

# Optical bleaching and thermal annealing of the ESR signals in quartz

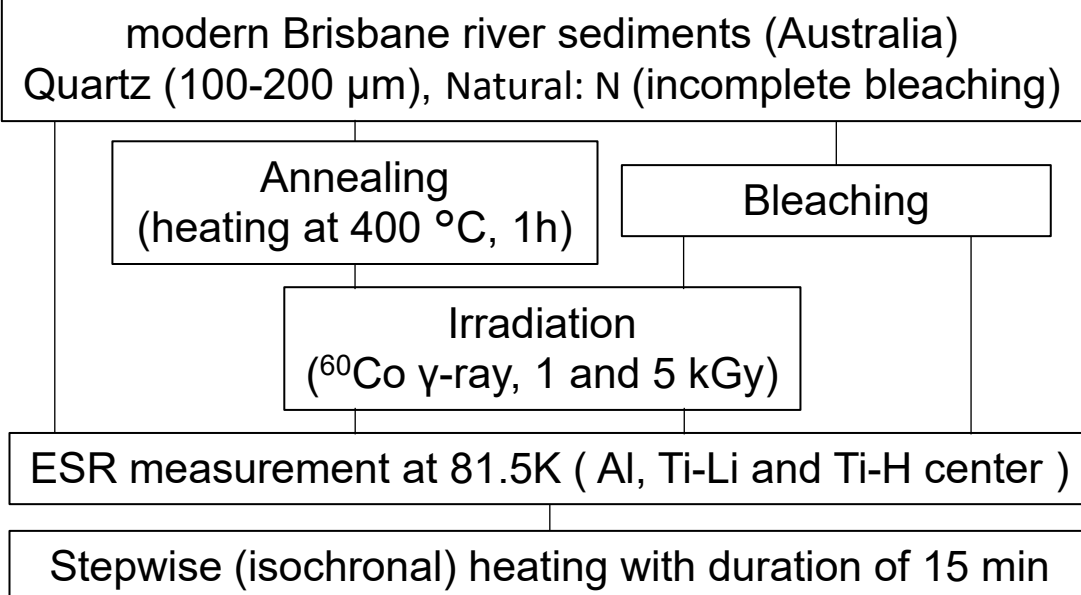
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## Introduction

- ESR method has an advantage that it can be applied to samples with older ages than OSL method, but on the other hand, the dating signals bleach harder than OSL signals. The ESR signals take several hundred hours to bleach, implying that the residual signal intensity can be significant.
- It is known that the Al center has two components, bleachable and unbleachable, where the former has to be subtracted to estimate the ages.
- However, the thermal stabilities of these components were not well investigated. In this study, the characteristics of the dating signals and these components are systematically investigated.

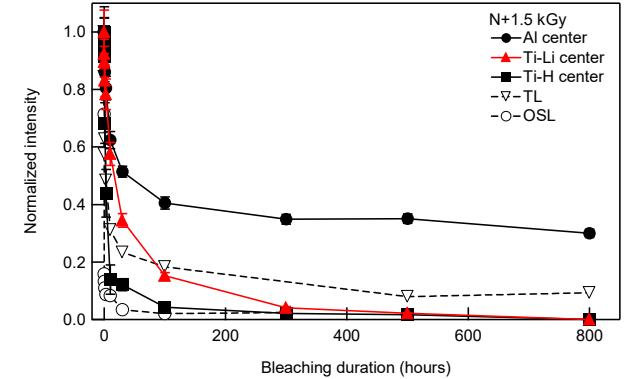
## Experimental procedures



## Optical bleaching



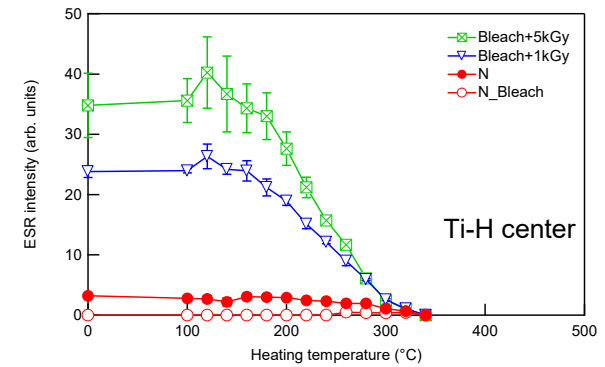
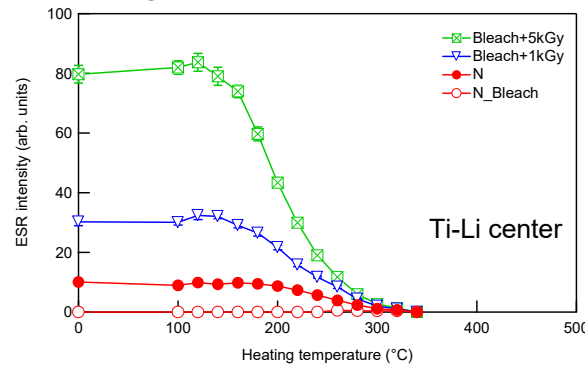
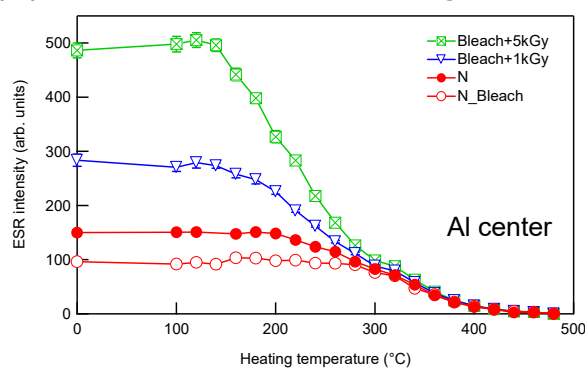
exposure to solar simulator SOLAX-500W at 100 klx



Bleaching was continued until the Ti-Li center is completely bleached.

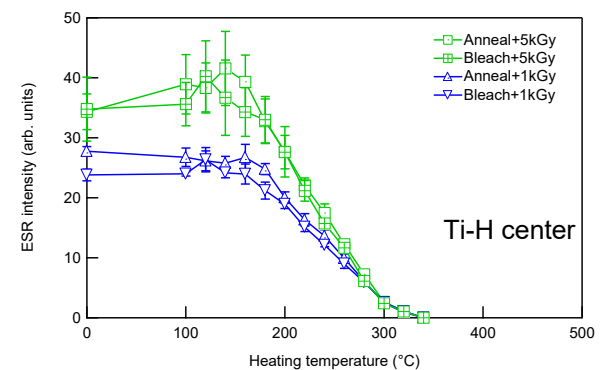
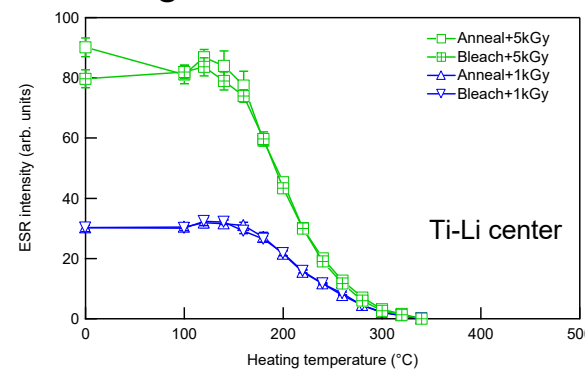
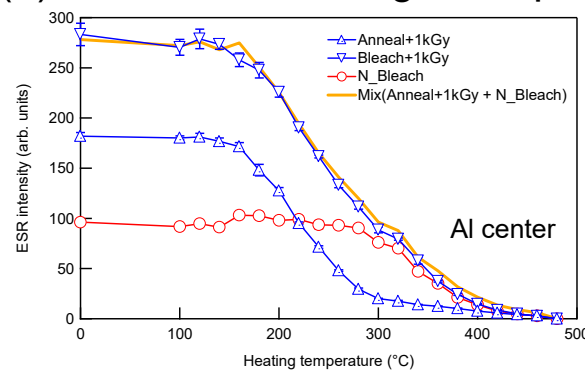
## Results of stepwise heating experiments

### (1) Radiation induced signal after bleaching



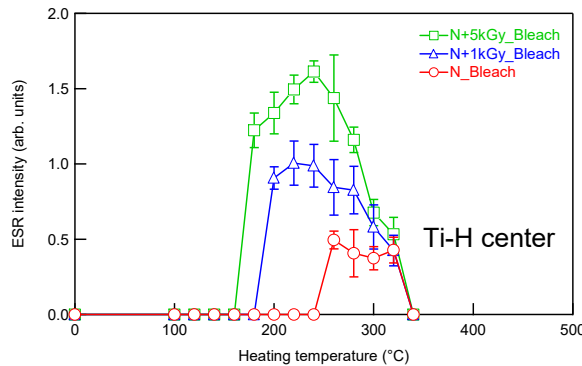
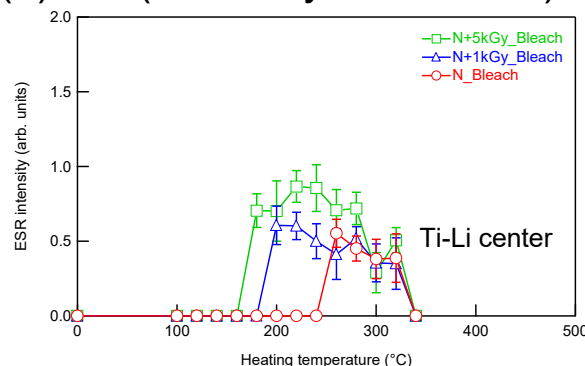
► Radiation induced signal is less stable as for Al center but not as for Ti-Li and Ti-H centers.

### (2) Thermal annealing and optical bleaching



► Heating at 400 °C destroys the stable component of Al center, but the characteristics of Ti centers are the same after heating and optical bleaching.

### (3) T-T (thermally transferred) Ti centers



► After bleaching, Ti-Li and Ti-H centers were generated on heating.

## Summary

- Non-bleachable component of Al center corresponds to the thermally stable component.
- The optical bleaching can be replaced by heating at 280 °C, to extract non bleachable component of Al and to reset the Ti centers.
- The thermally transferred Ti centers were clearly observed for the first time.