

Figure S1. The graphs show the grain size (c ; length of major axis) and aspect ratio (c/a ; length of major axis per length of minor axis) of investigated grains in KJTR samples. KJTR-1(a); KJTR-2(b); KJTR-3(c); KJTR-4(d).

A total of 33230 grains were investigated for all samples, and the aspect ratio and grain size for each individual grain are plotted (Figure S1, 2). There is no distinct difference in trend, but relatively large number of grains with high aspect ratio values are included in the sample of YH site. Further, the grains size was divided by 2.4 μm intervals, and the normalized frequencies of grains of the corresponding size were plotted on the y-axis (Figure S3a). In the same way, the section of the aspect ratio value was divided into <1.5 , $1.5\sim2$, $2\sim3$, $3\sim4$ and $4<$, and each normalized frequency was shown on the y-axis (Figure S3b). In fault gouge samples (YH-1, KJTR-1), many grains with large grain sizes are included, and samples of KJTR sites tend to be mostly grains with a low aspect ratio. In order to examine the shape of grains in more detail, the values of anisotropy, elongation, and flatness were divided into 5 sections from 0 to 1, and the normalized frequency values were shown (Figure S4). Samples of YH-1 and 2 show remarkably different trends, while other samples generally show high values for elongation and flatness.

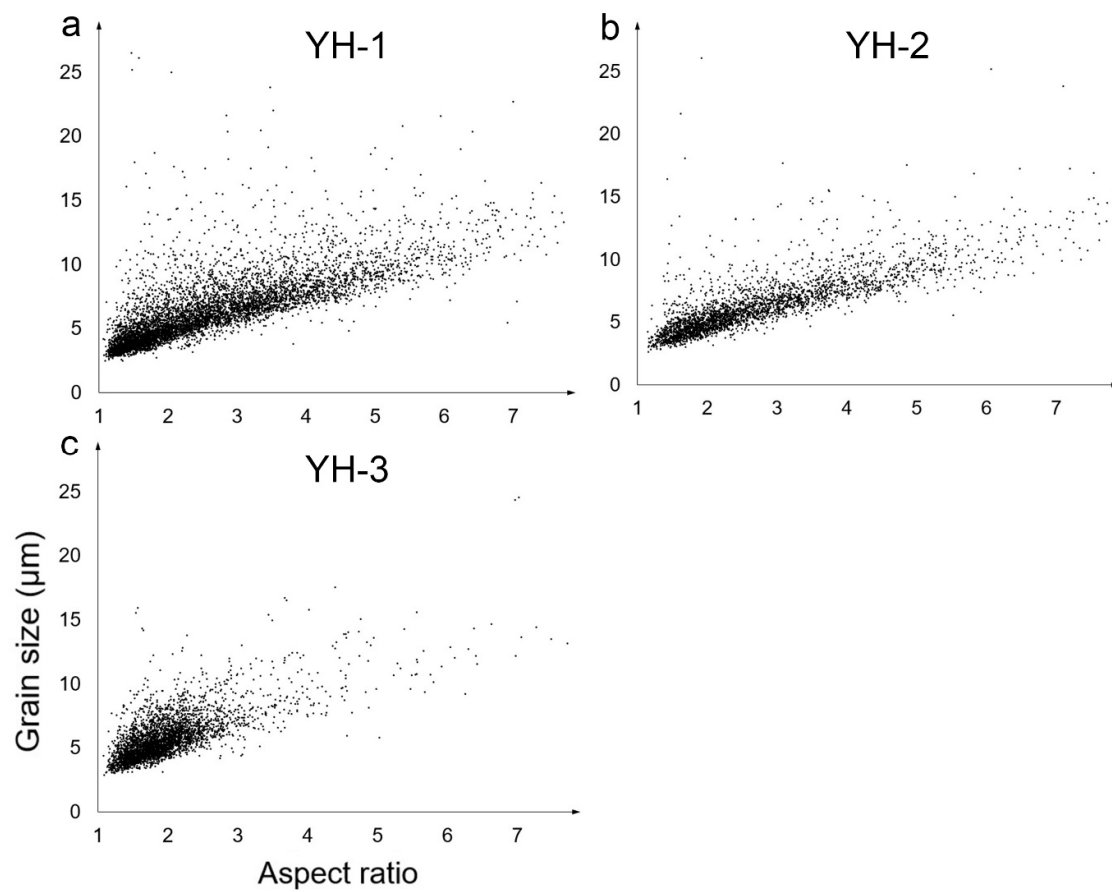


Figure S2. The graphs show the grain size and aspect ratio of investigated grains in YH samples. YH-1(a); YH-2(b); YH-3(c).

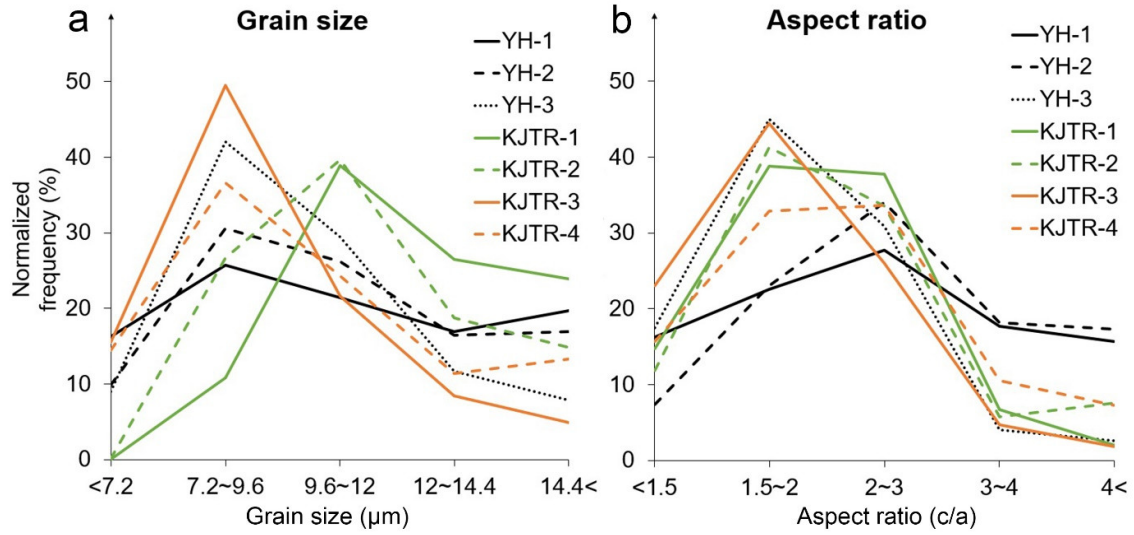


Figure S3. Results showing the distribution of actual values of grain size (c) and aspect ratio (c/a) of grains to be investigated. (a) The grain size was divided into sections of $<7.2\mu\text{m}$, $7.2\sim9.6\mu\text{m}$, $9.6\sim12\mu\text{m}$, $12\sim14.4\mu\text{m}$, and $14.4<\mu\text{m}$, and (b) the aspect ratio was divided into sections of <1.5 , $1.5\sim2$, $2\sim3$, $3\sim4$ and $4<$. The y-axis value represents the normalized frequency of the corresponding grains for each section. The solid black and dotted lines show the results of the YH site sample, and the solid green and orange lines and the dotted lines show the results of the KJTR site sample.

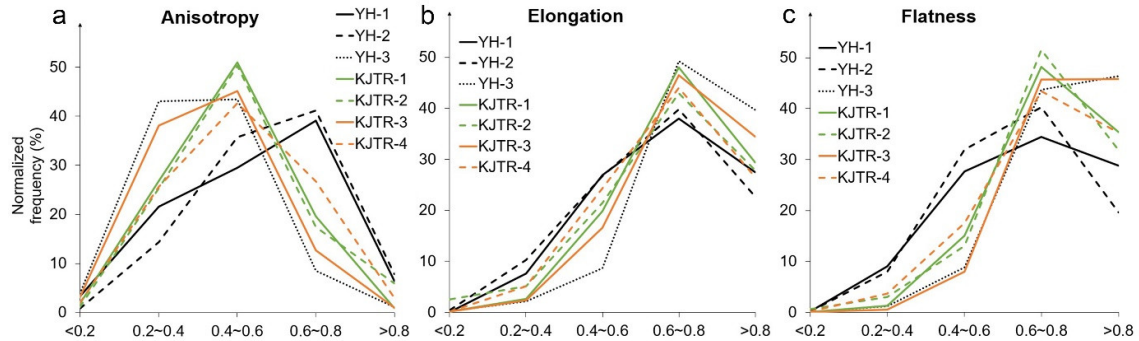


Figure S4. Results showing the distribution of values of (a) anisotropy ($1-c/a$), (b) elongation (b/a), and (c) flatness (c/b) of the grains subject to investigation. All values were divided into five sections: <0.2 , $0.2\sim0.4$, $0.4\sim0.6$, $0.6\sim0.8$, and $0.8<$, and the y-axis value represents the normalized frequency of the corresponding grains for each section. The solid black and dotted lines show the results of the YH site sample, and the solid green and orange lines and the dotted lines show the results of the KJTR site sample.