Mines Branch Information Circular IC 175

BIBLIOGRAPHY OF HIGH-TEMPERATURE CONDENSED STATES RESEARCH PUBLISHED IN CANADA, APRIL - SEPTEMBER 1965

by

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SYNOPSIS

This report contains bibliographic information concerning research work on high-temperature condensed states published in Canadian journals from April 1 to September 30, 1965.

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Circulaire d'information IC 175

BIBLIOGRAPHIE DES RECHERCHES EFFECTUÉES DANS LE DOMAINE DES ÉTATS CONDENSÉS AUX TEMPÉRATURES ÉLEVÉES, AU CANADA, D'AVRIL À SEPTEMBRE 1965

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RÉSUMÉ

Le présent rapport contient des renseignements bibliographiques sur les recherches effectuées sur les états condensés aux températures élevées, publiées dans les revues scientifiques canadiennes au cours de la période d'avril 1 à septembre 30, 1965.

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INTRODUCTION

This report is a further contribution to the series of bibliographic bulletins of information on high-temperature condensed-states research that have been published as Mines Branch Information Circulars since March 1960, on behalf of the Sub-Commission on Condensed States of the Commission on High Temperatures and Refractories of the International Union of Pure and Applied Chemistry. Hitherto the successive reports have covered quarterly periods; however, owing to the absence of the author in Paris last June and July attending the meetings of the International Union of Pure and Applied Chemistry, the present document covers a six-month period, namely from April 1, 1965 to September 30, 1965, and gives details of work published in Canadian scientific and technical journals during that period. It is the intention to resume quarterly publication of subsequent issues of these bibliographies.

At the above-mentioned meetings in Paris, several decisions were taken that will be of interest to the recipients of these bibliographies. Hitherto, the Commission on High Temperatures and Refractories, consisting of two Sub-Commissions, viz., one for Condensed States and one for Gaseous States, has been a part of the operation of the Inorganic Chemistry Division of the Union. Each Sub-Commission has issued regular bibliographies appropriate to its own interests. That for the Gaseous States Sub-Commission has been prepared entirely by

Professor Leo Brewer of the University of California and published by the National Bureau of Standards, Washington, on behalf of IUPAC. Insofar as the Condensed States Sub-Commission is concerned, national contributions, of which this report series is one, have been prepared for a considerable group of countries. These have been consolidated and issued by Dr. J. J. Diamond of NBS for the Western hemisphere and by Dr. Marc Föex of the Centre Nationale de la Recherche Scientifique of France for the European area. It was felt at Paris that the interests of the Gaseous States Sub-Commission, being related to high-temperature gas kinetics and to the chemistry of plasma phenomena, were more appropriate to the activities of the Physical Chemistry Division of the Union. The suggestion was therefore made that this Sub-Commission secede from the Inorganic Chemistry Division and, with the approval of the Council of the Union, become a Commission in its own right attached to the Physical Chemistry Division. The Condensed States Sub-Commission would then also become a Commission in its own right but still attached to the Inorganic Chemistry Division.

The publication of the Bibliographies would continue as heretofore. That for the Gaseous State would be expanded to include all relevant work on plasma phenomena, while that for the Condensed State would be expanded to cover relevant high-temperature work on the liquid state e.g., work on fused salts or on slag-metal equilibria, etc., where the work is conducted within the temperature limits hitherto adopted as being representative of "high temperature". There may be slight changes in the names of these two new Commissions but their functions in the preparation of these bibliographies and in sponsoring relevant symposia will continue as up to the present.

Any further information concerning these bibliographies, or any of the other IUPAC activities, can be obtained from the compiler of this report at this address:

Dr. Norman F.H. Bright,
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Anyone not now receiving these reports who wishes to do so, anyone who would like to receive the analagous documents referring to the gaseous state and to plasma phenomena, and anyone who currently receives these bibliographies but to whom they are no longer of interest, is requested to advise the compiler accordingly so that the appropriate changes may be made in the relevant mailing lists.

The compiler would very much appreciate being advised of any work published in Canadian journals, and lying within the scope of these bibliographies, that has escaped his notice, in order that such work may be mentioned in a subsequent issue of these Information Circulars.

BIBLIOGRAPHY OF WORK ON HIGH-TEMPERATURE CONDENSED STATES PUBLISHED IN CANADA, APRIL - SEPTEMBER 1965

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Commission on High Temperatures and Refractories
Sub-Commission on Condensed States

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for Canada

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NFHB:vn

*THE OCCURRENCE OF TELLURIDE MINERALS AT THE ACUPAN GOLD MINE, MOUNTAIN PROVINCE, PHILIPPINES**

Sir: The paper by Callow and Worley (v. 60, No. 2, p. 251–268) is an interesting account of the gold-bearing veins of the Acupan gold mine, Philippine Islands. My comments concern the statements made on p. 267 on temperatures of formation. The authors make several temperature estimates but give no detail for such estimates. They provide little basis for these estimates except for the reference to Edwards' "Textures of the Ore Minerals

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and their significance" (9). Without denying the usefulness of this textbook, much of the mineral stability data in it is considerably out of date. I will try to modify some of the temperature estimates by citing more recent findings and clarifying some misleading statements in Edwards' text.

1. The authors state that, in one instance, the former presence of pyrrhotite within pyrite indicates a formation temperature of about 600° C. This is completely without foundation (1, 11, 17). Furthermore, they state that the marcasite present has "completely" replaced early pyrrhotite. How can they tell that pyrrhotite was there at all?

2. The authors also state that, in other veins, the "absence" of pyrrhotite, coupled with the presence of sphalerite containing exsolved chalcopyrite, indicates that the initial deposition temperature was below 600° C but above 350–400° C. There is no justification for giving the upper limit, as chalcopyrite can exist in solid solution in sphalerite at least up to 666° C (16). The lower limit represents the exsolution temperature quoted by Edwards (9, p. 98) who, in turn, quoted Buerger (4). Since this work was done in 1934, this minimum exsolution temperature should possibly be treated with caution.

3. The erroneous idea that anisotropic calaverite is the low-temperature form deposited below 184° C is derived from Edwards (9, p. 154) who had quoted Borchert (3). Borchert's conclusions were based on observing the disappearance of lamellae in "calaverite" when heated to 184° C. He was of the opinion that high-temperature calaverite "Original-α-Calaverit" had in all cases converted to the low-temperature form "Primärer-β-Calaverit" which he equated with krennerite. Thus if Callow and Worley have the "low-temperature" form, according to Borchert, they have krennerite! However, both calaverite and krennerite are anisotropic and it has been clearly demonstrated that Borchert was wrong in his conclusions (19, 18). Such lamellae as Borchert described have not been found in calaverite by other workers, but I have recently found them in krennerite. This, together with other experimental work on the stability fields of calaverite and krennerite, is reported elsewhere (5, 6).

4. Another error coming from Edwards (p. 155) refers to the "anomalous" anisotropism of hessite indicating that it formed above 149° C. Edwards had quoted Stillwell (15), who, however, never called it "anomalously" anisotropic but had referred to it as an anisotropic mineral with intermittent and confused lamellar twinning. Stillwell referred to Borchert (2) who had reported that the anisotropism of hessite disappeared when heated to 150° C. Hessite cannot be "anomalously" anisotropic because the room-temperature polymorph is not isotropic. Synthetic hessite was determined to be orthorhombic (14) and, more recently, natural hessite was determined to be monoclinic (10). Frueh suggested that the synthetic hessite, which had been synthesized above the hessite (low) $\rightleftharpoons$ hessite (intermediate) transition, may have been twinned resulting in additional symmetry and an apparently larger cell. The confused lamellar twinning commonly observed in hessite may be due to this transition, which was more recently reported by Kracek and Rowland (12) to be 145° C

in the Ag-Te system. However, phase relations are far more complicated in the gold-silver tellurides (5, 7, 13).

5. The best indication for a maximum temperature of formation at the Acupan gold mine may be the reported association of arsenopyrite and pyrite. This would indicate that either or both minerals formed below $491 \pm 12°$ C (8).

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