

Conventional mechanical crushing versus Selfrag Lab. pulverization

Mami Takehara¹ and Kenji Horie^{1,2}

¹*Geoscience Research Group, National Institute of Polar Research, 10-3, Midori-cho, Tachikawa-shi, Tokyo 190-8518, Japan*

²*Department of Polar Sciences, The Graduate University for Advanced Studies (SOKENDAI), Japan*

Mineral separation is an essential process in sample preparation before SHRIMP U-Pb analysis. Selfrag Lab. is pulverization system using pulse power of high voltage discharge. This device can provide good opportunities to separate materials into individual constituents with retaining original morphology and mineral surface. There is possibilities that fine-grained mineral grains, such as zircon inclusions in garnets, can be collected without contamination and damage to zircon inclusions. In this study, enhancement of recovery rate of minerals is important for U-Pb dating if quantitative comparisons are to be attempted between polychronologic zircon populations.

Focused on pulverization process in the mineral separation process for U-Pb zircon geochronology, we compared the recovery rates of zircon between conventional fragmentation with stamp mill and high-voltage selective fragmentation with Selfrag Lab. machine. Nearly equal weights of rock (TEMORA2; Black et al., 2004) aer crushed by each crushing method. After pulverization, the conventional method (rinsing with water, heavy liquid separation, and magnetic separation with ferrite and Nd magnet) is applied. Weights of the products of each step were measured. Based on the sample weight, recovery rate of heavy and non-magnetic mineral including zircons were calculated and compared between two pulverizing processes.

Weights of TEMORA2 rock fragments and recovery rates are shown in Table 1. Recovery rate of heavy and non-magnetic minerals including zircons by Selfrag are slightly higher than stamp mill pulverization (stamp mill: 0.02680 g, 0.007%, Selfrag: 0.03067 g, 0.009%). However, the difference is so small that it is difficult to judge whether this is caused by difference of pulverization method or heterogeneity of component in TEMORA2 rock fragments. On the other hand, in the case of light minerals, recovery rate using Selfrag is much higher than one using stamp mill. Selfrag can keep the shape of crystals better than stamp mill, so relatively coarse-grained light minerals, such as feldspar and quartz can be survived during pulverization process.

Table 1. Weights and recovery rates of TEMORA2 zircon obtained using stamp mill and Selfrag Lab.

	rock sample	pulverization	elutriation (rinsing with water)	heavy liquid separation	non-magnetic fraction
Selfrag	378.5 g	307.9 g (81.3%)	--	9.32 g (2.5%)	0.0361 g (0.00953%)
Stamp mill	383.0 g	290.0 g (75.7%)	98.9 g (25.8%)	6.62 g (1.7%)	0.0268 g (0.00700%)

Values in brackets are recovery rate (ratio of weight of product from each separation process divided by weight of rock sample before all separation processes.)

References

Black, L.P., S.L. Kamo, C.M. Allen, D.W. Davis, J.N. Aleinikoff, J.W. Valley, R. Mundil, I.H. Campbell, R.J. Korsch, I.S. Williams, C. Foudoulis, Improved ²⁰⁶Pb/²³⁸U microprobe geochronology by the monitoring of a trace-element-related matrix effect; SHRIMP, ID-TIMS, ELA-ICP-MS and oxygen isotope documentation for a series of zircon standards, *Chemical Geology*, 205, 115–140, 2008.