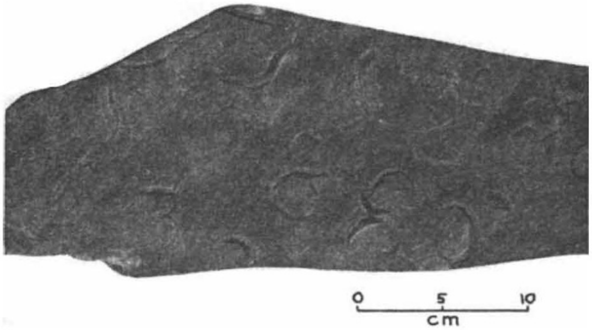

Fig. 1. Markings on ripple-marked bedding surface. Basal Kintla Formation, Precambrian Belt series, Moran Creek, south-east Whitefish Range, Montana

crack. Whenever a crack was propagated towards the thinner and drier mud at the edge of the 'nest' it was deflected back toward the centre, forming a continuously curving crack that was widest at its point of origin and narrowed progressively outward. The open crack was later inundated and filled with the sand of the overlying layer. The thinness of the more coherent and crackable mud layer resulted in a mud-crack that is tubular or rope-like in the manner of the markings described by Frarey and McLaren[1] and Faul[2,3].

While the gross similarity between the markings illustrated by Frarey and McLaren[1] and us is obvious, a similar mode of origin is by no means necessary. However, we feel that the general association of markings of this type with ripple-marks is compatible with a desiccation-crack hypothesis but is not adequately explained by a metazoan-relic hypothesis. The solution to the problem will probably have to wait until more examples of this type of marking are described not only from the Proterozoic of North America, but also from other systems in this and other parts of the world.

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MINERALOGY

Effect of Particle Size on Differential Thermal Analysis

IN a review of quantitative differential thermal analyses of clay, van der Marel[1] quotes numerous workers (which include Speil[2] on kaolinite, and Kulp *et al.*[3] on calcite), who have observed that the recorded temperature of transformation is lowered with a decrease in the particle size of the sample. This result was obtained from material which is either fractionated or ground. With regard to the fractionated material, the coarse portion of a sample contains the particles with better crystallinity because of their greater ability to grow. A recent example of this is the concentration of dickite in the coarse fraction and kaolinite in the fine fraction as recorded by Bayliss *et al.*[4]. In addition fractionated samples of a kaolinite are shown by Carthew[5] to have similar transformation temperatures, which again indicates that crystallinity and not particle size causes the variation in transformation temperature. In the grinding of a sample, internal disruptions as well as a decrease in particle size may occur. Since clay minerals have only one cleavage, which is a perfect basal type, it is easy for disruptions to occur along these planes during grinding so that a decrease in particle size is accompanied by a reduction in crystallinity.

Experimental evidence is required to show that similar transformation temperatures may result from different fractions of a sample obtained by grinding. In order to investigate this, a piece of high-purity calcite ($CaCO_3$, 98·5 per cent) was chosen because it was considered that with repeated gentle tapping and sizing the mineral would break along the three perfect cleavages with a minimum of internal crystal disruption. The following intermittent series of fractions were collected: $-35+48$ mesh, $-65+100$ mesh, $-150+200$ mesh, $-270+400$ mesh (Tyler sieve size), $-26+18\mu$, $-6{\cdot}5+4{\cdot}6\mu$, $-3{\cdot}2+2{\cdot}3\mu$ and $-1{\cdot}6+1{\cdot}16\mu$ (equivalent spherical diameter). A 0·2-g portion of each fraction was diluted and intimately mixed with calcined alumina in order to fill completely the sample chamber. Care was taken with the packing of the sample and position of the thermocouples so as to fix all the variables in the differential thermal apparatus, which was briefly described by Warne and Bayliss[6]. The differential thermal curves obtained with a heating rate of 15° C per min in a carbon dioxide atmosphere are identical. In addition, more curves of similar peak height and position were obtained for undiluted fractions which completely filled the chamber by the use of a slower heating rate.

These experimental data on ground material together with those of Carthew[5] on fractionated material casts considerable doubts on the validity of a connexion between particle size and transformation temperature. Therefore, it is suggested that correlation between particle size and transformation temperatures by other workers is caused only by the lower degree of crystallinity in smaller particles. Although the mechanism proposed by Bramao *et al.*[7] for lower transformation temperatures with smaller particles appears feasible, it can be neither proved nor disproved by chemical kinetics. However, a decrease in transformation temperature with crystallinity is acceptable, since less energy is needed to destroy structures of lower crystal perfection.

Particle size is quoted as a controllable variable by Bayliss and Warne[8], since this procedure indirectly controls crystallinity.

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Transformation of Allophane to Kaolinite under Low-grade Hydrothermal Conditions

RECENTLY, investigations were performed on soil allophane, which was obtained in the vicinity of Utsunomiya in the north part of Kanto District of Japan and purified from the alteration substance ejected from the central cone of the Upper Quaternary Akagi Volcano—the unaltered rock-forming minerals being eliminated by cribration and elutriation.

The sample was subjected for 520 h to a temperature of 200° C, corresponding to the pressure of 17 atm. in a Morey type 10-c.c. capacity microbomb. The water in the bomb showed before and after the test a *p*H value of 5·1 and 6·2, respectively.