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GEOLOGIC NOTES

An Occurrence of Bournonite ($2PbS.Cu_2S.Sb_2S_3$) in Perak, West Malaysia

K.F.G. Hosking and E.B. Yeap, Department of Geology, University of Malaya, Kuala Lumpur, Malaysia.

During a visit to the Bidor (Perak) dredging property of Associated Mines Sdn. Bhd., in November, 1972, one of us obtained a sample that, to the naked eye, consisted essentially of angular grains of galena that, due to abrasion, had matt rather bright surfaces. This galena had been collected by the Mill Superintendent during the further beneficiation of the stanniferous placer concentrate from the dredge. The size and physical character of the galena grains suggested that they had migrated little or no distance from their primary source and that they might even have been removed from the primary source by the dredge buckets.

Examination of a polished briquetted protion of the sample under the microscope in reflected light, confirmed that the overwhelming majority of the grains were, indeed, galena, albeit often with some most interesting inclusions of pyrite and other species. A few grains of pyrite also occurred, together with one grain that one of us tentatively identified as bournonite bordered by a rim of alteration products. This identification was subsequently confirmed by more precise examination under the microscope and the mineralogic character of the rim was resolved.

Subsequently a further six portions of the original sample were briquetted, polished, and examined under the microscope, but no further grains of bournonite were found.

Description of the bournonite grain

The bournonite grain under review is T-shaped, but the vertical piece is c. 3 times as thick as the horizontal one and about half its length: to be more precise, the lengths in question are 2.1 mm and 1.3 mm respectively.

The optical properties of the core of the grain agree very well with those of bournonite as described by Uytenbogaardt and Burke (1971,

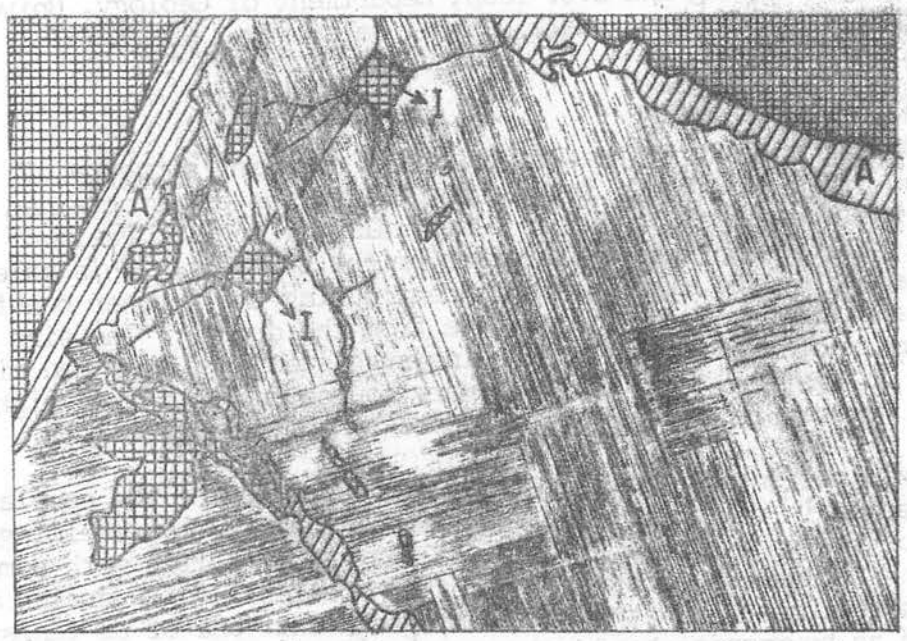

Fig. 1. Part of the bournonite grain, drawn from a photomicrograph, showing diagramatically the parquet twins and the alteration zone (A).

pp. 68-69) and by Ramdohr (1969, pp. 725-729). However, the first indication that the grain was bournonite beyond reasonable doubt, was the fact that between crossed polars it displayed a beautiful parquet texture due to polysynthetic twinning. Figure 1 is an attempt to portray this difficult subject which, as Ramdohr (op. cit., p.726) observes " is the most noticeable characteristic of bournonite": however, for those to whom Ramdohr's work is available, a far better idea of this beautiful texture may be obtained by looking at his figure 467 (p.727).

In green light (546 mm) and using Reflectance Standard tungsten carbide (47 42 53) which, at the wave-length in question, has a reflectance of 45.9%, the core of the grain provided the following reflectance values:- 34.2, 34.3, 34.2, 34.9, 35.5, 35.1, 35.2, 34.8, 35.9 and 36.2. These figures agree reasonably well with the range from 34.6-35.2 to 35.9-39.4 given by Uytenbogaardt and Burke (op. cit., p. 68) and with those of McLeod and Chamberlain (1968) who, in their table, indicate that the reflectivity of the species in question ranges from c.35 to over 38%. It is, however, relevant to note that some, at least, of the values recorded by the last-mentioned workers were obtained in white light.

Measurements of the micro-hardness, under a load of 100 g., provided the following VHN results:- 133, 137, 139, 140, 142, 147, 156, 165, 170, 184. In part the variation may have been due to the presence of a number of minute cracks in the specimen. For the species in question Uytenbogaardt and Burke (op. cit., p.69) provide the following values:- 132-2-3. However, these values were obtained when loads of 20 to 50 g. were used.

McLeod and Chamberlain (op. cit.) indicate that the VHN of the mineral may range from 167 to 210.

During determination of the micro-hardness it was noticed that radial fractures invariably developed around the indentations: these, as will be seen from examination of fig. 1, tend to develop from the corners rather than from the sides of the identification and so, according to the classification of Young and Millman (1963-64) should be termed star radial fractures rather than side radial ones. It is, however, interesting to note that Young and Millman figure an indentation on the (010) surface of bournonite that has side radial fractures associated with it (op. cit., Plate 1, fig. 8, oppo. p. 458). The difference between the writers' fracture pattern and that of Young and Millman doubtless stems from the fact that the latter were working on the (010) surface whilst the former were investigating one which was about parallel to the (001)

The altered rim

The altered rim of the grain, which varies in width from c. 10 to c. 100 microns, consists of three reasonably well-defined zones, each of which can be distinguished by its mineralogical composition and/or textural character.

The outer zone consists essentially of chalcopyrite. The middle one is finely mottled and composed of galena and what is almost certainly tetrahedrite, but the identification cannot be confirmed by reflectance and micro-hardness measurements as the individual component masses are too small. The innermost zone is made up of numerous irregularly shaped voids of widely varying size which are partly margined by an inner zone of chalcopyrite and an outer one of tetrahedrite (?): the matrix of this zone is bournonite.

The mineralogical character of the rim is, doubtless, in part due to the degradation of bournonite (Pb, Cu, Sb) to tetrahedrite (Cu.Sb) and galena (Pb). The genesis of the chalcopyrite is somewhat more problematical. Although bournonite may contain a little iron it would probably not be enough to account for that occurring in the chalcopyrite. It is likely that iron introduced from an external source reacted with bournonite, or one of its breakdown products, to produce the mineral under discussion. Possibly this source of iron was a mineral, say pyrite, that occupied the voids in the rim: however, the shapes of the voids are such that they provide no evidence for this. The replacement of either bournonite or its degradation products leads to a further unsolved problem. What happened to the released lead and antimony?

Whilst the writers believe that this is the first record of bournonite from West Malaysia (and from the entire Tin Belt of South-east Asia) other antimony-bearing species have been recorded. A number of these species has been found in areas not far removed from Bidor. It is of further interest to note that in West Malaysia, whilst a number of occurrences are known to the west of the Main Range, to the east of it antimony species have only been recorded from the Sg. Merbau area (stibnite) and the Raub gold mines (stibnite). One of us has, however, tentatively identified "boulangerite" in ore from the Pahang Consolidated Mine at Sungei Lembing.

Finally, the following table provides data regarding the occurrence of other antimony species in West Malaysia that have been established during the past five years by the Department of Geology, University of Malaya: to date, data concerning only some of these have been published.

Mineral	Locality
Stibnite Sb_2S_3	Bidor, Perak
Kobellite(?) $5PbS.4(Bi,Sb)_2S_3$	Tekka, Perak
Jamesonite $4PbS.FeS.Sb_2S_3$	Sin Nam Lee Pipe, Ampang, Perak
Tetrahedrite(?) $3Cu_2S.Sb_2S_3$	Sin Nam Lee Pipe, Ampang, Perak
Boulangerite $5PbS.2Sb_2S_3$	Sungei Lembing, Pahang

REFERENCES

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RAMDOHR, P., 1969. The ore minerals and their intergrowths. Pergamon Press, Oxford.

UYTENBOGAARDT, W. and BURKE, E.A.J., 1971. Tables for the microscopic identification of ore minerals. 2nd edn., Elsevier Pub. Co., N. York.

YOUNG, B.B. and MILLMAN, A.P., 1963-64. Microhardness and deformation characteristics of ore minerals. Trans. Instn. Min. Metall., 73, 437-466.

NEWS OF THE SOCIETY

Tentative Schedule of GSM Meeting, 1973

The following is a tentative schedule for the 1973 GSM meetings drawn up by Dr. S.H. Chan, the chairman of the GSM sub-committee for organising lectures/discussion sessions for 1973. The dates and venues have to be confirmed later and separate notices would be sent informing members of these meetings as soon as details are finalised.

July 6th 1973.	Aspects of Australian geology by L. R. Beddoes, Venue:- Dept. of Geology, University of Malaya, Kuala Lumpur.
August 4th 1973.	Seminar on Exploration and Evaluation. A number of speakers from the Mining industry will be invited. Venue:- Dept. of Geology, Universiti Kebangsaan, Kuala Lumpur.
September 7th 1973	Island Arcs by R.W. Murphy. Venue:- Dept. of Geology, University of Malaya, Kuala Lumpur.
December 1973 (1st or 2nd week)	Joint Discussion Meeting of the GSM and the Geological Survey of Malaysia. Venue:- Geological Survey, Ipoh.
	Papers for presentation at this meeting are being solicited. Those wishing to present papers are requested to write to the Secretary, Geological Society of Malaysia, c/o Dept. of Geology, University of Malaya. The papers could be on any aspects of the Geology of Southeast Asia (including Malaysia) or on related and relevant topics.
February 1974	Annual General Meeting. Venue:- Dept. of Geology, University of Malaya. It is likely that the AGM, like in previous years would be preceeded by a discussion meeting.

In addition, a field meeting in South Johore is being planned, possibly a joint meeting with the newly formed Southeast Asia Petroleum Exploration Society based in Singapore. The GSM Field Trip Chairman for 1973 is Dr. P.H. Stauffer.

Any other ideas and suggestions for meetings are welcome.

Proceedings, Regional Conference on the Geology of Southeast Asia (Collection of Papers) Edited by B.K. Tan. Bulletin 6 332 pages.

This Bulletin, its contents given below, is expected to be available in July 1973. All participants at the conference will receive a free copy. Members of the Society can purchase this Bulletin at a reduced rate. An order form is enclosed together with this Newsletter.

Contents

" Geology of the Malay Peninsula" appears

The Wiley-Interscience book on the "Geology of the Malaya Peninsula (West Malaysia and Singapore)", sponsored by the Geological Society of Malaysia, has finally been published earlier this year. One writes ' finally' not as a criticism, but in recognition of the amount of time and work that have gone into it. The idea for such a book was first proposed to the Society, at its very inception in 1966/67, by Derek J. Gobbett, long-time Hon. Sec. of the Society. Gobbett and Charles S. Hutchison were appointed by Council to edit the volume (along with S.K. Chung, who later had to withdraw due to pressure of work), and they obtained contributions of chapters from C.K. Burton, D.J. Gobbett, K.F.G. Hosking, C.S. Hutchison, C.R. Jones, P.H. Stauffer, and H.D. Tjia (as well as S.K. Chung and B.N. Koopmans who agreed to contribute but were unable to continue). Gobbett and Hutchison coordinated, edited, and put together the various contributions into a coherent book, a task of considerable magnitude and extending over a number of years.

The book, which is a volume in the Regional Geology Series edited by L.U.de Sitter, totals 438 pages, with about 200 illustrations, and is attractively printed in a large format. A coloured geological map of the Malay Peninsula at scale 1:1000000, compiled by Gobbett, comes with the book (This map is also available separately from the Society). The one unhappy note is the price of the volume: US $45.00 Even in this day of rising book prices, that figure comes as a bit of a shock! Nonetheless, this volume is the first comprehensive summary of the area's geology since the classic but now very outdated Geology of Malaya by J.B. Scrivenor, 1931, and is indispensible for anyone interested in the geology of the Malay Peninsula. For members of the Society wishing to purchase a personal copy, a limited number of copies will be available from the Hon. Sec. at 10% discount from the official price.

P. H. Stauffer

FINANCIAL NOTE: - Although the book is priced at US $ 45.00, it seems likely that the Society would not gain financially from this publication. Over the past years, the Society has been making a number of payments for typing, postage and other miscellaneous items. Under an arrangement made by the previous council, royalties resulting from the sales of this book would be shared between the Society, the editors of the book and the authors of the individual chapters.

The editors and authors would alsc be receiving a number of free copies of this book. The Society has received one free copy of this book which has been added to its Library.

EDITOR'S NOTE : Comments from members regarding this book are welcome for publication in future Newsletters.

GSM Loan Fund

Since the establishment of this fund in January 1973 (Geol. Soc. Malaysia Newsletter, 40, p.12) loan amounting to $ 4,450 has been approved by council for nineteen students. These students are all in their Honours Year Geology course, either at the University of Malaya or Universiti Kebangsaan. The loans granted vary in each case depending on the students' financial standing and on his field area. The maximum loan for any student is $300/-.

Membership

During the past year, there has been an increase in the number of resignations from members who have been transferred overseas. While the Council appreciates the position of such members, it would like to appeal to them to support the society by continuing their membership even though they may not return to the Southeast Asia region in the near future. The Council feels that many of these members would still find it beneficial to continue their membership even though they cannot attend meetings, seminars or conferences organised by the Society as the Society's publication and other circulars would help them to keep up with new developments and activities in this part of the world.

New Members: -

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1. S. Balakrishnan
Inter-Consult
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MALAYSIA

2. Chong Nai Hooi
Associated Mines Sdn.Bhd.
P.O.Box 2125
Kuala Lumpur
MALAYSIA

3. Kendall W. Sageser
United States Steel Int. (NY) Inc.
19 Parklane, Goodwood Park Hotel,
SINGAPORE

4. Kuo Say Lee
Department of Geology
University of Alberta
Edmonton 7, Alberta
CANADA

5. Paul Riddell
c/o Getty Oil Dev. Co. Ltd.
275 Alfred St. North,
North Sydney, N.S.W. 2060
AUSTRALIA

6. Robert Alexander McTavish
West Australian Petroleum Pty. Ltd.
Box C1580, G.P.O., Perth 6001,
WESTERN AUSTRALIA

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1. Faud/Tuah b. Wan Hassan
Wisma Selangor,
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University of Malaya
Kuala Lumpur

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University of Malaya
Kuala Lumpur

8. Harpajan Singh
Balai Poils, Pasir Puteh
Ipoh, Perak

9. Ong Guan Bee
1 Jalan 14/38
Petaling Jaya

10. Siti Zauyah bt. Darus
No. 62 Jalan SS2/22
S.E.A. Park
Petaling Jaya

5. Shaharin b. Ibrahim
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Jalan University
Petaling Jaya

6. Leong Pheng San
782 Road 17/29
Petaling Jaya

11. Coi Aun Chye
Department of Geology
University of Malaya
Kuala Lumpur

12. Teoh Seng Keat
No. 8 Jalan 12/16B
Petaling Jaya

Subcriptions

The Treasurer would like to remind those members who have not yet paid their subcriptions for 1973 to do so at the earliest. After 1st March 1973, the dues are:

Full or Associated Member M$ 17.00

Student Member (A) M$ 8.00

Student Member (B)
(who will receive GSM Newsletter and Notices only) M$ 2.00

Your cooperation will be appreciated

EMPLOYMENT OPPORTUNITIES

University of Singapore

Applications are invited for teaching appointments in the Department of Geography. Preference will be given to candidates with a higher degree, and suitable teaching and research experience in one or more of the following areas:

Soil Science

Environmental Management - urban geography

Geology/Marine Geology

Air-Pollution Meteorology - climatology

Oceanography

Cartographic Production

Biogeography

Candidates should write to:

The Registrar
University of Singapore
Singapore 10

giving curriculum vitae (bio-data), with full personal particulars, and also the names and addresses of three referees. Candidates must state their area/s of interest in their applications.

Salary in the range of $1000 - $ 2600 per month depending on qualifications and experience, and the level of appointment offered. An annual allowance of one month's salary is payable according to University's regulations.

Leave, provident fund, medical and other benefits are available.

GEOLOGICAL SOCIETY OF MALAYSIA

Publications: All prices given are in Malaysian dollars and include surface postage.

Newly published: Bulletin 5 (1973) The search for Tungsten Deposits. K. F. G. Hosking 70p. Price $10.00 ($5.00)

GEOLOGICAL MAP OF THE MALAY PENINSULA (1:1000,000, coloured) compiled by D.J. Gobbett March 1972 Price: $4.00 (folded flat; rolled, extra at cost)

ABSTRACTS OF PAPERS: Regional Conference on the Geology of Southeast Asia, Kuala Lumpur, March 20-25, 1972. 64p., 8 figs., tables, many extended abstracts. February 1972. Price: &6.00 ($3.00)

Also available: BULLETIN SERIES 1968 _

Bulletin 1 (1968): 79p.	$ 3.00	($2.00)
Bulletin 2 (1968): 152p.	$10.00	($5.00)
also in hard cover for	$15.00	($7.50)
Bulletin 3 (1970): 164p.	$10.00	($5.00)
Bulletin 4 (1971): 100p.	$10.00	($5.00)

(Prices to GSM members are given in parentheses)

Other publications of the Society include a bi-monthly NEWSLETTER, PRESIDENTAL ADDRESSES (1968-), and some miscellaneous papers, abstracts, and reprints (full list with prices on request).

About the Society: The GSM has a membership of about 300 geologists, mainly in Malaysia and Singapore, but including a scattering of geologists interested in Southeast Asia in many other countries. Annual dues are M$15.00 and there is an entrance fee of M$5.00. The Society's publications are available to members either free or at reduced price in general.

The Society's Editor will gladly consider manuscripts on the geology of Southeast Asia or neighbouring regions, or on related and relevant topics, for publication in the Bulletin Series or as short 'Geologic Notes' in the Newsletter.

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