# CHALLENGES TO GEOCHRONOLOGY — SEPARATING FACT FROM FICTION IN THE ARCHAEAN OF NW SCOTLAND

M. J. WHITEHOUSE

*Swedish Museum of Natural History, Box 50007, S-104 05 Stockholm, Sweden*

Recent advances in radiogenic isotope analytical techniques, in particular in-situ (e.g., ion-probe) and/or single crystal U-Pb and separated mineral isochron methods provide the Earth scientist with a variety of high-precision dating tools. In the majority of cases, application of these techniques considerably advances our understanding of both local geology and global Earth evolutionary processes, but occasionally results can be confusing, contradictory and/or controversial, requiring careful interpretation to separate geo-fact from geo-fiction.

A fundamental challenge to the modern geochronologist is to decipher early crustal histories from Archaean terranes using an abundance of available isotopic data. The case study presented here is from the late-Archaean (*ca*. 2.9 Ga) Lewisian complex of NW Scotland which, owing to its accessibility, is one of the most extensively studied pieces of ancient continental crust on the Earth. Four decades of geochronological studies, together with continuous geological investigations since the beginning of the nineteenth century, have revealed the broad outlines of late-Archaean crustal accretion and high-grade metamorphism followed by early-Proterozoic mafic igneous activity and extensive, but heterogeneous, tectono-metamorphic reworking. However, recent attempts to investigate the late-Archaean history of the Lewisian using state-of-the-art geochronological techniques (separated mineral Sm–Nd, Pb–Pb; ion-probe U–Pb zircon, Pb–Pb monazite) have raised almost as many questions as they have answered, in particular concerning the age of gneiss protoliths (?3.3 Ga to *ca*. 2.8 Ga) and the timing of granulite facies metamorphism (*ca*. 2.7 Ga, *ca*. 2.5 Ga or both). Ion-probe U-Pb data obtained using the Nordic Cameca ims 1270 will be presented, confirming that some of the more extreme claims for ancient protolith ages are the result of Proterozoic isotopic disturbance which produced highly precise but completely spurious ages. However, such spurious data can often be used to reveal details of isotopic evolution when placed within a well-constrained time framework. Furthermore, existing geochronological data from the Lewisian will be critically evaluated to assess whether they provide evidence for real geological events or simply for spurious behaviour and/or non-response of particular isotope systematics to given geological events.

Combining whole-rock isotope systematics with high-precision mineral geochronology should be seen as an important tool for modern geochronology, but one which must be applied with great care. In particular, it is always necessary to retain a geological overview in all data interpretations, and to be aware that in geochronology, accuracy and precision are not always complementary.