An example of activity evaluation of a minor crush zone including subparallel clay veins in granite near the Monju site

*Koji Shimada[1], Tsuneari Ishimaru[1], Shigeru Sueoka[1], Shuji Terusawa[1], Ken-ichi Yasue[1], Masakazu Niwa[1], Koji Umeda[1]

1.Japan Atomic Energy Agency

Introduction: Diverse situation of outcropping crush zones around important building constructions need upgrading of activity evaluation method without the use of overlying sediments. The method using the cross-cutting relations among geologic features in basement rocks is promising. However, minor crush zones without cross-cutting relation from intrinsic or extrinsic (restricted outcrop) properties are frequently observed. An activity evaluation of such minor crush zone was carried out in one outcrop. Outline of the crush zone: A crush zone in granite strikes ca. 030 deg. and dips ca. 60 deg. to E, is observed both side of small stream at the outcrop located in SW from the Monju site, Tsuruga Pen., Fukui prefecture, southwest Japan. The width of the zone is a few decimeter and the length of exposure is about 20 m. Sheared clay veins (b1 - b4) of a few centimeters in width run subparallel in the crush zone showing right step arrangement without cross-cutting relations. The b1 is the longest and soft one running through the left (southern) bank of the stream, b2 is the second long one at hanging wall side of the b1, b3 is the third long one at foot wall side of the b1, only b4 is on the right (northern) bank and partly soft. Continuity between the longest b1 on the left bank and the b4 on the right cannot be checked because of the stream and talus covers. Strikes of the b1 change considerably from NNE in the south to NNW in the north. A strike of the b4 is again NNE. The b2 seems straight near the bend of the b1, and pinch-out to the south. The b3 constitutes partly a level difference (eastern side is high) of granite. The level difference and the b1 are covered thick sediments and showing an nonconformity. The hanging wall of the crush zone is hard and constitutes an overhang rock wall, whereas, the foot wall is fragile due to brecciation with irregular crack. Method and result: 1; Geographic and geologic identification of continuation of the crush zone. There is no tectonic relief. There is no crush zone in granite at observed outcrops at the north of the crush zone. 2; A selection of a clay vein to be evaluated and age estimation of the sediment by means of tephlochronology. We select the b1 clay vein based on the longest continuity. Sediments overlying the b1 and b3 is not deformed by shear along the b1 and contain particles of the AT tephra. 3; Kinematic analyses. Normal (east side down) sense of shear is observed in the b1, b2 and b4 accompanied with sinistral or dextral component. In the b3, shear sense indicators are not observed but structures showing sinistral sense of shear with normal component is observed between the b3 and sediments. 4; Search for similar examples of the level difference of the basement rocks. At an outcrop along other stream, a projected clay-rich crush zone and eroded brecciated zone by present differential erosion is observed. 5; Clay size measurement. Clay size (mode) of the crush zone is 3.91 micron and that of an active Shiraki-Nyu fault (high angle reverse fault of N-S strike with dipping to E) near the crush zone is 0.584 micron. The activity of the crush zone (interpretation): The crush zone is minor structure with no tectonic relief. The sediments deposited since 30000 years ago, and the b1 is not active sympathetically at the latest slip of the active Shiraki-Nyu fault (9000 years ago). The crush zone sheared at multiple stage of deformation but inconsistent with the stage of the active fault, and the level difference seems to be shaped by differential erosion of brecciated zone and buried by sediments. The interpretation that the crush zone is small structure is reinforced by the lesser pulverized clay in the b1 indicating lesser cumulative displacement. These lines of evidence suggest that the crush zone is not an active fault as an expression of a seismogenic fault, or a

weak zone which slips accompanied with the active zone.

Keywords: crush zone, fast breeder reactor “Monju”, granite

