

Current State of the additional geological surveys of crush zones at the fast breeder prototype reactor "Monju" site

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Background: In the fast breeder prototype reactor Monju of the Japan Atomic Energy Agency (JAEA), a report of the additional geological survey regarding the crushed zones at the Monju site was submitted to the Nuclear Regulation Authority (NRA) on April 30, 2013. The NRA instructed to develop a further additional research plan on September 25. Accordingly, JAEA compiled and submitted the plan on October 3, followed by a "preliminary report" on November 29, and a "complete report" in March 2014.

Overview of additional research: The instructions from the NRA of September 25, 2013 were as follows:

1. to implement the dating of materials within the crushed zones, to research the displacement markers, and to understand their formation age, etc., in order to enhance understanding of the activity of crushed zones at the Monju site in the bedrock of the site investigation area; 2. to investigate the distribution of the fracture zones, the relationship of the sediment layer, and the depositional age of the sediment layer (14C dating, tephra analysis, etc.) for data expansion of the extended portion of the L-2 lineament located near the Monju site; and 3. to implement marine seismic surveys in the coastal sea area and geographical and geological surveys of the coast, etc., in order to understand the geological structure and activities of the coastal seabed in the extended portion of the Shiraki-nyuu active fault and the L-2 lineament.

JAEA developed a research plan in response to these instructions and conducted the stripping investigation over an expanded area, the additional detailed geographical and geological surveys around the mountains/terrace boundary, and the marine seismic surveys in the coastal waters.

Summary of findings: The basement rock of the northern Tsuruga peninsula where the Monju site is located is composed of the Late Cretaceous-Paleogene granite known as the Kojyaku granite. In the on-site investigation, the stripping area was extended in the northern direction of the longest fracture zone in the reactor building foundation rock. The fracture zones were grouped into 2 systems called α -system and β -system. We examined the cross-cutting relationships and displacements of the fracture zones and confirmed that the α -system was formed after the β -system. The α -system fracture zones are left-lateral faults that have mesh-like clay veinlets, and the width of the α -system fracture zones is several centimeters. The K-Ar ages of the basalt dyke displaced by the α -system fracture zones were about 19Ma. In addition, U-Pb and FT dating of apatite and zircon separated from the fracture zone materials and granite were conducted to reconstruct their thermal histories. The investigation results so far obtained were similar to the survey results of April 30, 2013, offering no clear evidence that the on-site crushed zones are of an active fault. It can be considered that these crushed zones are small-scale older (pre-Quaternary?) geological structures formed under the hydrothermal environment of the deep part before exposure of the granitic body. On the detailed geographical and geological surveys around mountainous/terrace boundary, no fracture zone along the strike of the boundary was observed. From the C-14 dating and tephra analysis of the depositional layer covering the granite, the distribution of sediments from about 40,000-50,000 years ago was confirmed in a few outcrops. The marine seismic surveys in the coastal waters were performed in conjunction with the bathymetric survey in December 2013. Currently, the data are being analyzed.

Upcoming: In order to further enhance the reliability of the investigation results and accumulate further data related to on-site geology and the underground, voluntary investigations are being conducted on a continuous basis. In addition, a basic study is also being carried out on the evaluation method of the activity of the fault zone not applicable to the overburden strata method.

Keywords: fast breeder reactor Monju, survey of crush zone, Kojyaku granite, Nuclear Regulation Authority