

BRITISH GEOLOGICAL SURVEY

TECHNICAL REPORT WC/93/17

Overseas Geology Series

TECHNICAL REPORT WC/93/17

**Sources of Geochemical Data collected
by the International Division since
1965**

R. C. Jones BSc CGeol
and J S Coats PhD

This report was prepared for the
Office of Science and Technology

Bibliographic Reference

Author, R. C. Jones and J S Coats
1993. Sources of Geochemical Data
collected by the International
Division since 1965 *British
Geological Survey Technical Report
WC/93/17*

©NERC copyright 1993

Keyworth, Nottingham 1993

Sources of Geochemical Data collected by the International Division since 1965

Introduction

The purpose of this report is to gather together information on geochemical data which BGS has collected from overseas over the last 25 years to enable a properly managed database to be designed and created. This report is based on an incomplete collection of datasets, though it is believed that most of the data from this period has now been located. An appendix to this report provides a listing of all known projects which generated geochemical data, and the location of that data where it is known. In some cases the data has been deposited with a counterpart organisation.

Business Objectives

- To provide rapid and efficient access to validated geochemical data collected by the International Division of BGS for use by customers in BGS, ODA, overseas Governments, academic researchers and the mining industry.
- To provide a formal management system and quality control for geochemical data collected over the last 25 years and held by the Division.
- To promote uniform standards for the collection and storage of geochemical data in the future.
- To enhance and promote the information skills obtained as part of the project.

User Requirement

The data may be used in a wide range of sectors, making it less dependent on the cyclical nature of mineral exploration and exploitation activity. The major applications are listed below:

Mineral resource development
Environmental geology
Research and development of geochemical techniques
The resolution of geological problems

The principal users of the data are expected to be:

BGS:

- a) The availability of historic data is of importance in the formulation of bids for overseas contracts. Many of the datasets represent the only data available for considerable areas of developing countries, and should provide us with a commercial advantage over competitors.
- b) The datasets provide the raw material for innovative research into the application of geochemical data in a wide variety of environments.

Overseas Governments:

- a) The database provides a backup for their data holdings, which may be necessary to help recovery after civil turmoil, as in Uganda, or when data is lost due to poor management, termites etc..
- b) The database also provides them with a resource for attracting investment from the commercial sector which is located close to the home base of many international mining companies.

- c) The data may be of value in other fields, for example for environmental monitoring.

Mining Companies:

The database gives them a convenient source of information from little-explored areas of a known standard, though not all datasets are available for general release.

The need for information by the above customers is dependent on such a wide variety of factors that any one dataset may remain unused for many years, but it is submitted that this fact does not diminish the long-term importance of the data. As an example the data holdings from a certain country are unlikely to be used at present because of the political instability of the country, but in the long term the country is likely to enter a phase of reconstruction and development, when our data holdings will become of interest to the mining industry.

Sources of data

S J Mathers' review of past projects (see reference list) and the IGS/BGS Annual Reports have been used to identify the projects in which suitable data may have been collected. A selection of project reports have been examined to see what geochemical data has been published. Direct contact with those who have worked on projects has led to the discovery of some original data, and more may be produced when cupboards have been searched.

As much of the analytical work took place at Grays Inn Road, particularly during the 1960s and 70s many sample analyses can be recovered from the ACU archives, but this may not be of much use if the locational data is missing. It is desirable to validate any datasets currently in machine-readable form against the original analyst's reports in case errors have crept in, where these are available. Data from other UK laboratories is not stored centrally as it has not been registered in the ACU system. Few, if any, of the analyst's reports of analyses performed by local laboratories overseas are available at BGS for checking against machine-readable records.

In certain projects the original field records, and sometimes the original analytical records have been deposited with the geological survey of the country in which a project was carried out. These may be the only existing copies of the data, which could contribute to the comprehensiveness of our database.

The current state of Data curation

The present project has led to the identification of a considerable body of information from past BGS projects overseas. That which is already in digital form is being gathered together on a microcomputer which has been bought as part of this project to handle the overseas database. Paper records are being left in their current locations until they are required for conversion to digital files.

There is no provision for depositing field notebooks, maps and related data for overseas projects, consequently much data still remains in the hands of staff who were involved in them. Dr R L Johnson keeps a series of box files for paper records on countries in Africa and the Middle East, into which miscellaneous items are placed. This system seems to work, as he was able to find the original sample location forms from work in Oman carried out in 1971.

There does not seem to be a comprehensive collection of reports for work carried out prior to 1985. NGDC holds the numbered Open File series, and the Library has some reports, the Overseas Geology and Mineral Resources series and the Overseas Memoirs. There is no systematic collection of the older reports which do not form part of a numbered series.

Recommendations

1. Archiving standards

A clear procedure should be established for archiving all data from current and future overseas projects. It should be the responsibility of all project leaders to ensure that all data is entered into the database before the completion of the project. Care should be taken to provide sufficient funds and time for this in project budgets.

In order to retain a complete picture of the results obtained the field maps, sample locations, notes, analysts reports, analytical data should be archived. The system of using box files to curate miscellaneous data might be extended to cover areas outside Africa, enabling the unique documents in the hands of individuals to be gathered together for long term curation. It will be necessary to provide extra storage facilities for maps and sample cards, which do not fit into box files conveniently.

2. Data collection standards

The staff of future projects should be provided with standard data recording forms and coding systems reflecting the structure of the BGS and divisional data models, to facilitate the easy incorporation of new data into the database. Note should be taken of the report of IGCP 259, which is about to be published. This report provides recommended standards and procedures for the World Geochemical Map, and contains much useful information on quality assurance standards and procedures. A manual of sampling and data recording procedures will be needed to meet the requirements of the BGS QA policy, as well as being a saleable item in its own right. It should be the responsibility of all project leaders to ensure that quality control procedures are followed.

The cost of the provision of copies of database table formats and the data collection standards handbook (translated where necessary) should be included in new project budgets when possible. New contracts should contain an explicit statement on the ownership of the project data, and where required the provision for BGS to maintain a copy of it. A charge could be made to cover the costs involved, particularly where BGS takes on the responsibility for disseminating the data to interested parties.

3. Implementation of the data model

The very limited number of parameters contained in the datasets do not warrant the use of the Oracle RDBMS on the VAX. It would be both cheaper and simpler to implement in dBase on a PC. As the datasets may be copied to computer systems in the countries to which they relate they should be in a format that is compatible with the simple equipment which is used in developing countries. This does not imply that a lower standard of database design is required. A well-designed database will be both more portable and more widely applicable than one in which the data structure has not been rigorously analysed.

4. Recovery of missing data

It is recommended that when staff visit a country where past data is held an attempt should be made to obtain copies of anything not also held at BGS. To that end a list should be prepared of datasets held overseas once the data to hand has been fully structured and validated. There may be some difficulties in obtaining all such datasets where the ownership is unclear, particularly when the BGS staff involved were working under OSAS terms, or where local policies deem such data to be restricted.

Implementation Plan

1. To produce workable data models for the quantitative data held by the Division. The majority of this has been completed in f/y 1992/3, though in some subject areas it will be sensible to wait for the relevant Home Survey groups to produce a data model, which can then be 'internationalised'. The data model for overseas geochemical data is the subject of a separate report (BGS Technical Report No. WC/93/18)
2. To develop tables in a relational database management system from the data models. The logical model of the database will require some simplification to produce an efficient set of table formats for use. These should seek to minimise the number of empty fields and the number of relational joins necessary to retrieve complete records.
3. To adjust all suitable existing datasets to conform to the appropriate models, and bring them together in a central data management facility where this has not been done already. Fragmentary data should be catalogued at index level, and held in a paper records archive. Some data cannot be found in BGS but copies of which are known to have been deposited with counterpart organisations. Where possible copies of these should be retrieved when the opportunity arises. The order of priority in which the datasets should be processed is given in Appendix I.
4. To produce a handbook of data collection standards for overseas use. This should reflect the structure of the data models, to facilitate the easy incorporation of new data into the database. Standard data recording forms should be designed, using simplified english to make translation into foreign languages easier.

Once steps 1 to 3 have been completed the database will represent an important resource for informed compilation of future BGS bids for overseas work. The ownership of much of the data may be claimed by counterpart organisations and funding agencies, but revenue can legitimately be produced by charging for the 'added value' accruing from the organisation and presentation of the data.

References

- Mathers S J (ed.), 1991. A decade of ODA/BGS International Research and Development. British Geological Survey Technical Report WC/91/15.
- Mathers S J (ed.), 1991. BGS Technical Cooperation in Latin America (1965- 90). British Geological Survey Technical Report WC/91/25.
- Mathers S J (ed.), 1991. BGS Technical Cooperation in the Caribbean (1965- 90). British Geological Survey Technical Report WC/91/31.
- Mathers S J (ed.), 1991. BGS Technical Cooperation in Africa (1965- 90). British Geological Survey Technical Report WC/91/47.
- Mathers S J (ed.), 1992. BGS Technical Cooperation in the Eastern Mediterranean and Western Asia (1965-90). British Geological Survey Technical Report WC/92/1.
- Mathers S J (ed.), 1992. BGS Technical Cooperation in the South West Pacific Islands (1965-90). British Geological Survey Technical Report WC/92/3.
- Mathers S J (ed.), 1992. BGS Technical Cooperation in South East Asia (1965- 90). British Geological Survey Technical Report WC/92/5.

Appendix I

Datasets

Group A

These are large high quality datasets from regional geochemical surveys, which can be incorporated into the database without significant changes. They are already in machine-readable form.

Bolivia:	Proyecto Precambrico
Kenya:	Samburu-Marsabit
Sierra Leone:	Northern Sierra Leone
Zimbabwe:	North east Zimbabwe
Indonesia:	north Sumatra
Indonesia:	Padang, Painan & Solok
Solomon Islands:	Choiseul & New Georgia Group

Group B

These two whole-rock geochemical datasets were collected by Dr E J Cobbing as the basis of his work on granites. They are of considerable importance.

Peru:	Andean Batholith
South East Asia	Tin Granites

Group C

These datasets are available at Keyworth, but are either in manuscript form wholly or partially, or require reformatting to conform with the data architecture. In most cases the number of samples cannot be determined accurately without further work:

Belize:	Maya Mountains regional geochemistry (5,200 km ²)
Bolivia:	Rincon del Tigre detailed soil and whole rock sampling
Bolivia:	Sierra Manomo detailed radiometrics, soil and whole rock sampling
Bolivia:	Velasco detailed soil and whole rock sampling
Colombia:	Cauca Valley regional geochemistry (16,000 km ²)
Colombia:	Pacific Coast Gold Project heavy mineral data
Ecuador:	Project San Miguel regional geochemistry
Ecuador:	Telimbela detailed stream sediment and soil samples
Botswana:	Molopo Farms drilling (also geophysics)
Kenya:	Geothermal project whole rock and gas sampling (also hydro)
Uganda:	Regional stream sediment and regolith sampling
Egypt:	Regional geochemistry covering approx. 1° square at 34°E/23°N
Oman:	Regional geochemistry (approx. 200 samples)
Hong Kong:	Whole rock samples in support of regional mapping
Myanmar:	Mandalay area soil and stream sediment samples
Pakistan:	Various geochemical samples from N W Frontier Province
Fiji:	Whole rock samples in support of mapping of Lau Group of islands
Vanuatu:	Stream sediments from central Malekula (circa 100)

Group D

These datasets are small or incomplete, and are accorded lower priority

Bolivia:	Whole rock samples in support of regional mapping
Costa Rica:	Detailed survey of the Tilaran - Aguacate area (3,500 km ²)
Costa Rica:	Gold Project of 1986 (few samples)
Guyana:	Whole rock samples in support of regional mapping
Peru:	Whole rock samples (w. of Lake Titicaca) in support of regional mapping
Jordan:	Whole rock samples in support of regional mapping
Ghana:	Archaean Goldfields Project samples
Swaziland:	Regional Geochemistry (?data from CIDA)
Uganda:	Carbonatites survey (11,000 soil samples)
Hong Kong:	Regional geochemical survey (currently classified)
Indonesia:	Hatapang Granite Project
Myanmar:	Mount Popa geochemistry (10,000 km ²)
Tonga:	Whole rock samples in support of regional mapping

Group E

These datasets have not been located, and may be unrecoverable

Peru:	Stream sediments from w. cordillera of northern Peru (25,000 km ²) 1969- 71.
Laos:	Geochemical samples collected in 1967-8
Thailand:	Data from three projects carried out in 1964-70

New datasets from current projects

Ecuador:	Cordillera Real
Malaysia:	Gold
Zimbabwe:	Midlands Goldfields
Indonesia:	south Sumatra (if politics allow retention of data)

Appendix II

A Catalogue of Overseas Geochemical Data

South and Central America

Belize

Geochemical samples were collected from an area of 5200km² of the Maya Mountains.

The stream sample cards have been archived at Keyworth. The analytical determinations were performed by I.G.S. Grays Inn Road, and are archived in ACU at Keyworth (Lab. Nos. 7620, 7627, 7636 and 7890).

The results were published in Bateson J H and Hall I H S, 1970. Reconnaissance geochemical and geological investigations of the Maya mountains of southern British Honduras. I.G.S. Overseas Division Report Series No. 16.

Bolivia

The Proyecto Precambrico (1976-86) collected a large quantity of high quality drainage sample data, covering an area of 250,000km², which has been compiled by J D Appleton into computer files. In addition, detailed work was done by R N Annells at Rincon del Tigre and by others at Cerro Manomo and Velasco, involving soil, whole rock and radiometric data collection. J D Appleton believes that the raw data for the detailed geochemical studies was deposited in Bolivia, though he will check to see if he has any copies.

The drainage data has been published in Appleton J D and Llanos 1985, Geochemical atlas of eastern Bolivia.

Whole rock data in support of the regional mapping is contained in Overseas Memoir No. 9.

A series of 26 project reports were produced, of which Nos. 11-16, 23 and 24 are likely to contain useful geochemical information.

The Rincon del Tigre study was published in Overseas Geology and Mineral Resources No. 63 by R N Annells.

Chile

A geochemical survey of the area between 51° S and 53° 30' S was conducted in 1969-70 by B G N Page. The only analytical data which has been found at Keyworth is 37 stream sediment analyses (Lab. No. 7686), but other results may have been preserved by the Instituto de Investigaciones Geologicas in Santiago. Two reports were published in Spanish.

Colombia

1) Drainage data was collected from an area of 16,500km² in the Cauca Valley area by J W Aucott and others (1980-84). The results were published by INGEOMINAS in six Project Reports, copies of which are held by Mr R B Evans.

2) The Pacific Precious Metals Project (MPP) data was collected by R N Annells 1986-88 and W McCourt 1988-90, and is held on a series of linked dBase files on the database computer in International Division at Keyworth. The database contains mineralogical and environmental data on samples taken from Quaternary and recent sediments from the Rio Timbiqui area of the Pacific coast of Colombia. The data quality is high, though there may be a problem over sample locations, which were originally on a tracing of aerial photographs in the absence of any suitable topographic map.

Costa Rica

1) A survey of the Tilaran-Aguacate area (3,500km²) was conducted by B Amos (1981-3). The analyses were performed in Costa Rica, and the original data is thought to have been deposited with the Corporacion Costarricense de Desarrollo (CODESA).

The results of this survey (including geochemistry) are published in Amos B J and Rogers P J 1983. The geology and exploration geochemistry of the Cordillera Tilaran-Montes del Aguacate Gold Field, Costa Rica. BGS Technical Report No. 1983/3.

2) A small number of samples were collected by J Berrangé (1983-6) from a small-scale gold mining area in the Osa Peninsula, Costa Rica. These were analysed for trace elements by XRF and gold grains were analysed by electron microprobe at BGS.

Ecuador

1) Geochemical samples were collected by J W Aucott (1972-80), most of which were analysed locally. The results were published in their entirety in the reports listed below. Copies of these are held at BGS. Some heavy mineral concentrate data is archived at BGS (Lab. Nos. 8372 and 8373).

Aucott J W, Puig C, Quevedo L and Báez N 1979. Regional geochemical exploration in western central Ecuador (Project San Miguel). Report, Direccion General de Geologia y Minas, Quito, and Institute of Geological Sciences, Overseas Division, London (bilingual),

Aucott J W and Quevedo L 1979. Geochemical, geophysical and geological investigations in Telimbela, Bolivar province, western central Ecuador. Report, Direccion General de Geologia y Minas, Quito, and Institute of Geological Sciences, Overseas Division, London (bilingual).

Aucott J W and Puig C 1979. Geochemical, geophysical and geological investigations in San Miguel, Bolivar Province, western central Ecuador. Report, Direccion General de Geologia y Minas, Quito, and Institute of Geological Sciences, Overseas Division, London (bilingual)

Aucott J W, Baez N and Puig C 1980. Geochemical, geophysical and geological investigations in Chaso Juan and Mulidiahuan. Report, Direccion General de Geologia y Minas, Quito, and Institute of Geological Sciences, Overseas Division, London (bilingual)

2) Whole-rock and mineralogical data has been collected by M Litherland, J Aspden and R Jemielita (1986-93). This has not been deposited at Keyworth yet.

Guyana

An area of 64,000km² of southern Guyana was mapped in 1966-71. The analyses of all the whole rock samples collected were published in the Overseas memoir No. 4 and in Hutchison D. 1970. Chemical analysis of rocks from southern Guyana. IGS Analytical Chemistry Unit Rept. No. 58.

Jamaica

P R Simpson's collaborative work with the University of the West Indies has been published. The complete dataset is held by the UWI, but P R Simpson has a copy of some of the data. Some samples were analysed in the UK and some in Jamaica.

Peru

1) J Cobbing collected a large number of whole rock samples of plutonic rocks in a joint study with Liverpool University (1973-80). Much, if not all of this is contained in numerous publications, but as far as is known the raw data is not available in digital form. Some of the original data is held at Liverpool University.

Overseas Memoir No. 5, contains whole rock analyses, determined for a wide range of elements, in Tables 7 and 8.

2) Stream sediments collected from 25,000km² of the western cordillera of northern Peru (from Cajamarca to the Ecuador border) in 1969-71. Samples analysed at Grays Inn Road for Cu, Pb, Zn and Ag by AAS and Mo by colourimetry. Some samples were analysed for As, Co, Mn, V and W. Cold extractable copper was determined locally. The BGS Lab. Nos. of the analyses are 4917 and 4918. J W Baldock reports that stream cards were completed, and deposited with the Survey in Lima. Ing G Flores, now the Director of Geology in Lima was the project counterpart, and may still have some data.

The project results were published in Baldock J W, 1977. Low density geochemical reconnaissance in Peru to delineate individual mineral deposits. Trans. Inst. Min. Metall. Sec. B Vol. 86, pp 863 - 872.

J D Bennett conducted a follow-up survey of anomalies in 1977-82, the raw data and sample locations from which was deposited with INGEOMET in Lima.

3) Some geochemical data from southern Peru, collected (1982-85), is contained in Ellison R A, Overseas Geology and Mineral Resources, No. 65, and in Klinck B A, Ellison R A and Hawkins M 1986. The geology of the Cordillera Occidental and Altiplano west of Lake Titicaca, southern Peru. Rep. Overseas Div. BGS (unpub.). RAE says that all analyses were included in the reports.

Africa

Botswana

1) Most of the work carried out in Botswana has been under OSAS terms, and the data produced has remained in Botswana. The results of a regional geochemical survey carried out in the 1970s were found to be of variable analytical quality, and were eventually presented as classified maps in a Botswana Government publication. Most of the data was obtained from mining companies, and only about 20% of the samples were collected by the Survey. The raw data is held as a computer printout in Botswana.

2) The Molopo Farms project (1980-83) involved the geochemical analysis of drill core, the results of which are held by D Gould on a VAX computer at BGS.

Ghana

Some data was collected by M Crow et al. as part of the Archaean Goldfields R&D project.

Kenya

1) Samburu-Marsabit project (1980-86). The geochemical data, from an area of 100,000km² in northern Kenya was processed at Keyworth, and is held on the database computer in the International Division, BGS.

2) The Kenya Geothermal Project (1985-92) is currently being written up. Most of the data is held on PC in dBase files. D Woodhall loaded the Phase 1 whole rock data on Apple Mac disks in Excel format, which have been passed to R C Jones. Other paper records exist in the possession of former project staff.

Malawi

The whole of Malawi has been covered by a survey of drainage geochemistry (circa 1968-72). The samples were analysed in part by OES, and have suffered from the low accuracy of optical plate reading, and in part by AAS. The latter part of the survey was supervised by H W Haslam. The data has been curated in paper form in Zomba, and in 1988 R C Jones initiated a program of keying in the data on a PC, so that it can be analysed more thoroughly. It is not known how far the data capture process has progressed.

Sierra Leone

Geochemical samples were collected from 25,000km² of northern Sierra Leone between 1969 and 1974. 3100 stream sediment samples were collected, and were analysed for Cr, V, Co, Ni, Mn, Cu and Pb by OES. The detailed methodology is reported in Overseas memoir No. 7 (Chapt. 10 and Appdx. 1). The

data was processed in the UK by J W Aucott, and is available on disk at Keyworth. 660 panned concentrates were collected, but the quality of the panning was uneven. These were analysed mineralogically by magnetic and heavy liquid separation methods, followed by optical grain counting. The full results were deposited at the Geological Survey of Sierra Leone in Freetown, as were the stream data cards and the radiometric (total gamma) maps. Some whole-rock geochemical analyses were made.

Swaziland

Follow-up of a geochemical survey of the country by UNDP was undertaken by M C G Clarke while on secondment to the Geological Survey and Mines Dept. The work was completed by staff from CIDA. The location of any raw data is unknown, but a summary and maps have been published by the Geological Survey and Mines Department in Bulletin No. 8, Regional stream sediment geochemical reconnaissance of Swaziland. 31 sheets were produced for 13 elements, covering the whole country at 1:50,000 scale. J D Appleton has a copy of data on disk which was produced by CIDA.

Uganda

1) Carbonatite Studies. 11,000 soil samples and 1500 stream sediment samples were collected from seven areas by K Bloomfield (1968-70) and were analysed locally. Confirmatory analyses were performed on some samples at Grays Inn Road. The results were published by the Ugandan Survey, but some of the data exists on punched cards at Keyworth.

2) Regional Geochemical Reconnaissance. The analyses of 17,000 regolith and rock samples and several thousand stream sediment samples were used to compile a geochemical atlas of Uganda in 1971. Some of the data has been found, and has been loaded onto disk at Keyworth.

Zimbabwe

14,000 stream sediment samples were collected from north-east Zimbabwe (1982- 86) and analysed for 12 elements at the laboratory of the Institute of Mining Research in Harare. The data is held on disk at Keyworth. Whole-rock analyses are listed in the map reports, which have been published by the Geological Survey of Zimbabwe.

Middle East

Egypt

A geochemical survey was conducted between 1979 and 1983. The samples were analysed and the data processed at BGS. The results were published in two or more IGS Overseas Division internal reports. Some raw data exists on punched cards and in the ACU records at Keyworth (Lab. Nos. 8533 & 8589), and the sample location maps are held by Dr R L Johnson.

Jordan

Some whole rock analyses were produced in support of systematic geological mapping (1984-92), and were included in the sheet reports by W McCourt and J Powell. These small datasets may still be on Cifer disks.

Oman

A stream sediment survey was carried out in the mountains of Oman in 1972-3. 197 stream cards and a printout of the raw data is held by Dr R L Johnson. The analytical results are to be found under BGS Lab. No. 8221.

The results of the survey are published in Carney J N and Welland M J P 1974. Geology and mineral resources of the Oman Mountains. Inst. Geol. Sci. Overseas Division Report No. 27.

Asia

South East Asia tin granites

A study was made of the geochemistry and petrology of the granites of Malaysia, Thailand and the Tin Islands of Indonesia by Dr E J Cobbing and others (1981-6). Data and samples gathered by previous projects in Burma was included, though no field work was possible in that country. The analytical data for 42 elements also exists on Cifer and PC disks held by R C Jones. The sample locations are plotted on maps held by Dr Cobbing.

The very large whole-rock dataset has been published in Overseas Memoir No. 10.

Burma

1) Detailed geochemistry was carried out in the Mandalay area (1968-74). Stream sample cards and some soil sample locations are archived at Keyworth, but it is not certain whether this data is complete. The samples were analysed at Grays Inn Road, and are available from ACU (Lab. Nos. 7880, 8003, 8004, 8006, 8007, 8008, 8015, 8059, 8060, 8079 & 8249). The Project managers were M S Garson and J H Bateson.

The results have been published in Overseas Geology and Mineral resources No. 51, Overseas Memoir No. 2, and IGS Overseas Division Report Nos. 13, 22 and 25.

2) Geochemical sampling, covering an area of 10,000km² around Mount Popa in central Burma was carried out between 1976 and 1979. The extent of the raw data holdings for this project is not known, though some data is stored in room G206 at Keyworth. The geochemical analyses were carried out in Rangoon. Project manager: B J Amos.

The results were published in IGS Overseas Division Report No. 38.

Hong Kong

1) A geochemical survey was carried out between 1967 and 1969 by P M Allen. The samples were analysed for 9 elements in the UK, and the data was included in IGS Overseas Division Report No. 14. which was classified as confidential for political reasons. P M Allen has a copy.

2) Whole-rock analyses were produced in support of the mapping of the colony. The analyses were performed in the UK and are held by J Ridgway.

Indonesia

1) A geochemical survey of Sumatra north of the Equator was carried out between 1975 and 1983. The data is held in digital form at Keyworth.

2) Geochemical data collected by DMR staff from the Padang, Solok and Painan areas of Sumatra just south of the Equator, was analysed and a validated database was prepared by R C Jones, Endang Suganda and Ratih Wiratnawati. This data is held at Keyworth in dBase files.

3) Hatapang Granite investigation (M C G Clarke). The data collected in this detailed study was published in:

Clarke M C G & Beddoe-Stephens B, 1985. Mineralogy, geochemistry and plate tectonic setting of a late-Cretaceous Sn-W granite in Sumatra, Indonesia. BGS Technical Report MP/85/12.

Clarke M C G & Beddoe-Stephens B, 1987. Min. Mag. v.51 pp 371-387.

4) The geochemical data from the South Sumatra Project (1988-present) is held in Bandung. All of this was collected by DMR staff, with BGS acting as consultants. At present the data is only available from The Director, Directorate of Mineral Resources, Bandung, Indonesia. Whole rock geochemical data from the granites of Sumatra collected as a sub-project by Dr E J Cobbing and Dr W J McCourt (1992) is in preparation, and will be available at BGS Keyworth.

Iran

Contrary to a report in the IGS Annual Report no geochemical sampling was carried out during the mapping of the Alborz Mountains (1968-75).

Korea (South)

The location of the raw data is not known. Hall's rock collection is mentioned in the 1987 BGS data catalogue.

Laos

Some geochemical sampling took place in 1967-8, before the civil war forced abandonment of the project. The following BGS Lab. Nos. contain data from Laos: 4553, 4554, 4688, 4689, 4690 & 4866.

Reference: Page B G N and Workman D R, 1968. Geological and geochemical investigations in the Me-kong Valley between Vientiane and Sayaboury and at Ban Houei Sai. IGS Overseas Division Rept. No. 9.

Pakistan

Geochemical sampling took place in various mineralised areas of north-western Pakistan in 1982-5. The results are held by R C Leake, and are in digital form on the VAX at Keyworth. Various unpublished BGS Technical Reports were prepared, which are believed to contain listings of all the data collected.

Thailand

Some data is available in the following publications:

Several projects took place in Thailand between 1963 and 1970. Though some data has been preserved, it is not yet clear how much of it can be validated for inclusion in the database. The projects are:

- 1) Bleackley D and Workman D R 1964. Report on the Geochemical reconnaissance survey in the Loei-Chiangkarn Area of Thailand. IGS Overseas Division Rept. No 4, also Reports nos. 4a, 4b & 4c.
- 2) Hughes I G and Bateson J H 1967. Reconnaissance geological and mineral survey of the Chanthaburi Area of south-eastern Thailand. IGS Overseas Division Report No. 7
- 3) Overseas Memoir No. 1

The ACU archives contain data from Thailand under the following Lab Nos.:

3924-6, 3928-36, 3940-1, 4376, 4381, 4382, 4383, 4413, 4424, 4561, 4624, 4625, 4626, 4632, 4858, 4883, 4930, 7582 & 7607.

Pacific Region

Fiji

D Woodhall holds a collection of whole-rock analyses for the Lau Group of islands, a copy of which has been deposited at BGS Keyworth. The locational information is of a relative nature, as at the time there were no published topographic maps of the area.

Solomon Islands

Choiseul and the New Georgia group of islands were sampled, and the results were presented in Overseas Memoir No. 8 and in Dunkley P N 1986. The geology of the New Georgia group, Solomon Islands. BGS Overseas Directorate Report MP/86/6. The raw data is held on disk at Keyworth.

There was no regional collection of geochemical samples on Guadalcanal, and the data from the Shortland Islands (187 samples) was collected by the Geology Division, Ministry of Natural Resources, Solomon Islands, and is held in Honiara.

Some stream sediment analyses of unknown origin, dating from 1969, are held by ACU at BGS Keyworth (Lab. No. 7687).

Tonga

D Tappin has a collection of 50-60 whole rock analyses and locations, which are as yet unpublished. He reports that earlier workers obtained 15-20 whole rock analyses.

Vanuatu

Detailed geochemical surveys were carried out on the Cumberland Peninsula, Santo and in central Malekula by J N Carney (1978-80). The Malekula data is held on Cifer disk at Keyworth, and the results have been published in Vanuatu.