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AusGeochem and Big Data Analytics in Low-Temperature Thermochronology

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The AuScope Geochemistry Network (AGN) and partners Lithodat Pty Ltd are developing AusGeochem, a novel cloud-based platform for Australian-produced geochemistry data from around the globe. The open platform will allow laboratories to upload, archive, disseminate and publish their datasets, as well as perform statistical analyses and data synthesis within the context of large volumes of publicly funded geochemical data. As part of this endeavour, representatives from four Australian low-temperature thermochronology laboratories (University of Melbourne, University of Adelaide, Curtin University and University of Queensland) are advising the AGN and Lithodat on the development of low-temperature thermochronology (LTT)-specific data models for the relational AusGeochem database and its international counterpart, LithoSurfer. These schemas will facilitate the structured archiving of a wide variety of thermochronology data, enabling geoscientists to readily perform LTT Big Data analytics and gain new insights into the thermo-tectonic evolution of Earth's crust.

Adopting established international data reporting best practices, the LTT expert advisory group has designed database schemas for the fission track and (U-Th-Sm)/He methods, as well as for thermal history modelling results and metadata. In addition to recording the parameters required for LTT analyses, the schemas include fields for reference material results and error reporting, allowing AusGeochem users to independently perform QA/QC on data archived in the database. Development of scripts for the automated upload of data directly from analytical instruments into AusGeochem using its open-source Application Programming Interface are currently under way.

The advent of a LTT relational database heralds the beginning of a new era of Big Data analytics in the field of low-temperature thermochronology. By methodically archiving detailed LTT (meta-)data in structured schemas, intractably large datasets comprising 1000s of analyses produced by numerous laboratories can be readily interrogated in new and powerful ways. These include rapid derivation of inter-data relationships, facilitating on-the-fly age computation, statistical analysis and data visualisation. With the detailed LTT data stored in relational schemas,

measurements can then be re-calculated and re-modelled using user-defined constants and kinetic algorithms. This enables analyses determined using different parameters to be equated and compared across regional- to global scales.

The development of this novel tool heralds the beginning of a new era of structured Big Data in the field of low-temperature thermochronology, improving laboratories' ability to manage and share their data in alignment with FAIR data principles while enabling analysts to readily interrogate intractably large datasets in new and powerful ways.