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A sanidine from Ordovician bentonite beds.

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During an investigation of the Ordovician bentonite beds at Kinnekulle, Sweden (Byström, 1954), there was isolated among the phenocrysts an unweathered glassy sanidine. It was considered to be of such interest to find an absolutely fresh sanidine in these old layers that the mineral was isolated and subjected to a more detailed study, which gave the following results:

Chemical data (Composition by weight):

$$K_2O = 12{\cdot}5\%,\quad KAlSi_3O_8\ 75{\cdot}2\%$$
$$Na_2O = 2{\cdot}90\%,\quad NaAlSi_3O_8\ 24{\cdot}8\%$$

Specific gravity: 2·57.

Optical data:

$$n_\alpha = 1{\cdot}519,\ n_\beta = 1{\cdot}523\ (\text{calc.}),\ n_\gamma = 1{\cdot}524;$$
$$2V_\alpha = \sim 15°;\ \alpha \wedge a = 3°;\ \beta = b\,.$$

A powder photograph taken with monochromatized copper radiation gave:

$$a = 8{\cdot}48 \pm 0{\cdot}02,\ b = 12{\cdot}97 \pm 0{\cdot}05,\ c = 7{\cdot}16 \pm 0{\cdot}02\ \text{kX.};$$
$$\beta = 116{\cdot}1°.$$

Weissenberg photographs of the $h0l$ and $0kl$ zones were also taken, and the intensities were compared with those found by Cole, Sörum & Kennard (1949) for a sanidinized orthoclase. As far as could be judged from the visually estimated intensities there were no remarkable discrepancies. There was no sign of perthitization in the crystals.

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Aging of crushed silicon and germanium crystals.

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Studies of the disorientated surface layer on abraded crystals show that when different crystals are subjected to the same treatment, both the depth (Gay, Hirsch & Kellar, 1952) and the time of formation (D'Eustachio & Brody, 1945) of the disorientated layer have a considerable range of values, depending on the crystalline material used. To make a start on the general problem of correlation of the depth, degree of disorientation and speed of formation of the layer, with physical crystal properties, a study of the substances isomorphous with diamond appears promising. Silicon and germanium have been investigated for the occurrence of time-dependent changes in the X-ray diagrams of freshly crushed crystals. Germanium does not show these changes, but silicon does.

As described in the earlier paper (D'Eustachio & Brody, 1945), aging changes occur in the powder diagram of a coarse powder during the first hour or so after crushing as follows: new spots appear which are at first strong and not well resolved; later they become weaker and sharper; sometimes, if the combination of intensity and exposure time is fortunate, they disappear.

The method of preparation of materials was to crush several single crystals in a mortar, sift the coarse powder in a sieve, selecting a sample of the size wanted, and mounting it in the camera by means of a suitable adhesive. Powders of satisfactory coarseness were obtained from that fraction of the grind which passed through a 270 mesh screen but not through a 375, during one minute of vigorous shaking. Electron-microscope pictures showed that a large number of smaller particles failed to fall through the smaller mesh, but this inefficient method of screening was retained because of its speed. Four-minute exposures were taken, at intervals ranging from two minutes after the crushing was started, to several days. Preliminary runs were made with a back-reflection focusing camera. In order to follow the history of individual spots, a defocusing arrangement was preferred.

This arrangement is a forward transmission picture. The sample-to-film distance was 3 cm.; unfiltered copper radiation was used; a flat film holder, divided into 60° sectors, was rotated in a counterclockwise direction, as viewed from the sample, between exposures. In Fig. 1(*a*) is shown a typical run on germanium. In the overall view, the first picture shows good register with the rest. Most of the spots are present on all exposures. Fig. 1(*b*), which is an enlargement of the area enclosed in a rectangle, shows a group of spots which are typical of germanium. Three of the four are about constant in intensity and resolution, even after 23 hr. This is the predominant feature of germanium runs. Also common in the germanium runs are spots like the encircled group, enlarged in Fig. 1(*c*), showing streaks, which may be radial or tangential, and which show some recovery. In Fig. 1(*d*) is shown a rarity in the germanium runs: the appearance and subsequent sharpening and weakening of a spot not initially present. There are two such in the figure: one in the upper right corner and one at the middle of the left side.

The results for silicon are more typical of the aging changes found in quartz and calcite. In Fig. 2(*a*) is shown the first, second and last of a run consisting of five exposures. The history of several sets of spots is shown in the enlargement in the next figure. Unlike the germanium pictures, here the first exposure shows poor register compared to subsequent ones. Very many spots appear in later exposures which cannot be found on the first (Fig. 2(*c*, *d*, *e*)). Many of these get sharper and weaker

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with time and some disappear. Two in Fig. 2(*b*) disappear; the two small spots in Fig. 2(*c*) get very weak, as does the one on the left in Fig. 2(*e*). The large blob in Fig. 2(*d*) and the one in Fig. 2(*e*) both separate into two spots; in one case the lower and in the other the uppermost nearly disappears. The prevalence of this type of change in silicon and its absence in germanium is surprising.

These aging changes have been variously attributed to recovery from plastic deformation and to recrystallization. The resemblance to polyganization has been noted. No satisfactory explanation of the changes, if indeed they are not artifacts, has been proposed. Attempts to find some evidence of recrystallization by following the aging of crushed quartz, silicon and rocksalt under direct observation and photography in an electron microscope have so far had negative results. A slight anisotropic

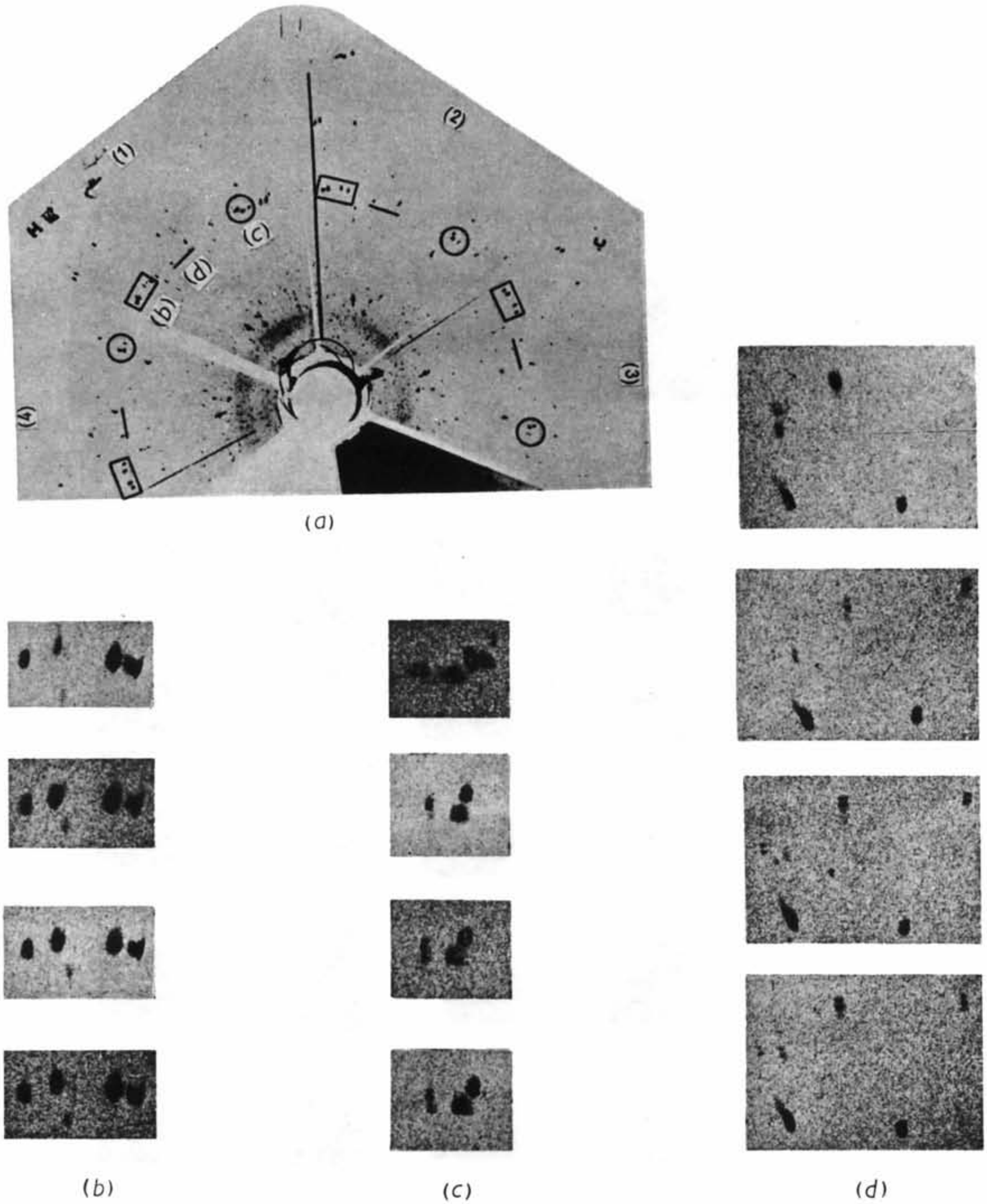

Fig. 1. (*a*) Germanium. (*b*)–(*d*) Enlargement of detail of (*a*).
Age at start of exposure: (1) 4 min. (2) $14\frac{1}{2}$ min. (3) 60 min. (4) 23 hr.

swelling noted for one quartz particle was measured and found to be approximately proportional to time; it is possible that this was a real change since in the same time a small projection on the particle changed its orientation with respect to the main body of the crystal by about 1°, but one cannot tell whether the small crystal is attached to the large one. No other change was observed.

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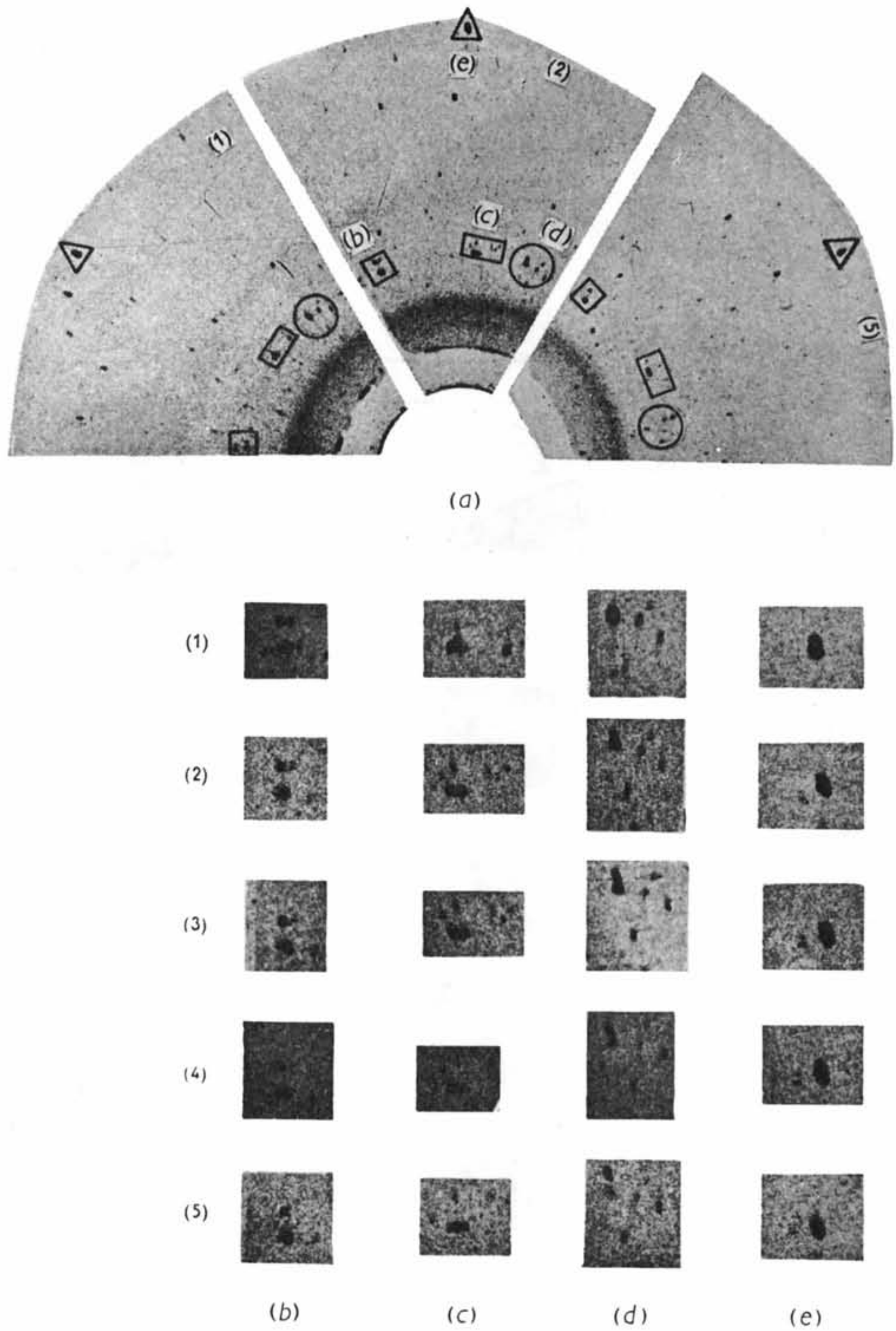

Fig. 2. (*a*) Silicon. First, second and fifth exposure of run. (*b*)–(*e*) Enlargement of detail of (*a*). Age at start of exposure: (1) 2 min. (2) 7 min. (3) 24 min. (4) 36 min. (5) 80 min.