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Geochronology of carbonates in service to chemostratigraphic correlations of terminal Ediacaran

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Sedimentary successions of terminal Ediacaran age (550-538 Ma) are holding the key for resolving the chronostratigraphy of the early metazoan evolution: the transition from Ediacaran soft-bodied biota to first biomineralizing metazoans. The sedimentary siliciclastic and carbonate rocks from the Kuibis subgroup of Nama Group (Namibia) record this transition, which seems to coincide with the recovery from a global negative carbon isotope excursion and considered to be either end Shuram (~562Ma) or younger (~551Ma). However, the absence of datable ash beds at the base of the Kuibis Subgroup makes it impossible to constrain precisely the time of this carbon isotope excursion and precludes accurate correlation with chemostratigraphic record in other sections worldwide. Therefore, U-Pb dating of carbonate rocks from the base of the Kuibis Subgroup became the only alternative for acquiring geochronological information from the base of the Nama Group.

Carbonate samples from outcrops and GRIND-ECT drill cores were identified as preserving pristine marine signatures and suitable for U-Pb dating, based on a combination of careful petrography, mineralogical data and geochemical proxies ($d^{13}C$, $d^{18}O$, SEM, QEMSCAN). We have developed a workflow combining the spatial resolution of the Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) with the high-precision U-Pb Isotope Dilution Thermal Ionisation Mass Spectrometry (ID-TIMS) technique and additional $^{87}Sr/^{86}Sr$ isotope analysis on the same material.

This process allows objective evaluation of different early and late diagenetic carbonate phases, addresses some of the common problems in U-Pb dating of marine carbonates (mixing multiple chemical or age components, open system behaviour, variable initial Pb isotopic composition), and justifies calculation of robust U-Pb isochrons.