INTERNATIONAL GEOLOGICAL CORRELATION PROGRAMME

STVDIA GEOLOGICA

(SPECIAL ISSUE)

Mineralization Associated With Acid Magmatism

UNIVERSIDAD DE SALAMANCA

1978

MEETING OF THE WORKING GROUP OF THE PROJECT «MINERALIZATION ASSOCIATED WITH ACID MAGMATISM»

Salamanca (Spain), 26-30 April 1976

SCHEDULE

MONDAY 26

9:30	12:00	Mawam Business Meeting
12:00	14:00	Lunch
14:00	17:00	Business Meeting (Cont.)
	Evening free	

TUESDAY 27

9:30	12:00	Scientific Sessions
12:00	14:00	Lunch
14:00	18:00	Scientific Sessions (Cont.)
	Evening free	

WEDNESDAY 28 FIELD TRIP «A»

8:00		Departure
9:00	11:30	Barruecopardo Mine (W)
11:30	12:00	Trip to Aldeadávila
12:00	13:00	Aldeadávila dam
13:00	13:30	Trip to Villarino
13:30	15:00	Lunch
15:00	16:30	Villarino Hydroelectric Power Plant
16:30	17:00	Trip to Almendra
17:00	17:30	Almendra dam
17:30	18:30	Return to Salamanca

THURSDAY 29

10:00		Departure
11:00	15:00	Special program (Rodasviejas)
15:00		Return to Salamanca
16:30	19:30	Seight-Seeing tour (Old town, Cathedrals, University)
20:00	21:00	Reception Given by the President of the Provincial Deputation (Palacio de la Salina)

FRIDAY 30		FIELD TRIP «B»
10:00		Departure
10:30	12:30	Golpejas Mine (Sn, Nb, Ta)
12:30	13:30	Lunch
13:30		Departure
14:00	16:00	Cubito Mine (Sn)
16:00	17:00	Trip to Morille
17:00	18:30	Morille Mine (W)
18:30		Return to Salamanca
19:00	20:00	Mawam W. G. Final Meeting
21:00	23:00	Farewell Dinner Offered by the Department of Geology and Mineralogy.

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* The number preceding the participant's name shows his place in the group picture (Photograph taken by Prof. P. Evrard).

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DEPARTMENT OF GEOLOGY AND MINERALOGY
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(6) GRACIA, Alfonso

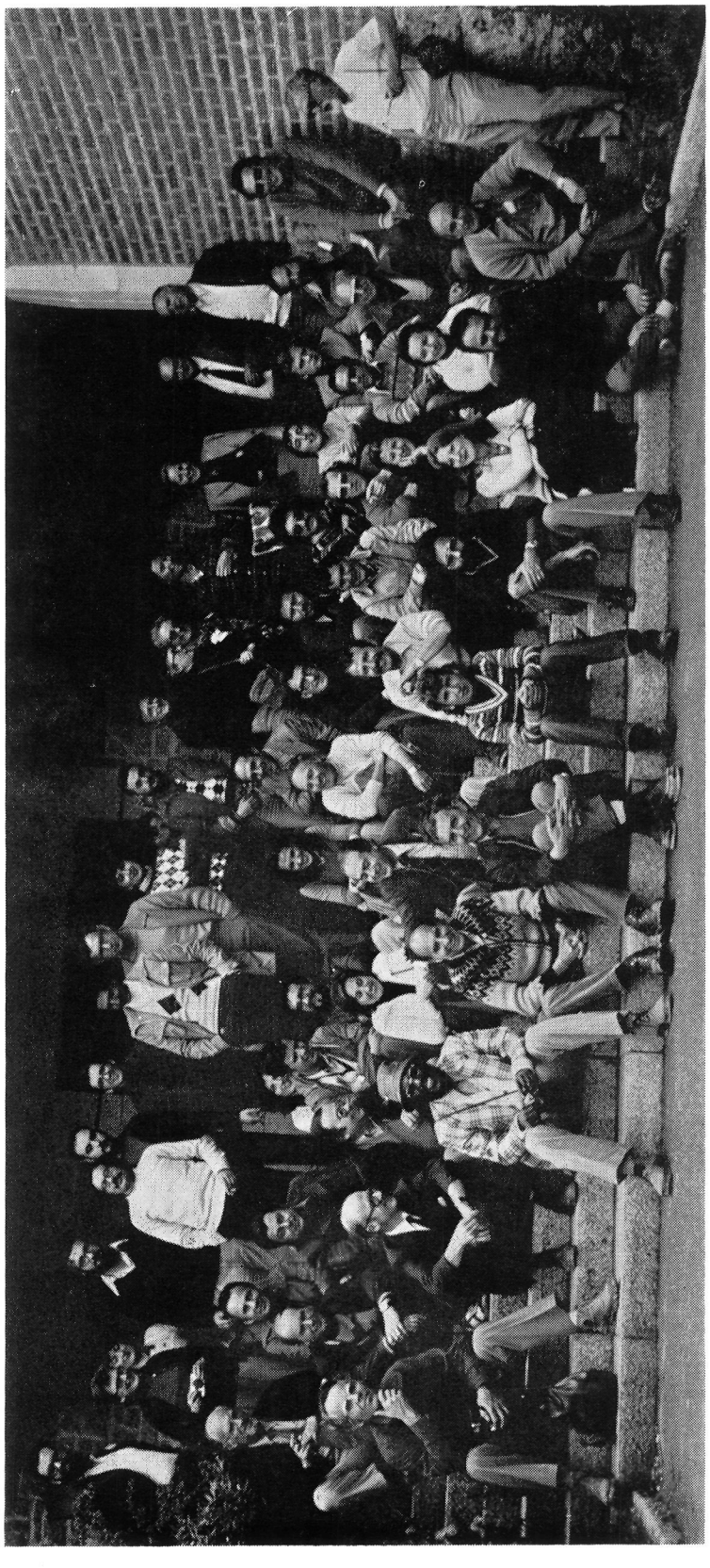
(26) MORO, Candelas

(55) NIEVES, Gloria

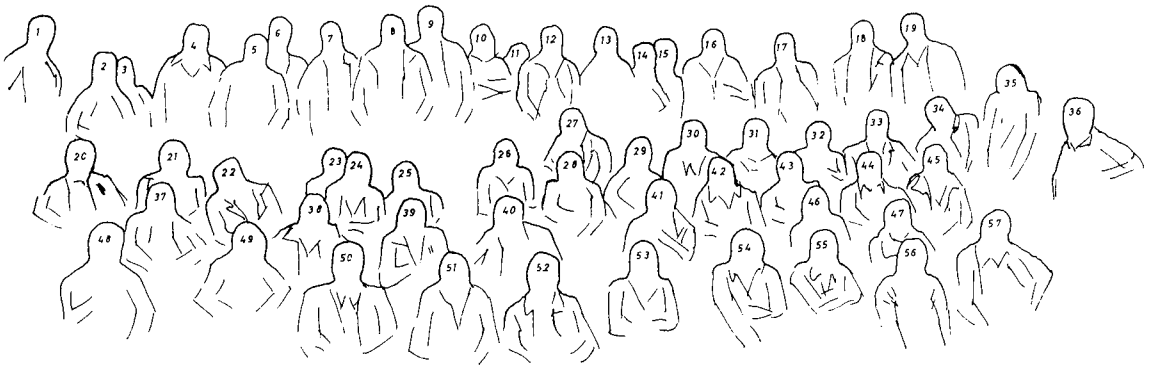
(39) PELLITERO, Pilar

(23) REGUILON, Rosa

(1) SAAVEDRA, Julio



Members of the Working Group and participants at the MAWAM meeting after IBERDUERO'S lunch, Villarino (28-4-76)



SCIENTIFIC MEETING

The second meeting of the IGCP project «Mineralization Associated With Acid Magmatism» was held 26-30 April, 1976, at the University of Salamanca, Spain. It consisted of a business meeting (April 26), a scientific session (April 27), and two field-trips (April 28-30).

Business meeting

It was attended by 10 national representatives of the countries participating in the MAWAM project and devoted to the agenda of the project, future plans of activity, and membership policy. The following members were presents:

Prof. Arribas, Antonio. Spain
Dr. Bowden, Peter. Great Britain
Dr. Burnol, Lucien. France
Prof. Dr. Evrard, Pierre. Belgium
Dr. Haapala, Ilmari. Finland
Dr. Olade, M. A. Nigeria
Dr. Oosteroom, M. C. The Netherlands
Prof. Dr. Pauly, Hans. Denmark
Dr. Stemprok, Miroslav. Czechoslovakia
Prof. Thadeu, Décio. Portugal

Scientific session

The scientific meeting of the Working Group was held at the Department of Geology and Mineralogy. It was attended by the national representatives

of the MAWAM WG and was joined by numerous Spanish mining geologists and students invited to the meeting.

The meeting was held in two half-day sessions. The morning session was chaired by Professor Antonio Arribas with the following programme:

M. Stemprok: Classification criteria of tin and related deposits /convenor's report/.

G. Tischendorf /delivered by P. Bowden/: Criteria of distinguishing normal granites from metallogenetically speciallized ones.

Each report was followed by discussions.

The afternoon session was chaired by Professor P. Evrard with the following lectures:

M. Oosteroom: Ways of treatment of geochemical data in granite investigation related to tin-tungsten mineralization.

P. Bowden: Geochemical aspects of the evolution and mineralization of the Nigerian Mesozoic anorogenic granites.

A. Arribas and J. Saavedra: Introduction to the field trips in the Salamanca area.

The convenor's report of M. STEMPROK summarized the present state of criteria which have been applied to the classification of tin and related deposits associated with acid magmatic rocks. At first M. Stemprok gave the review of earlier views on the classification of deposits based on physicochemical parameters, ore formations, wall rock alteration etc., which gave in total eleven parameters so far employed.

The second part of M. Stemprok's report delt with the latest views on classification delivered for his convenor's report by different geologists. It was the latest information on the types of deposits described from Korea and India by Soo Jin Kim from the College of Natural Sciences of Seul and by N. K. Mukerjee, Banaras Hindu University, Varanasi. The most complete proposal of tin deposits classification was the one by late Professor N. Varlamoff, delivered in printed form. His classification is based on the spatital distribution of mineralisations, i.e., the depth of the formation of deposits as well as the paragenesis of minerals. V. K. Denisenko based his classification of tungsten deposits on ore formations which have been grouped into plutonic, plutono-volcanic and sedimentary-metamorphic ones. Another suggestion of classification was given by D. V. Rundkvist and V. K. Denisenko who, by using the method of cluster and factor analysis, suggested in total 7 types of Sn-W deposits and distinguished the main associations of elements

in them. The proposal by R. Taylor from Australia considers as the main criteria of classification the factors of geological environment and distinguishes five groups of tin deposits. This classification is oposed by C. L. Sainsbury from the U.S.A. who rejects the possibility to classify the deposits on the basis of the geographic provinces and proposes the form of the deposits and its genetic history as the main classification criteria.

M. Stemprok presented his own suggestion for classification of Sn-W deposits based on the distinction of individual mineralisation stages which were active in the formation of ore deposits. In total, he differed 8 stages of mineralisation, manifested themselves as a special type of wall rock alterations, which can be variously combined within a single deposit: pegmatitization (skarnization in calcacerous rocks), feldspatization, quartz vein formation and silicification, greisenization, tourmalinization, chloritization, sericitization, argillitization.

The review showed a vast disagreement in the application of classification criteria by various geologists. The criteria based on physico-chemical aspects are less widely used recently. Many of the present classifications stress the genetic and mineralogical or geochemical aspects.

In discussion, Prof. Evrard pointed out that the identical position of skarnization and pegmatitization in the first phases of the processes of ore deposition is justified; also thermodynamic data indicate that skarnization occurs at high temperature and low pressures while pegmatitization is characterized by high temperature and high pressure.

G. TISCHENDORF, in his convenor's report, presented geologic-tectonical, geochemical and petrological criteria which might be used as a guide for the recognition of metallogenetically specialized granites. He gave 15 features by which the metallogenetically specialized granites can be distinguished. They include also the petrochemical data, which show that, in their averages, the specialized granites, when compared with the normal ones, are characterised by higher contents of K_2O and SiO_2 and by lower contents of TiO_2, Fe_2O_3, MgO and CaO. Further the metallogenetically specialised granites show and increase in the content of specific rare elements (regional specialization). Proposed average values for some trace elements are as follows:

fluorine	3700	± 1500	ppm
rubidium	580	± 200	ppm
lithium	400	± 200	ppm
tin	30	± 20	ppm
beryllium	13	± 6	ppm
tungsten	7	± 3	ppm
molybdenum	3.5	± 2	ppm

In the discussion, the importance of water in the interpretation of silicate analyses was stressed, and the problem of the difference between late-magmatic and postmagmatic processes was extensively discussed.

M. OOSTEROOM gave in his review a broad account of the application of X-ray fluorescence analysis in the problem of ore-bearing granites. The results of the semiquantitative analyses of samples mainly from Galicia in Spain and some other provinces were treated by the methods of mathematical statistics. The trace elements showing a positive correlation with tin are *Rb, Cs, Li, Nb,* Be, B, Ga, Pb and negative correlation *Sr, Ba, Ti, Sc,* Y, V, Zr. It was stated that some correlations are strongly decreasing or increasing during the granitic differentiation, indicating thus the geochemical evolution of a granite belt. The use of factor score operation was found useful in the geochemical classification of granitoids in the Hercynian belt.

In the discussion the main problem raised was the number of samples needed as representative of a particular granite body.

P. BOWDEN gave an introduction to the planned meeting in Nigeria, discussing the aspects of the evolution and mineralization of the Nigerian Mesozoic granites. The anorogenic Mesozoic ring complexes of northern Nigeria evolved through the early development of trachyte-peralkaline silicic volcanics, mirrored at subvolcanic levels by syenite and related paralkaline granites. As the magmatic cycle progressed, the granitoid liquids became less alkalin and allowed the associated peraluminous biotite granites to dominate and end the magmatic cycle. In the peralkaline granites there was one period of mineralization essentially related to recrystallization and the introduction of albite. High agpaitic coefficient maintained miscibility of the albite-rich ore fluids between silicate and aqueous phases to low temperatures, so that mineralizing components continually accumulated together and prevente widespread precipitation of ore minerals. If, however, the high agpaitic coefficient could not be maintained, silicate and aqueous fluids would have separated, what resulted in substantial ore formation. This process appears to have occurred in the peraluminous biotite granites. Data on Sr^{87}/Sr^{86} isotopic ratios suggest that there have been three contributions to the granite material: from the mantle, lower crust and sialic upper crust.

PROF. ARRIBAS gave a summary of the geological features of West central Spain, especially the characteristic of granitoids, including their late and postmagmatic alterations and tin and tungsten mineralization. These lectures gave an excellent introduction to the field trips following the session and summarized the new data on the geology and geochemistry of ore-bearing granitoids with which tin and tungsten deposits are spatially associated.

Field-trips

Excursion A was on Wednesday, April 28, 1976, heading look from Salamanca to the Barruecopardo scheelite mine and the Aldeadávila dam. The geological explanation was presented by Prof. Arribas.

The Barruecopardo tungsten deposit is mined by a large open pit. It is confined to two-mica granite (muscovite > biotite), intersected by a swar of steep subparallel quartz veins striking N-S and with an average width of 5-15 cm. The vein filling consists besides quartz of scheelite, arsenopyrite, probably löllingite, small amounts of wolframite (ferberite) and pyrite. There is no wall-rock greisenization, but the granite has been affected altered by extensive microclinization and chloritization. Chlorite is present in the vein filling too, mainly in association with arsenopyrite. The genesis of the scheelite mineralization is explained by the microclinization which was responsible for the leaching out of tungsten originally dispersed in the granites. The discussion following the explanation concerned the problem of microclinization in relation to the genesis of the deposit and the question of late magmatic or post magmatic muscovitization of the granites.

The participants of the excursion were provided by a tasty dinner by the Iberduero Company which hosted the excursion in the afternoon and showed the important dam system of the Duero and Tormes rivers. The hydroelectric plant is cut in the two-mica granite showing little signs of secondary alteration.

Excursion B was on Friday, April 30, 1976, going to the Golpejas tin mine, located 18 km W of Salamanca, which is a strongly kaolinized albite granite with Nb-Ta-rich cassiterite disseminations. Then the excursion visited a tin placer quarry at Cubito, and afterwards two scheelite deposits of both the skarn and vein types at Morille, 20 km S of Salamanca. The deposit at Morille occurs in an area of Paleozoic metamorphic schists containing carbonate layers following the foliation. The skarn bodies with scheelite impregnations consist mainly of grossular, pyroxene, vesuviane, zoisite, plagioclase and actinolite. The skarn bodies are characterized by actinolization of the surrounding biotite schists and are clearly earlier than quartz veins which contain scheelite and cassiterite at the intersection with the skarn bodies. The owner of the mine offered the excursion participants with a field lunch.

Social programme

In addition to the business and scientific sessions and field trips the participants of the meeting were entertained at many enjoyable social events.

Of special interest was the visit to the Rodasviejas farm where the geolo-

gists enjoyed the first steps in bull fighting, followed by a lunch at the farm. A nice look into the ancient history of Salamanca was given to the participants by Prof. Caamaño, Head of the Department of Art Histroy of the University. A reception for the particpants of the MAWAM meeting was given by the president of the Provincial Deputation of Salamanca on April 29, and on the last evening the farewell dinner was offered by the Department of Geology and Mineralogy of the University of Salamanca.

Both the meetings and excursions were carried out efficiently, reflecting great care and effort, given to the meeting by Prof. Arribas and his coworkers. All the particpants enjoyed the cordial hospitality of the Spanish colleagues which created a pleasant atmosphere for fruitful discussions and exchange of opinions.

M. Stemprok