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# バライト結晶年代測定：プレート境界の流体移動様式の解明

## ESR Barite dating: understanding fluid movement at plate boundaries

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*Abstract*

The age of flowing hot fluid is crucial to the understanding of the geological evolution and activities in subduction zones. International Ocean Discovery Program (IODP) Expedition 370 discovered characteristic barite mineralization in the Nankai Subduction Zone (NSZ) off Japan[1]. The barite enables us to determine the age of its formation fluid, i.e., hot fluid flowed in the underthrust domain of the NSZ, with electron spin resonance (ESR) dating. In 2022, we irradiated barite minerals from the NSZ for ESR dating at the National Institutes for Quantum Science and Technology (NIQST). We are now calculating the ages of the irradiated mineral samples, i.e., timing of hot fluid flow at the NSZ, and preparing to submit the results to a scientific journal.

*Keyword*: ESR dating, barite, Nankai Subduction Zone, geochronology

## 1. Introduction

Fluid has a profound effect on fault mechanics and the transition of seismogenic behavior of subduction zones[2]. The migration of high-temperature fluid is a common phenomenon in subduction zones, including the Nankai Subduction Zone (NSZ) off Japan. However, it is difficult to track the development of such fluid migration below the seafloor with direct observations.

Expedition 370 of the IODP (Site C0023) discovered barite formed in fluids up to 219 °C at 1 km below the seafloor in the underthrust section of the NSZ[1]. Identifying the age of the barite is essential to construct the history of hot fluid flowing in the NSZ. Dating the barite is thus desirable and the ESR dating method is suitable for the age range of the Quaternary barite.

## 2. Methods and Materials

We applied isochronal and isothermal heating to natural and irradiated barite samples, observed the decay of their ESR signals, and carried out the associated calculations on the thermal stability of the barite samples[3].

## 3. Results and Implications

In 2022, we used samples irradiated at the NIQST to confirm ESR dating can be applied to the NSZ barite without significant concerns of burial resetting the ESR signals in the barite[3].

After that, with more samples irradiated at the NIQST, we confirmed that the formation ages of the NSZ barite are not older than the Quaternary (i.e., < 2.58 million years old). This proves that the hot fluid flowed in the NSZ recently in the geologic time scale.

We are now calculating the exact age of each barite sample to compare the timing of fluid flow at different parts of the NSZ. Together with geochemical data, we will also be able to associate the fluid flow with geological processes such as seismic events or subducting ridges.

## Reference

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