

セール・ロンダーネ山地に産する氷河堆積物の物理・化学風化特性

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Physical and chemical weathering properties of till deposits in the Sør Rondane Mountains, Dronning Maud Land

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Weathering has strong impacts on chemical and physical properties of rocks. Generally, a degree of weathering ought to increase with time. Therefore, the degree of weathering had been used to estimate relative ages of glacial till deposits on the glacial area in the Sør Rondane Mountains in Dronning Maud Land, East Antarctica (e.g. Moriwaki, 1994). In spite of its importance, however, quantitative method to estimate degree of chemical and physical weathering for this region has not been fully established. In this study, physical and chemical weathering properties of rock samples from several sites listed in Table 1 in the Sør Rondane Mountains have been investigated to provide quantitative information of the degree of weathering.

Whole-rock chemical analyses by Wave-length dispersive X-ray fluorescence are carried out for weathered crusts and fresh parts extracted from outside and inside of the rock samples, respectively. The improved degrees of weathering (Kamei, 2012) of the weathered crusts shows only a few percent differences from those of the fresh part (Figure 1). Powders of these rock samples are heated at 1000°C for 2 hours to measure loss on ignition (LOI). This measurement also shows no clear difference between the weathered crusts and the fresh parts of rock samples (Figure 2). These studies indicate that the chemical weathering process does not play an important roll for weathering in this area. On the other hand, the a^* value of weathered crusts, which shows reddish color defined by $L^*a^*b^*$ color space, are larger than the fresh parts for the most rock samples (Table 1, Figure 3). The hardness tests of rock samples with the Equotip3 rebound hardness tester show that the hardness generally weakened from the fresh parts toward the weathered crusts. Importantly, the weakening rate of the hardness become higher when a^* diff value (see caption of Figure 1) is higher (Figure 3). The weakenings of Hardness are owing to physical weathering caused by ambient temperature fluctuations. These results suggest that physical weathering process is dominant in this region. The strong correlation between the redness and weakening of hardness of rock samples is thought to be a useful tool for estimating degree of weathering in Sør Rondane Mountains, although the origin of reddening is not clear.

Table1. List of samples examined. Letters F and W in Freshness column indicate fresh part and weathered crust of rock samples, respectively.

Sample Number	Locality	Site number	Freshness	a^*	PIA_i	LOI wt.%
A	Mehaugen	11122303	F	-0.52	65.5	1.89
			W	0.72	63.9	2.19
B	Dufekfjellet	12010303	F	3.16	63.6	0.58
			W	10.12	63.2	0.92
C	Mefjel	12010502	F	2.28	64.4	0.44
			W	4.46	64.7	0.55
D	Mefjel	12010505	F	0.40	62.4	0.43
			W	0.78	62.9	0.39
E	Lunkeryggen	12020109	F	2.22	62.3	0.62
			W	1.84	63.4	0.51
F	Lunkeryggen	12020502	F	2.20	59.7	0.50
			W	4.90	61.6	0.22

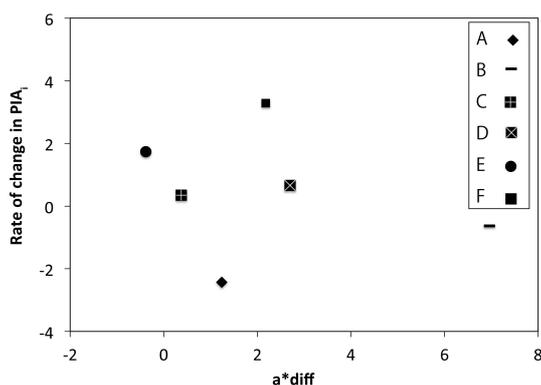


Figure 1. Diagram showing an example of the improved degree of weathering (PIA_i) vs color index. a^* diff means difference between a^* value of fresh part and that of weathered crust. Vertical axis indicates rate of change in PIA_i . Letters in legend correspond to those in Table 1.

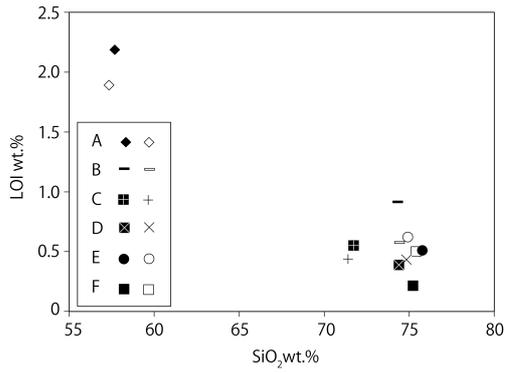


Figure 2 Silica variation diagram of loss on ignition (LOI) for fresh parts and weathered crusts. Letters in legend correspond to those in Table 1. Open symbols: fresh parts. Closed symbols: weathered crusts.

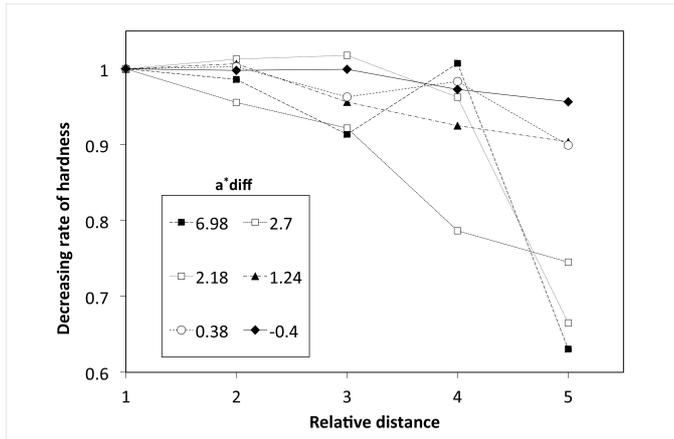


Figure 3. Diagram showing change in hardness from fresh part toward weathered crust. Vertical and horizontal axes indicate decreasing rate of hardness and relative distance from fresh parts, respectively.

References

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