Silcrete is a ubiquitous regolith material found throughout Australia. Despite being the subject of much study, there is still much unknown or debated as to their genesis, age and significance in the Australian landscape. Genetic models range from evaporative processes acting in arid environments to crystallisation in swampy environments similar to those in which coal forms. Silcrete refers to intensely indurated rock composed mainly of quartz clasts cemented by a matrix of crystalline, crypto-crystalline quartz or amorphous silica, where induration occurred at or near the surface, due to inputs of silica from weathering, streams or ground waters. From stratigraphic and fossil evidence, silcretes have been broadly assigned Tertiary ages in Australia.

The Sandstone Tank site is on Fowlers Gap Research Station, ~100km N of Broken Hill, western NSW, where silicified Paleogene palaeochannel sediments contain leaves and twigs of possible Eocene temperate rainforest plants. The outcropping material, about 6 m thick, consists of a basal conglomerate of Adelaidean metasediment gravels, grading up through smaller sized clasts to more massive, tabular silcrete at the top (Figure 1). The basal gravels and larger pebbles are draped by beige-coloured geopetal cappings composed of anatase, iron oxides and silica in varying proportions (Figure 2). Towards the top of the conglomerate, clasts are draped by thicker caps than at lower levels. The anatase is a late stage illuviation feature, commonly as a microcrystalline matrix, as has been noted in other silcretes around the world.
Initial attempts to date the anatase involving Laser Ablation-ICPMS revealed the presence of large amounts of common lead, and the precision of measurements was poor. To remedy these problems, more detailed sampling and analysis was undertaken: 1 – 2mm wafers of the capping material were extracted, crushed and handpicked, to obtain ~10 - 100 mg samples which were then dissolved in HF/HNO₃ dissolution, followed by measurement of spiked and unspiked aliquots, including standards, on a Finnigan Neptune multi-collector ICPMS.
The common Pb composition for the Sandstone Tank silcrete anatase was obtained from regression on a Tera-Waserburg plot to yield values of \(^{207}\text{Pb}/^{206}\text{Pb} = 0.930\) and \(^{204}\text{Pb}/^{206}\text{Pb} = 0.0593\). The error on the common Pb composition is \(\sim 7.7\%\), owing largely to the tight clustering of the data. This common Pb component has a Stacey-Kramer single stage age of 1430 Ma. The radiogenic Pb component has been established by subtraction of the common Pb component (Figure 3). The U/Pb results for the radiogenic component include two outliers, samples 7.1 and 7.3. The remaining seven samples plot around the concordia curve, and yielding a concordia age of 481±85 Ma (2\(\sigma\) confidence level). This is in agreement with the \(^{206}\text{Pb}/^{238}\text{U}\) age of 477±85 Ma (2\(\sigma\) confidence level). The age errors are large owing to the 7.7% uncertainty in the common Pb value, and the spread of the data.
Figure 3. Sandstone Tank U/Pb data

The calculated ages of the anatase are at odds with the Eocene floral age assigned to the silcrete. However, the possibility that the ages represent either mixing of an older component (e.g. from the Delamerian Orogeny), with a younger component brought into the area with the Paleogene sediments, or possibly incomplete resetting of the U-Pb system, cannot be ruled out. Further work is necessary to refine the interpretation of U-Pb results obtained from silcretes in order to date these important deposits and provide improved chronologies for landscape evolution.