Integration of electron, laser and ion microprobe techniques to create an open source digital mineral library of Western Australia

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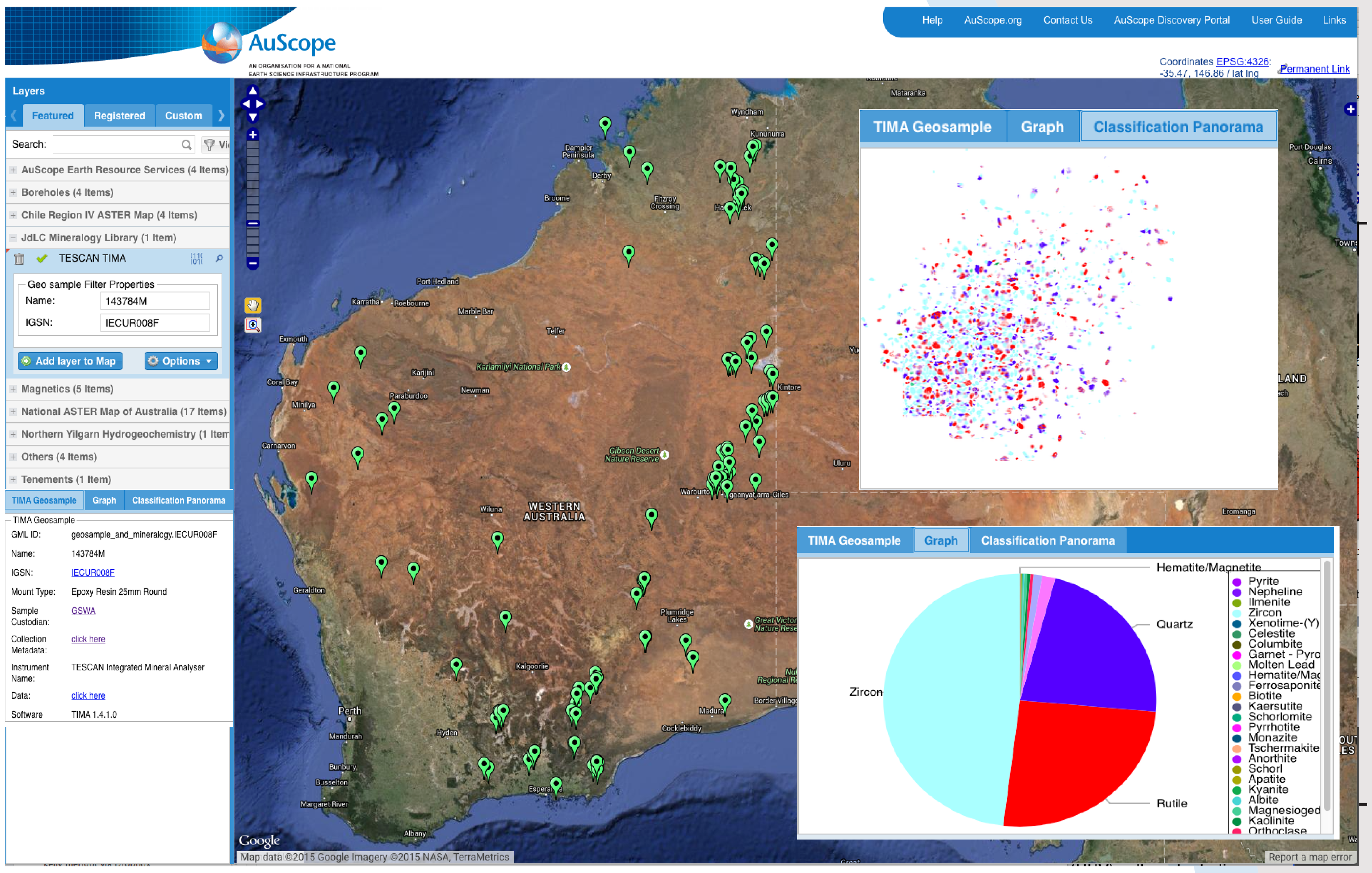
Introduction

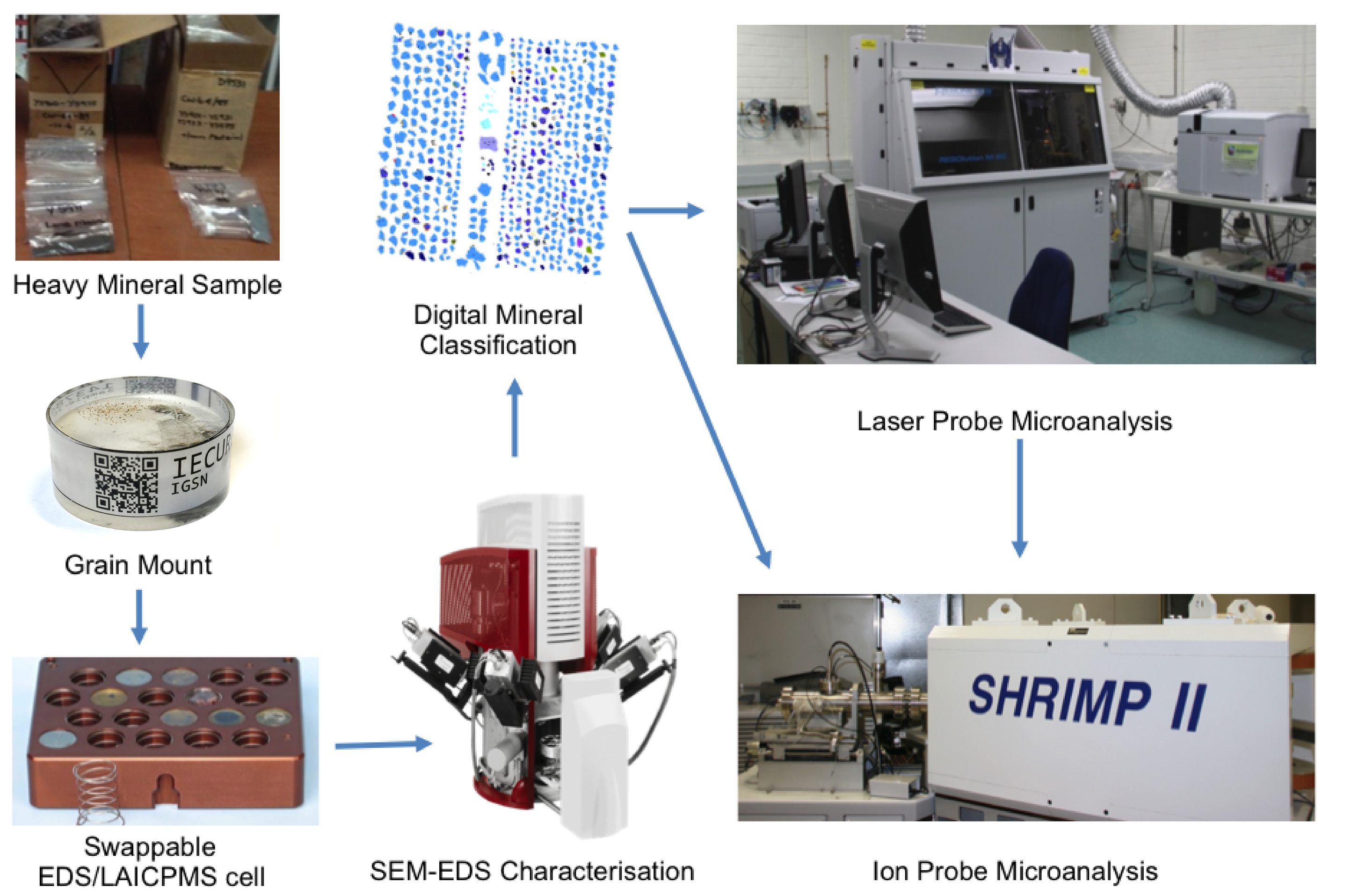
Accessory minerals contain trace element signatures that can be used to indicate the physical conditions and history of host rock formation, information which has utility in exploration targeting by the minerals industry. A key issue for the mineral exploration industry is the discrimination between fertile and background mineral chemistry signatures.

This project utilised SEM and ELA-ICP-MS techniques to characterise the mineralogy and mineral chemistry of 150 heavy mineral concentrates from the GSWA geochronology collection in order to generate an open source database of the age, chemistry and mineralogy of non-mineralised rock units in Western Australia. This database offers the community an innovative way to access laboratory data.



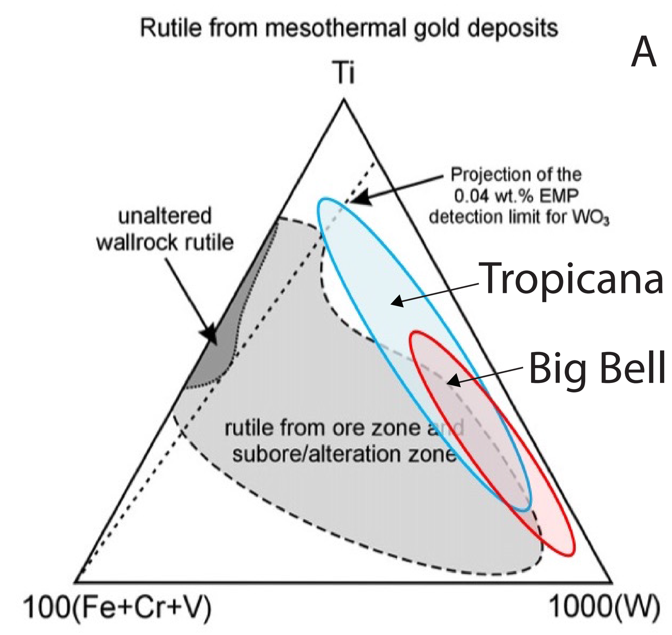
Instrumentation

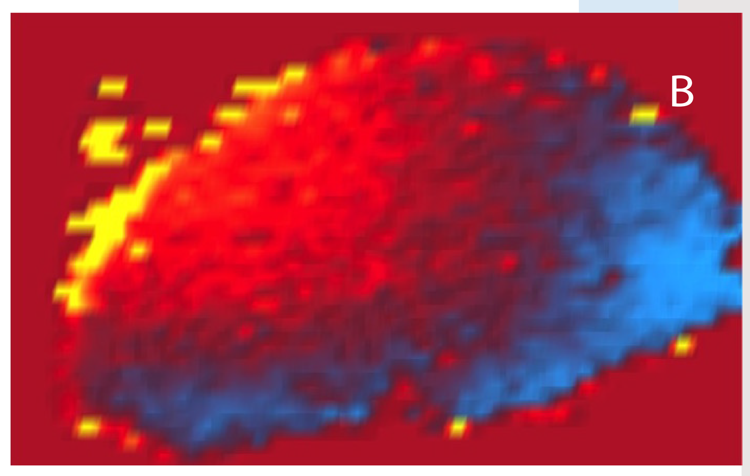
The project team developed a workflow integrating a bespoke laboratory information management system (LIMS) with IGSN sample registry, TIMA FE-SEM automated mineralogy, SHRIMP U-Pb and ELA-ICP-MS data outputs. Zircon, monazite, titanite, rutile, apatite and many other accessory minerals in polished mounts werre rapidly identified (up to 20,000 grains/hr) and spatially registered for subsequent trace element analysis by laser or ion microprobe. Instrument outputs are linked to the LIMS metadata registry and are made acessible via the AuScope Discovery Portal (portal.auscope.org). *Scan the QR code on the grain mount at right for an example of data discovery and accessibility.*



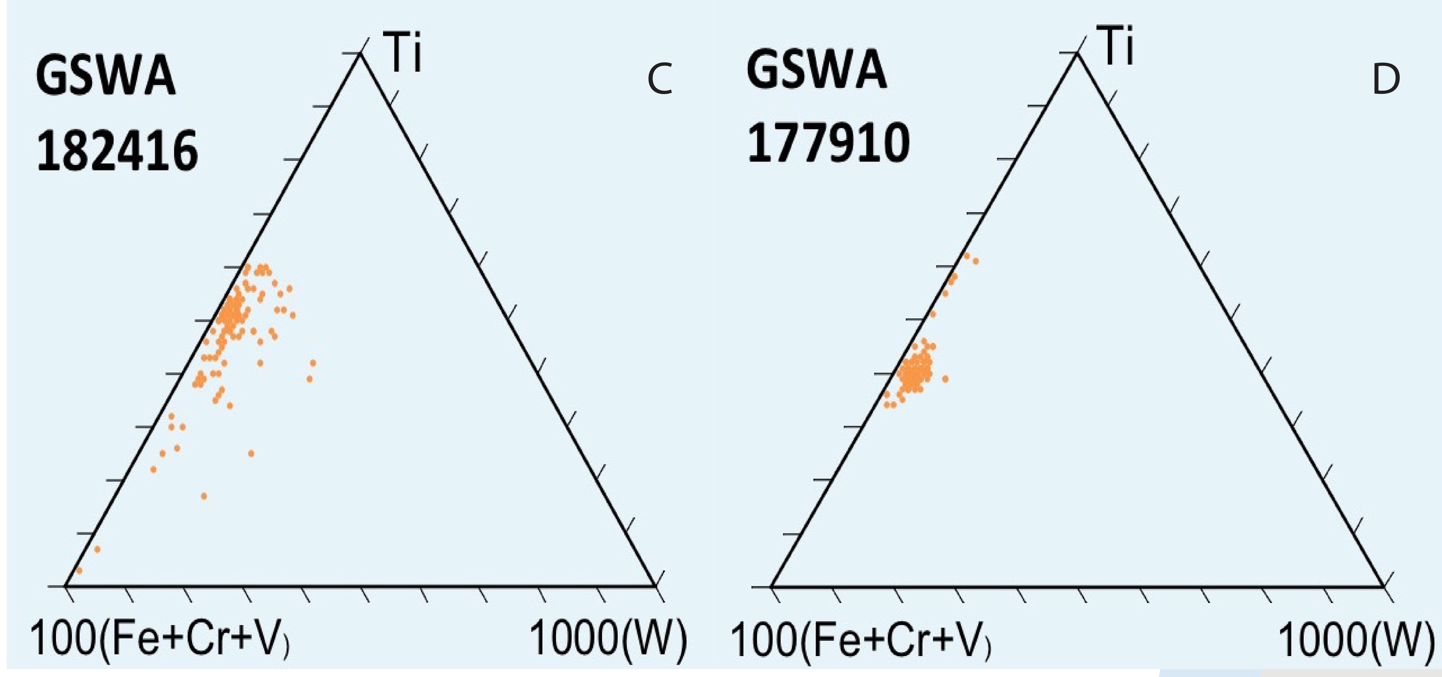
Applications

The determination of rutile trace element contents is an example of the practical utilisation of this integrated analysis approach. Previous research [1] has shown that trace element abundances of W and Sn in rutile can be used to differentiate between altered ore zone from unaltered wall rock samples in metamorphosed Canadian mesothermal gold deposits (A). This work has shown similar trends towards W-rich compositions for the Tropicana and Big Bell mesothermal gold deposits in Western Australia (A), however laser ablation mapping data of Tropicana rutile grains has shown that W concentrations are not homogeneously distributed (B). In contrast, rutile from the GSWA collection has generally low W concentrations (C and D).





Laser ablation map of W concentration in rutile from the Tropicana gold deposit. Red areas have >6,000 ppm W whereas blue areas contain <2,000 ppm W. Diameter of grain is 100 microns.



Acknowledgements

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References

1. Clark JR and Williams-Jones AE, 2004. Rutile as a potential indicator mineral for metamorphosed metallic ore deposits. Rapport Final de DIVEX, Sous-projet SC2, Montreal, Canada. 17 pp.
2. Doyle MG, Fletcher IR, Foster J, Large RR, Mathur R, McNaughton NJ, Meffre S, Muhling JR, Phillips D and Rasmussen B. 2015. Geochronological constraints on the Tropicana gold deposit and Albany Fraser Orogen, Western Australia. Econ Geol 110, 355-386.

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