of Ontario almost contemporary with the Blind River conglomerates, heavy mineral assemblages completely of modern aspect are widely developed, indicating that the mineralogy of the blanket ores cannot be explained in terms of abnormal atmospheric conditions. The latest work on the Serra de Jacobina ore-body shows clearly that this deposit is not alluvial, and that the mineralization was probably emplaced hydrothermally³. The recently discovered Russian deposits of blanket-type gold-uranium ores⁴, the locality of which has not yet been revealed, exhibit both sulphidic (pyrite-uraninite) and oxidic (magnetite-brannerite) phases in the same conglomeratic ore-body, demonstrating beyond a shadow of doubt that the mineral assemblages are of hydrothermal origin.

The orthodox geological conceptions on the history of the atmosphere have recently been reviewed by A. P. Vinogradov⁵ in his Vernadsky Memorial Lecture, in which he concludes that the primæval atmosphere of methane, hydrogen and carbon dioxide (akin to the gases of meteorites and of terrestrial rocks of mantle origin such as kimberlites, carbonatites and dunites) lasted only a relatively short time. Probably it was lost in the 1,000 million years of the Earth's history before the earliest known rocks came into being. A. A. Polkanov⁶ has lately observed that even for these earliest Katarchacan rocks of 3,500 million years ago, Lyell's principle of actualism may not, and should not, be rejected.

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¹ Bernal, J. D., *Nature*, **196**, 850 (1961).

² Davidson, C. F., *Econ. Geol.*, **52**, 668 (1957); **53**, 887, 1048 (1958); **54**, 1316 (1959); *Mining Mag.*, **88**, 72 (1953); **100**, 92 (1959); **102**, 84 (1960).

³ White, M. G., *Geological Survey Research 1961*, B, 8 (U.S. Geol. Surv., Washington, D.C., 1961).

⁴ Shkvorov, V. A., and Kovaleva, K. V., *Voprosy Rudnoi Geofiziki*, 68 (Gosgeoltekhizdat, Moscow, 1961).

⁵ Vinogradov, A. P., *Khimicheskaya Evolyutsiya Zemli* (Akad. Nauk, Moscow, 1960).

⁶ Polkanov, A. A., *Voprosy Geokhronologii i Geologii* (Akad. Nauk, Moscow, 1961).

THE origin of early Precambrian gold-uranium ore deposits has indeed been a controversial issue. But, as I stated explicitly in my book, I have become convinced that the features acquired by hydrothermal processes are due to younger alterations. These deposits are placers originally. The hydrothermal alterations have been important in enriching the original placers. They may even be at the origin of the money value of a given deposit, and consequently seen as the most important process by an economic geologist.

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CRYSTALLOGRAPHY

Commination of Crystal Nucleation by a Precipitation Method

THERE are two ways to precipitate sediments of slightly soluble salts, namely, by simple mixing of the reagents or by the homogeneous method, that is, by developing the reagent *in situ* and thus precipitating the insoluble salt homogeneously in the whole bulk of the solution. In both cases no special care is taken with regard to nucleation and the parameter of time.

The formation of a sediment of an insoluble salt comprises two basic processes, the character of which is quite different: a chemical process involving the formation of a new compound of the ions existing in or introduced into the solution, and a physical process of solid phase formation. Different kinds of this general scheme, comprising extreme and intermediate cases, are being examined. The

ionic process of chemical compound formation proceeds very fast. The physical process is rather slow and thus—depending on existing conditions—the solid phase is obtained as an amorphous body, that is, of poorly ordered crystal lattice or in the crystalline, well-ordered state.

The principle of the new technique which I have developed is to perform the chemical reaction as slowly as is necessary to obtain a well-ordered solid phase, that is, a crystalline form of the sediment. Under such conditions many now features, unknown until now, have been observed¹⁻³.

Now further work has revealed that:

(1) Crystallization proceeds on nuclei of symmetric shape and a mass of only 10^{-15} g or smaller.

(2) A great, but limited, number of crystallite shapes are obtained. The shape depends on the nucleus acting as a centre of crystallization.

(3) The different shapes are obtained simultaneously, which shows that just the specific properties of the nuclei are responsible for the shape and not the properties of the medium, for example, the concentration, surface tension, pH, etc. (Fig. 1).

Fig. 1. $\times 400$

(4) While introducing small quantities of foreign ions (the basic precipitate being barium chromate) crystallites of quite different shape are obtained. Because of the lack of separating methods it could not be established until now whether they were other compounds or other crystalline forms.

(5) A fractional precipitation performed with the aid of the new method removes the existing nuclei. On further precipitation the number of crystallite forms diminishes.

(6) In spite of their very delicate structure the crystallites are very stable. It has been stated that sediments do not change while in contact with the mother liquor for a period of even four years, showing that the solid phase has been formed under conditions enabling the building of an ideal crystal lattice, that is, a lattice of lowest energy.

(7) Observations have shown that nuclei formation proceeds possibly on amorphous matter of indefinite composition (hydroxides?, silica?).

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¹ Adamski, T., and Rykowski, S., *Nucl. Res. Inst., Warsaw, Rep. No. 91*, 4 (1961).

² Adamski, T., *Nature*, **190**, 524 (1961).

³ Adamski, T., and Przytycka, R., *Nucl. Res. Inst. Warsaw, Rep. No. 266*, 4 (1961).