-399, (1963).

Jantschik and Huon, *Eclogea Geol. Helv*, **85**, 195-212, (1992).