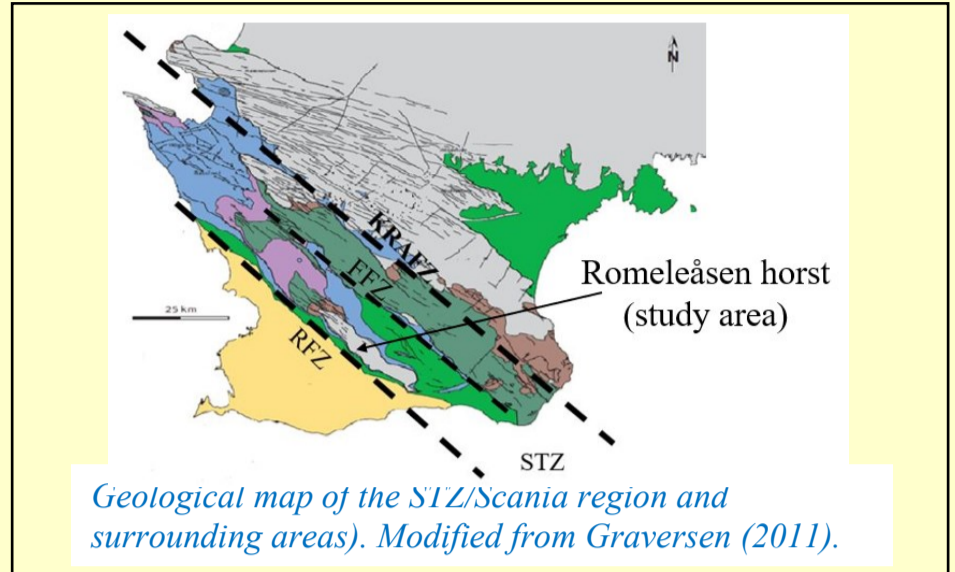




Introduction

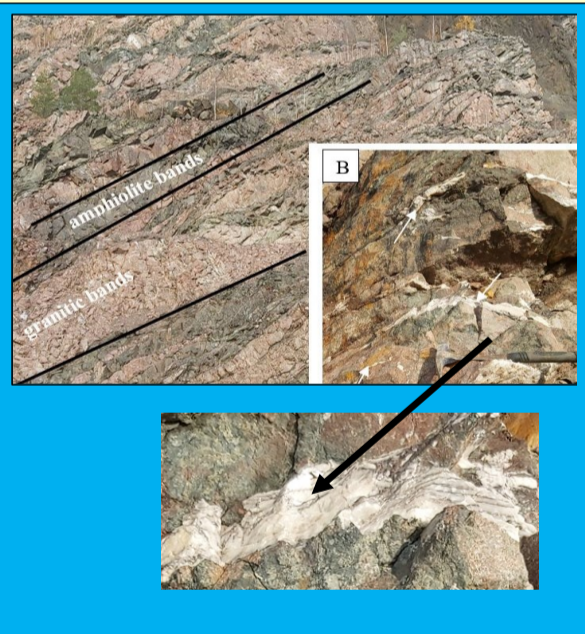
U-Pb age dating of a brittle deformation is generally considered problematic due to lack of minerals with enough amounts of radiogenic isotopes suitable for age dating. Carbonate minerals (i.e., calcite) are the most conceivable target minerals as they occur in wide range of tectonic environments associated with brittle deformation. Dating carbonate minerals is however challenging due to low U and high initial Pb content. By implementing LA-ICP-MS imaging method that combine U-Pb isotope and trace element analyses it is possible to circumvent some of these problems (Drost et al., 2018). The aim of this study was to test and apply the LA-ICP-MS imaging U-Pb age dating method on fracture-filling calcites along the Sorgenfrei-Tornquist Zone (STZ) in Scania, southern Sweden where there is no record of direct absolute age of brittle deformation.



Geological map of the STZ/Scania region and surrounding areas). Modified from Graversen (2011).



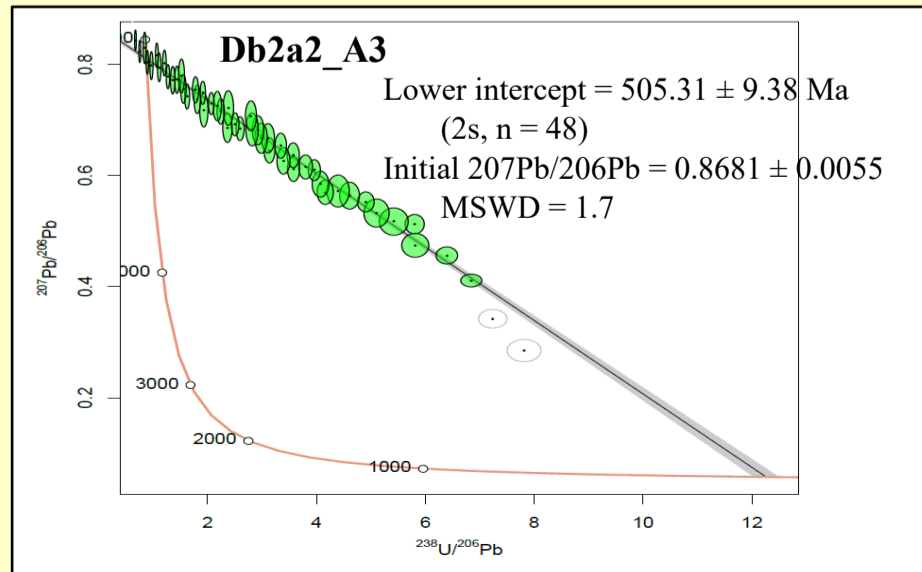
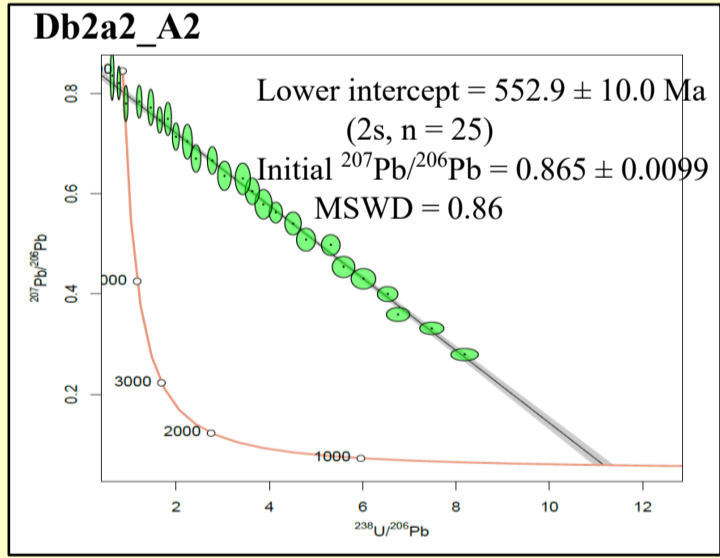
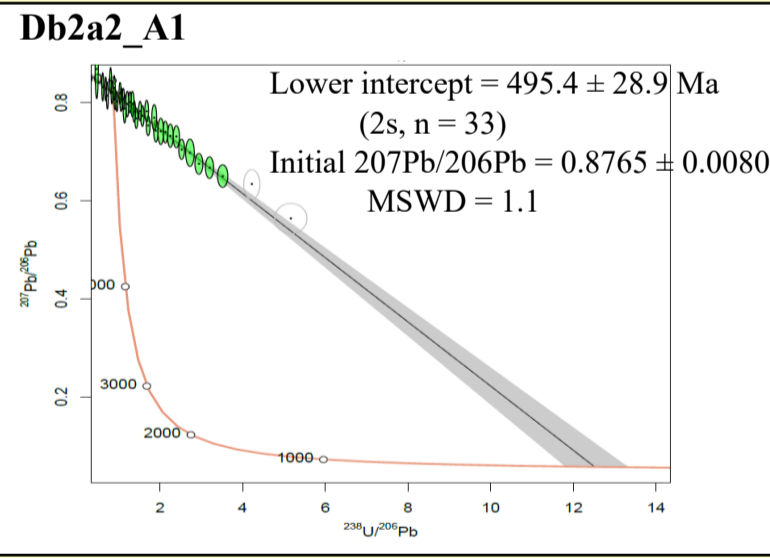
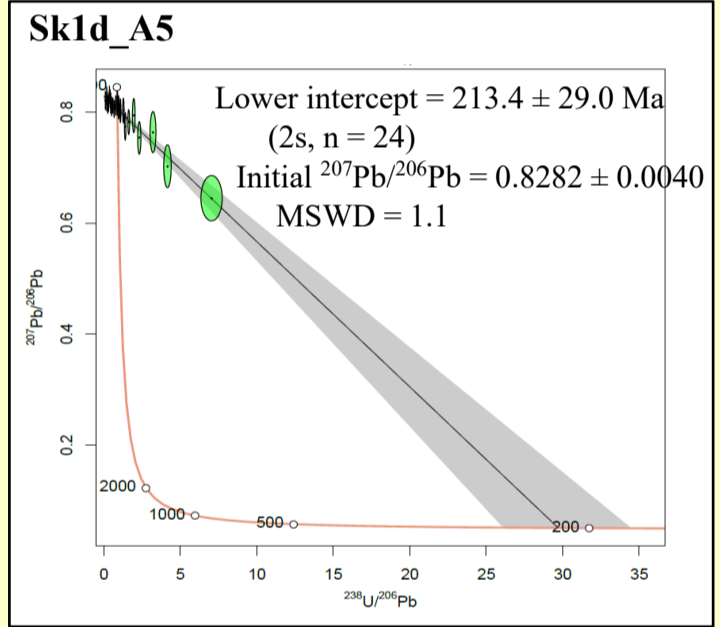
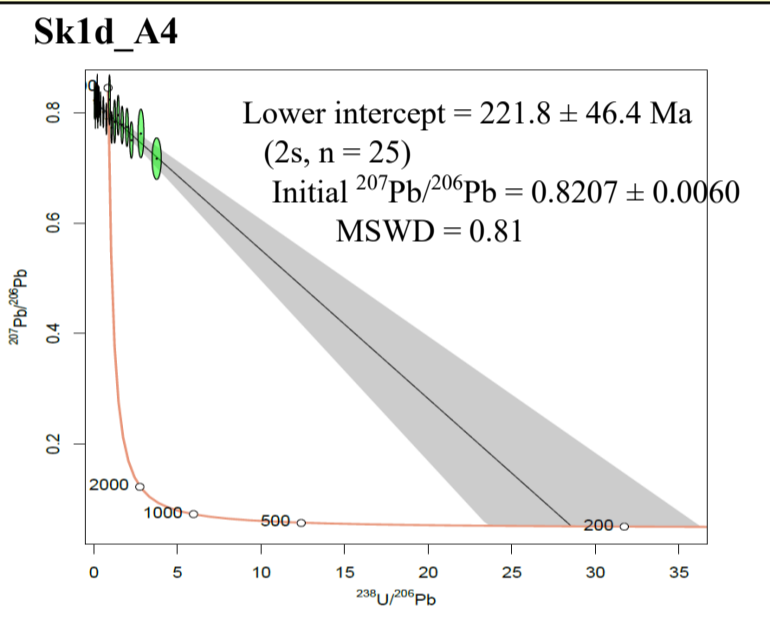
Fracture-filling carbonate in the Skrylle quarry



Fracture-filling carbonate in the Dalby quarry

Results

The age plotting diagrams show U-Pb age dating results of samples from Skrylle quarry with analytical areas Sk1d_A4, Sk1d_A5 as well as Dalby quarry with analytical areas Db2a2_A1, Db2a2_A2, and Db2a2_A3. Selected and pooled data points are regressed along a discordia line in Terera-Wasserburg diagram ($^{207}\text{Pb}/^{206}\text{Pb}$ vs $^{238}\text{U}/^{206}\text{Pb}$ space). The data points show a linear distribution of mixed radiogenic and common Pb components with data points of relatively higher radiogenic lead spreading towards the $^{238}\text{U}/^{206}\text{Pb}$ axis.



Conclusion

Despite overall low U and high initial Pb in calcite, analysis of a large analytical area through LA-ICP-MS imaging enables to obtain seemingly realistic U-Pb dates. Sample from the Skrylle quarry resulted U-Pb dates of 222 ± 46 and 213 ± 29 Ma. Calcite from Dalby quarry yielded U-Pb dates of 495 ± 29 , 553 ± 10 , and 505 ± 9 Ma. On the assumption that the dates are analytically accurate, and calcite is formed at the instant of fracturing, the U-Pb ages are the first that directly dates brittle deformation along the STZ. Given that fracturing at both localities are located within the STZ, the age results indicate that the STZ is not a result of single tectonic event of brittle deformation but has a prolonged tectonic history. However, the geologic significance of the age dating results cannot be taken as unequivocal conclusive and further research is recommended.