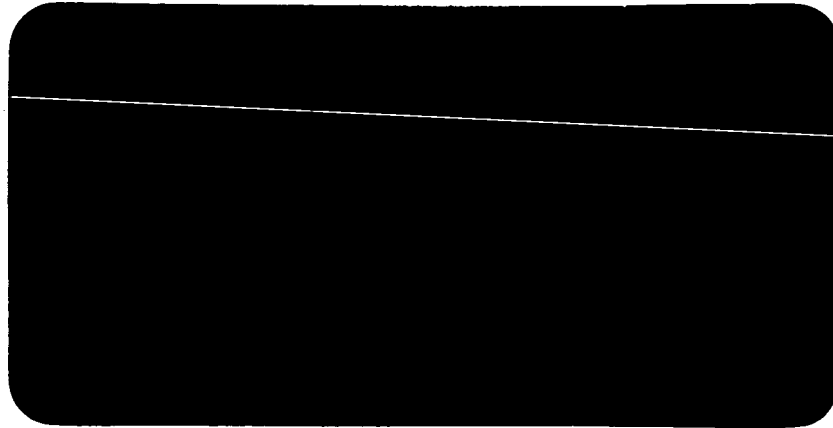


Institute of Geological Sciences

OVERSEAS DIVISION



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NATURAL ENVIRONMENT RESEARCH COUNCIL

REPORT ON ADVISORY/LIAISON VISIT TO
BOTSWANA, SWAZILAND AND MALAWI BY
DR. G.M. BROWN, FRS., DIRECTOR
AND MR I.G. HUGHES

February 1980

Report No: 1980/2

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FEBRUARY 1980

BY DR. G.M. BROWN, FRS., DIRECTOR,

INSTITUTE OF GEOLOGICAL SCIENCES

AND

MR I.G. HUGHES, ASSISTANT DIRECTOR AND HEAD,

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1. Introduction

1.1 This was Dr Brown's first overseas visit as Geological Adviser to ODA since assuming duty as Director of the Institute of Geological Sciences in September 1979. Our departure from London was delayed by 24 hours owing to engine failures and a consequent missing of onward connections led to our arrival in Botswana two days later than anticipated. Nevertheless, we were able to fulfil all our engagements in that country before our departure for Swaziland on the 14 February.

1.2 Unfortunately Mr Hughes suffered an attack of tick-bite fever (doubtless contracted during our visit to a camp in the Kalahari) in Swaziland and this brought on a bout of phlebitis. On medical advice he therefore did not proceed with the Malawi sector of the visit and this was carried out by Dr Brown on his own. Mr Hughes returned from Swaziland to London on the 22 February.

1.3 Dr Brown proceeded to Malawi on the 18 February and returned to London on the 23 February.

2. Botswana

2.1 On our arrival early in the morning of the 10 February we were taken by Dr C.R. Jones the Director of the Geological Survey by road to a Botswana Geological Survey (BGS) Underground Water Evaluation Project (GS10) field camp in the Kalahari west of Serule. There a programme of work involving geophysical surveying, water-well drilling and pump-testing was underway in an attempt to identify adequate supplies of water, as was done in the case of the Jwaneng diamond mine, for a proposed thermal power station in the Moropule area further to the south. This particular programme did not form part of the original GS10 project but was undertaken at the request of the Botswana Government as a cooperative effort with the Geological Survey preparatory to the latter taking over overall responsibility for such activities. The geophysics input to the programme was being provided by a BGS geophysicist while a trainee hydrogeologist (Mr Sekwale) worked as a counterpart to the GS10 hydrogeologist.

- 2.1.1. Mr J.L. Farr, Team leader, GS10 Project gave us an account of the framework of the investigation underway and Mr R.J. Peart, Geophysicist described the results of the surveys completed. We were then shown a drilling and test-pumping operation being carried out under the supervision of Mr C Cheney and Mr Sekwale, and we subsequently met the drilling contractors' Overseas Manager and members of his staff.
- 2.1.2. The preliminary results so far achieved did not appear to be as encouraging as those in the Kweneng field which will supply the new diamond mine at Jwaneng.
- 2.1.3. We spent the night of the 10 February at the BGS/GS10 camp and returned to Lobatse the following day. En route we visited the Moropule Coal Mine we were shown the underground workings and surface facilities by Mr Thomas the Mine General Manager.
- 2.3. Geological Survey Department Staffing.
- 2.3.1. All the senior posts in the Geological Survey Department are filled by IGS officers on secondment and an informal agreement exists whereby the IGS undertakes to keep these posts filled, under ODA auspices. The post of Director will shortly be vacated by Dr C.R. Jones who has been promoted within IGS to fill a senior post in the Overseas Division and that of Deputy Director will become vacant towards the end of the year when Dr R.D. Walshaw returns to the U.K. Following discussions with Dr Jones it was agreed that we should propose to the Permanent Secretary, Ministry of Mineral Resources that Dr G.C. Clark currently Assistant Director (and also on secondment from IGS) be promoted to Director on Dr Jones' departure. This procedure would enable a smooth handover of the directorial responsibilities and we are completely satisfied that Dr Clark is thoroughly competent to undertake these responsibilities.
- 2.3.2. Dr Clark's promotion will entail a vacancy for an Assistant Director, Economic Geology (though Dr Jones thought that the post might revert to that of Principal Geologist) and we agreed to identify a suitable IGS Officer for nomination in due course.
- 2.3.3. A replacement for Dr Walshaw as Deputy Director will also need to be nominated within the next four months.
- 2.3.4. On arrival in Lobatse we were informed that Dr R.M. Key seconded from IGS to the post of Principal Geologist, Field Mapping had given notice of his intention to terminate his service in Botswana. This development was unfortunate as we had hoped that Dr Key who has had eight years service in the country would be returning for another tour thereby strengthening the pool of experience remaining in the department depleted by the departure of Drs Jones and Walshaw and by Dr Gould's departure and subsequent transfer to the Molopo Farms (TC) project. Dr Key's reasons for seeking to leave the department are personal ones and in the circumstances we felt that it would be in everyone's interests not to stand in his way. Dr Cedric Mortimer shortly to complete an assignment for ODA in Panama, is available to replace Dr Key and the nomination has already been made.
- 2.3.5. Mr R.J. Peart, Geophysicist on secondment from IGS is approaching the end of his second residential tour. He informed us that he would be

happy to transfer to a similar assignment in one of the east African countries but failing this would be prepared to return to Botswana for a further tour. It is unlikely that a suitable vacancy elsewhere will arise at the appropriate time so that it is likely that Mr Peart will continue to serve in Botswana.

- 2.3.6. Recruitment action to fill the vacancy for a Senior Geologist (Economic Geology) caused by Dr D Gould's departure is currently in progress.
- 2.4. Discussions in Gabarone
 - 2.4.1. British High Commission We were received by His Excellency the High Commissioner, Mr W Turner on the morning of the 12 February. Dr C.R. Jones accompanied us at the discussion.
 - 2.4.1.1. Mr Turner said that he was sorry it had not been possible for him to accompany us on our visit to the GSLO camp as had been planned. We gave him a brief account of the project's standing at the present time but in view of Dr E.P. Wright's impending inspection visit we did not go into detail. We did however, mention that there was a possibility that ODA might have funds available for a continuation of GSLO or for a new hydrogeological project to succeed it, and Dr Wright would be examining the situation during his visit.
 - 2.4.1.2. The lack of interest on the part of British mining houses in the possibilities open to them in Botswana was discussed and Mr Turner again asked that every effort be made to remedy this situation. He explained that he had not been in favour of seeking a formal understanding with the Botswana Government that UK mining houses should be accorded priority in the allocations of prospecting rights covering any discoveries made in the course of the forthcoming Molopo Farms project though the Department of Industry still considers that this is desirable.
 - 2.4.1.3. We informed His Excellency of the progress of our preparations for the Molopo Farms project. If everything goes according to plan the proposed team-leader, Dr D Gould should assume duty in Botswana in May and it is hoped that geophysical fieldwork will be starting in August.
 - 2.4.1.4. The staffing situation in the Geological Survey Department was reviewed. Mr Turner was favourably inclined towards our proposal that Dr Clark would succeed Dr Jones: he accepted that it is sensible for Dr Clark to overstep Dr Walshaw in view of the latter's departure in November. His Excellency also concurred in the view that Dr Key's request to leave Botswana should be granted.
 - 2.4.2. Ministry of Mineral Resources and Water Affairs From the British High Commission we proceeded to the Ministry of Mineral Resources and Water Affairs where we were received by Mr M.C. Tibone, Permanent Secretary and Mr G.N. Thipe.
 - 2.4.2.1. We informed Mr Tibone that verbal agreement had been obtained from ODA that IGS accepts the undertaking to second officers to the BGS senior posts, and that IGS would be happy to do this.

- 2.4.2.2. We then examined the situation that would arise on the departure of Dr C.R. Jones whose promotion to a senior post in the Overseas Division had been announced. In our opinion as Dr Walshaw would only be in Botswana until November or thereabouts Dr G.C. Clark was the officer best suited to succeed Dr Jones and we asked Mr Tibone for his views on this proposal. The Permanent Secretary accepted this and we said that we would nominate a suitably experienced officer for Dr Clark's present post as soon as possible. We would also be nominating a successor to Dr Walshaw in due course.
- 2.4.2.3. The position of Dr R.M. Key, Principal Geologist (Field Mapping) was raised with the Permanent Secretary and he agreed with our view that it would be best for Dr Key to terminate his services in Botswana at the end of his current tour. We informed Mr Tibone that Dr Cedric Mortimer was being nominated to fill the vacancy resulting from Dr Key's departure: Dr Mortimer would be available to assume duty in Botswana about mid-year.
- 2.4.2.4. The Permanent Secretary then raised the matter of training in the earth sciences for Botswana which had been first discussed at the meeting which one of us (IGH) had with Mr Tibone last year vide paragraph 3.2 of the report on the visit. We informed Mr Tibone that ODA had agreed in principle to the scheme suggested in the above-mentioned report but we emphasised that the earth sciences are very demanding disciplines and that only high calibre students should be put forward for training. Mr Tibone welcomed the agreement for the scheme particularly as the CIDA training programme is now ending and no further nominations will be made for Canadian places. The Earth Sciences course at the University of Gabarone had run into problems and the first graduate in the discipline was not now expected until 1986 at the earliest.
- 2.4.2.5. We reminded the Permanent Secretary of the difficulty of finding places on the only two post-graduate courses in Mineral Exploration offered by British Universities. Two of the BGS's Botswana geologists had failed to obtain places on these courses in 1979 and were being renominated this year: we said that we would do whatever that can be done to help them. We also advanced the opinion that there should not be too much difficulty in obtaining a place of an M.Sc Hydrogeology course for Mr Sekwale this year.
- 2.4.2.6. We informed the Permanent Secretary that as Dr E.P. Wright would shortly be visiting Botswana to review the G.S.10 project we did not intend to discuss its position except to say that we had formed a good impression, in the short time available at the Serule location, of the methodology. The project termination date was discussed and this question also was left to Dr Wright to consider during his visit, though we did mention the possibility that ODA funds might be available for a continuation or for another project in the same broad field.
- 2.4.2.7. With regard to the Molopo Farms TC Project we said that planning was under-way and that Dr Gould the proposed Team-leader was expected to assume duty in Botswana in May. Geophysical field-work was scheduled to start in July/August.
- 2.4.2.8. The possibility of a court case involving certain holders of prospecting rights was raised by the Permanent Secretary and Dr Brown said that there would be no objection to IGS officers returning to Botswana to give evidence if need be.
- 2.4.2.9. We then had a brief meeting with the Minister of Mineral Resources and Water Affairs during which she expressed thanks on behalf of the Government

for the very substantial help rendered by ODA/IGS in her field of responsibility. She hoped that this assistance would continue and we took the opportunity to mention the agreements for IGS to fill the senior B.G.S. posts and for the training scheme noted in paragraph 2.4.2.4 above.

2.4.3. Director of Personnel

Our final call was on the Director of Personnel who was glad to hear of our proposals for filling the impending vacancies in the BGS. He also expressed satisfaction with the agreement for the training of earth scientists: he said that of 10 students in Canada under the auspices of CIDA only one was at university with the other nine undergoing sub-professional training at the Haileybury School of Mines. With only four earth scientists in the BGS at present there was still a very great need for training geologists and he thanked the UK Government for its readiness to help.

3. Visit to Jwaneng Diamond Mine

One of us (GMB) visited the Jwaneng Mine at the invitation of Debswana Ltd on the 13 February. Underground workings were examined and a tour of the surface facilities was carried out.

4. Job Appraisal Reviews, etc

JARs were carried out by one of us (IGH) on the 13 February with Drs Walshaw and Key and Mr Peart and reports thereon have already been forwarded to the IGS Establishments Officer (Dr Clark declined a JAR).

4.1 The following contract officers were also interviewed at their request by one of us (IGH):

Mr Milner, Electronics Engineer
Mr Hutchins, Senior Geophysicist
Mr MacKewen, Technical Records Officer

4.1.1. News of the increased supplementation figures reached Lobatse during the course of our stay there and it was the general satisfaction with the increases that we believe, accounted for (a) the small number of officers requesting interviews; and (b) the lack of any complaints regarding the level of remuneration amongst the three that were interviewed.

4.1.2. Mr Milner's main point concerned the possibility of being appointed to a suitable post in another territory. He said that he and his family had been happy in Botswana (with the exception of one unpleasant incident) but he felt that a change might now be beneficial from his career point of view. A promise was made that he be kept in mind should a vacancy for an electronics engineer arise elsewhere this year - his tour is due to end in July.

4.1.3. Mr Hutchins expressed satisfaction at the manner in which his salary problems had been sorted out by Personnel Services Executive ODA. He also discussed the requirements for filling an impending vacancy for a geophysicist in his section, and he drew attention to the need for practical training for Mr Ishmael Modiakgotla who is undergoing a technician training course at the South London Polytechnic.

- 4.1.4. The future of the British aid programme was foremost in the mind of Mr MacKewen who had heard a rumour that all OSAS appointments were to be stopped. He was told that there was no information available regarding the cessation of OSAS appointments but that an investigation was underway into the possible amalgamation of OSAS and TC terms of service. It was this investigation that might have given rise to the rumour that he had heard. Mr MacKewen also mentioned the matter of an ISTS award to read for a post-graduate gratification in information sciences which he had raised the previous year vide paragraph 2.2.4 of the report by Hughes. He was advised to raise the question again next year as his tour does not end until July 1982 so that he would not be in a position to start the course until September 1982 at the earliest.

5. Acknowledgements

We are most grateful to Dr C.R. Jones and his staff for organising a most worthwhile programme for our visit and we apologise for the inconvenience caused through not arriving as scheduled. Dr Jones is also thanked for his generous hospitality as are Mr C Thomas, General Manager, Moropule Collieries and the General Manager, Jwaneng Mines Ltd. We should also like to thank Miss Ann Doherty and Mr D Howard of ODA for their help in arranging our itinerary.

3. Swaziland We arrived in Swaziland in the afternoon of Thursday the 15 February and were met by M.C. McKeown who is on secondment from IGS to the Geological Survey and Mines Department.
- 3.1 Word had reached us shortly before we left the UK that the Director of the Geological Survey and Mines Department would be on leave when we reached Swaziland. However, when we arrived at the Department on the morning of the 16 February Mr Dlamini was present to greet us. We had a brief discussion with him and then he handed us over to his deputy Prince Khuzulwandle Dlamini.
- 3.2 Ministry of Commerce, Industry, Mines and Tourism
- 3.2.1 Our first formal meeting was with the Ministry of Commerce, Industry, Mines and Tourism, Prince Nqaba Dlamini. His Permanent Secretary Mr Douglas Ntwane was present at the meeting and we were accompanied by Prince Khuzulwandle Dlamini and Mr M.C. McKeown. After the normal pleasantries Prince Khuzulwandle expressed his Department's appreciation of the support rendered to Swaziland by IGS as part of ODA's technical cooperation programme and he particularly mentioned the high quality of the geologists that had or were serving in the Department. He also drew the Minister's attention to the very considerable assistance given with training Swazi nationals for professional and sub-professional posts in the Department.
- 3.2.2 The Minister endorsed Prince Khuzulwandle's remarks and then went on to say that despite all the help received with training much remained to be done. He mentioned that in 1982 the component parts of the University of Botswana and Swaziland would become independent but that no thought apparently was being given to establishing the geology and mining courses in Swaziland after the splitting up. We said that a Geology Department was to be set up in the Botswana wing of the university but that no graduates could be expected until 1986 at the earliest. Would it perhaps not be better for Swaziland to send students to Botswana to read geology rather than go to the expense of establishing its own university department to cater for what must be a very small requirement in toto. We mentioned that in the case of Botswana outline agreement had been given for the training in the UK in the intervening period, of students with satisfactory 'O' levels in science subjects. The Minister thought that this was an excellent arrangement and asked whether a similar scheme could be negotiated for Swaziland: we promised to discuss the matter on our return to London.
- 3.2.3 We handed the Minister an advance copy of a report by Mr U.Mc.L. Michie of IGS on his visit to Swaziland in July 1979 during which he carried out an evaluation of the country's radio-active mineral potential. We mentioned briefly the report's main conclusion viz that no specific investigations appeared to be justified but that the Department's general exploration programme should always include provision for radio-activity measurement.
- 3.2.4 A proof copy of one of the new 1:50,000 scale geological maps prepared by Dr A.C. Wilson of IGS and formerly seconded to Swaziland, was also handed to the Minister. The remaining 15 sheets are in various stages of preparation and the 1:250,000 scale geological map of the whole country is at the line-proof stage. Most of this work has been carried out by Dr Wilson since his return to duty with IGS last May. The Directorate of Overseas Surveys are undertaking the fair-drawing of the maps and arranging for the printing and their assistance has been invaluable. We told the Minister that it was estimated that all the 16 1:50,000 sheets would be printed by the end of October and the 1:250,000 map before the end of the year.

- 3.2.5 The Minister expressed his Ministry's appreciation of the report and the maps and thanked us for all the help given to the Geological and Mines Department. He hoped that this support would continue.

3.3 Geological Survey and Mines Department

- 3.3.1 At our formal discussion in the Department (at which Mr T.H. Winsor, Government Mining Engineer was present) Prince Khuzulwandle said that as the remaining Japanese Coal Mining Engineer would be leaving early in 1981 the Swaziland Government would like the UK to provide the services of a mining engineer to join the Department's Coal Unit. A fairly junior engineer would be suitable and this request had been included in the Department's proposals submitted to the ODA Manpower Review team. We took note of this and promised to discuss the matter with our High Commission in Mbabane and with ODA on our return to London.

- 3.3.2 The existing staffing situation in the Department was reviewed: there are no early changes to be faced or can be seen from the following list:

<u>Name</u>	<u>Post</u>	<u>End of Engagement</u>
Mr D.H.R. Simms	Chemist	15 March 1981
Mr T.H. Winsor	Govt. Mining Engineer	12 May 1981
Mr F Stocks	Drilling Superintendent	16 October 1981
Mr L Bills	Inspector of Mines	27 December 1981
Dr C.M. Barton	Geologist	1 February 1982
Mr M.C. McKeown	Geologist	1 May 1982

From the Department's point of view the situation is therefore satisfactory though there will be a problem when Mr Simms departs as his counterpart Mr Hlophe will probably still be away on his post-graduate training course at that time. Prince Khuzulwandle said that they would like Mr Hlophe to continue to understudy an expatriate for a year or so after his return from his studies which would mean a replacement for Mr Simms (who does not wish to return to Swaziland) to serve for 18 months to 2 years.

- 3.3.3 In informal discussions with the British expatriate staff we did not identify any instances of dissatisfaction (Mr Simms' wish not to return for a further tour is on the grounds that from a career viewpoint he must seek a more demanding post). Mr Winsor appears to have made a good recovery and he is putting in a full day's work without apparent ill-effect.
- 3.3.4 The question of the localisation of the Geological Survey and Mines Department's chemist posts has been touched upon in paragraph 3.3.2 above, ie this should ideally take place in the first half of 1983. We see no immediate prospect of the localisation of the Government Mining Engineer and Inspector of Mines posts: the recently graduated Hlatshwayo has joined Mpaka Colliery and there are no other Swazi students reading Mining Engineering at university level as far as can be ascertained. The two Geologist posts at present supplemented should be localised in 1982 when Nkambule, studying at Leeds and Strachan at Reading, complete their under-graduate courses. At that stage Mr McKeown's post as head of the Department's Coal Unit could be filled by Mr Maphanga who is already working in that unit and shaping very well. The remaining supplemented post, that of Drilling Superintendent could be localised in 1983/4 if Mr Stock's understudy maintains his promise.
- 3.3.5 Turning to the Department's training requirements, the most pressing

need is for mining engineers and the GOS request for two awards in each of the years 1981 and 1982 is supported. Mention of our discussion with the Minister regarding the training of geologists has been made in paragraph 3.2.2 above: we do not however, think that the Botswana and Swaziland situations are strictly comparable as it has been possible so far to select suitable UBS students for Honours Geology courses in the UK which has not been the case in Botswana. We do not therefore think that serious consideration be given at this stage to introducing in Swaziland an arrangement similar to that agreed to for Botswana. We understand that the GOS has requested two awards for geology training in each of the next three years: it is doubtful that they will be able to identify more than one suitable candidate each year and it is a moot point as to whether they really need to train more than this anyway. In our view there is a greater need for mining engineers but we do not know what plans if any, Havelock Mines have for training engineers consequent on Professor G.R. Davis' visit in September 1979.

3.4 British High Commission

- 3.4.1 We informed Mr David Gordon-Macleod of our discussion with the Minister of Commerce, Industry, Mines and Tourism and we promised to have Mr Michie's report forwarded to the High Commission via ODA on our return to the UK. Mr Gordon-Macleod mentioned that he believed a post for a Coal Engineer was to be included in the Manpower Review team's recommendations for 1981/2 when there would be six supplemented professional posts in the Geological Survey and Mines Department and one supplemented technical post (Drilling Superintendent). We impressed upon Mr Gordon-Macleod that the UK contingent formed the backbone of the Geological Survey and Mines Department and we were therefore glad that UK support was to be maintained at least for the next three years.
- 3.4.2 Mr Gordon-Macleod raised various matters regarding officers at post in Swaziland and these have, or are being dealt with separately.

3.5 Mineral Development

There has been remarkably little development in the minerals field in Swaziland since last year's Report and most situations appear to be at a standstill.

- 3.5.1 Coal There has been no progress since the last Report on the Area 3 or the Maloma prospects. As will be recalled a prospecting licence covering Area 3 was granted to a Mr de Vega following the withdrawal of the application for EDF funding for a mine feasibility study. Since then no work has been done on the ground as de Vega has failed to secure funding and the latest news is a court case brought by a Johannesburg group alleging improprieties over attempts to float a company to develop a mine. The Maloma anthracite prospect has suffered a similar fate in that Inter-Coal Trading have also failed to find development funds.

A detailed feasibility study for the development of an anthracite Mine at Mhlume by Shell Coal Swaziland (Pty) Ltd was submitted to the Minerals Committee in October 1979 but at the time of our visit no decision had been reached regarding the issue of a mining licence to that company. It is believed that the reason for the delay is disagreement over the financial terms to be attached to the mining lease.

- 3.5.2 Diamonds A stalemate exists on the Dokolwayo situation where De Beers are still attempting, after more than a year's negotiations to reach agreement on the terms whereby they may mine the deposit.
- 3.5.3 Asbestos The Havelock Mine experienced some difficulties during 1979 as the grade of ore decreased with increased depth of mining. This resulted in a lower production figure and this trend could be accentuated as mining proceeds. A government investigation into the grading, pricing and marketing of the fibre has been undertaken by a firm of consultants but the results are not known.
- 3.5.4 Iron Ore The iron ore pelletising proposal is still apparently under consideration by the Japanese and spasmodic discussions are taking place with the Kenyans regarding a joint venture with that country. It is believed that the last of the stockpiled ore at Ngwena will be shipped to Japan in the first half of 1980.
- 3.6 Acknowledgements
- 3.6.1 Our thanks are due to the Director of the Geological Survey and Mines Department and his officers for arranging our programme and we are also grateful to the Director for his hospitality.
- 3.6.2 We wish to record our appreciation of H E the British High Commissioner's hospitality.
- 3.6.3 We are grateful to Mr V.R. Pheasant, ODA for his help in arranging our visit to Swaziland.
4. Malawi
- I (Dr G.M. Brown) arrived at Chileka Airport, Blantyre late on 18 February and spent 19 February with the Chief Geologist, Geological Survey Department (Zomba) and his officers. The Chief Geologist and I travelled by road to Lilongwe on 20 February. The next day we visited the Department of Agriculture and Natural Resources and the recently constituted Department of Lands, Valuation and Water, and visited the British High Commission. We travelled by road from Lilongwe, via Zomba to Chileka airport the next day (22 February) from where I flew back to London.
- 4.1 Geological Survey Department
- 4.1.1 The Chief Geologist is Dr R.L. Johnson who was seconded from IGS to the post in May 1978. He is supported by Dr M.J. Crow as Assistant Chief Geologist, who was seconded from IGS in 1974.
- 4.1.2 The next in seniority is J.C. Chatupa, Principal Geologist, a very competent Malawian who obtained an M.Sc. in Mineral Exploration from Leicester University. The rest of the geologist staffing is currently severely depleted and of 2 Senior Geologist posts, only one is filled (Mr Phiri). Of 7 PO posts, only 2 are filled (Mr Mndala and Mr Nanu, both trained in Vancouver).
- 4.1.3 The present tour of Dr Johnson ends in November 1980, and of Dr Crow in July 1980. It was proposed to the Ministry's Permanent Secretary, who warmly agreed (4.2.6), that I request ODA that Dr Johnson returns to Malawi on a further (final) tour of 2½ years until mid-1983, at

which stage a Malawian Chief Geologist will be appointed. It is anticipated that Mr Chatupa will be appointed. Dr Johnson has a very high regard for his abilities, and he impressed me as an excellent, versatile scientist with all the necessary leadership qualities. Dr Crow will be returning for a further tour of a year on the conclusion of his leave later this year.

- 4.1.4 There is an urgent need for the two recently approved geologist posts to be filled on secondment from IGS. The periods of appointment should coincide to end with that of Dr Johnson to end in mid-1983. I endorse what was stressed many times, which is that these should be economic geologists, especially interested in industrial minerals. Also they should be young, junior staff in a position to work easily under their Malawian seniors. They should not be orientated towards basic research and geological mapping, but towards professionally applied projects from which they will gain valuable experience on Industrial Minerals.
- 4.1.5 Both Dr Johnson and Dr Crow are well respected, and both have initiated a wide range of new investigations. They recognise that the basic geological mapping of Malawi is in a healthy state and that the main current and future role of the Geological Survey is to use these maps to the best advantage in resources exploration and development.
- 4.1.6 There is a need for a chemist, which we drew to the attention of the Government authorities. This is particularly so in regard to the national emphasis on crop fertilisers (nitrogenous and phosphatic), clearly evident on a tour through the Shire-River region of maize fields where the non-fertilised crops are extremely poor. Also, interest in the possibility of methane emanations in Lake Malawi is, I consider, more the concern of an organic chemist than a geologist since they are probably related to the lake-floor organic debris.
- 4.1.7 The housing shortage is still a problem in Zomba and Lilongwe. However, this was not raised as a serious matter (cf. 1978 Report) and it was agreed that with the small extra staffing envisaged, the expatriates would find accommodation although it may not be immediately available.
- 4.1.8 The final transfer of hydrogeology to the new Department of Lands, Valuation and Water is planned for April 1, 1980. Despite early teething problems, the situation is at last satisfactory and expected now to proceed smoothly. All hydrogeology staff will henceforth be based at Lilongwe.
- 4.1.9 Dr Johnson has now completed the draft Mining Law for Malawi, to replace outdated legislation. It was largely drafted by him and completed with the help of a Consultant from the Commonwealth Secretariat (Mr Menary). The aim is for it to be presented to the Parliament in October 1980.
- 4.1.10 Restrictions on the expenditure of funds for travelling and subsistence, that were previously causing problems (1978 Report) have now been satisfactorily resolved. Funding from the UN for vehicles and for Industrial Minerals travel expenses are adequate. Staffing problems (see above) are much the more serious problem now.
- 4.1.11 The two Malawian graduates who took M.Sc courses in Hydrogeology overseas and who married Canadian wives during their undergraduate days in Vancouver have failed to return to Malawi. It is considered that in situ training of graduates, in hydrogeology, will henceforth be a preferable course of action.

4.2 Department of Agriculture and Natural Resources

- 4.2.1 Dr Johnson and I met the Permanent Secretary, Mr S.M. Khakobwe (previously at the Malawi High Commission in London), together with the Deputy Secretaries for Natural Resources (Mr C.L. Mphande, ex-Treasury) and for Agriculture (Dr L Lipato, ex-Chief Veterinarian).
- 4.2.2 The subjects were wide-ranging, because the PS was new to office (2 weeks) and he showed a keen interest in becoming acquainted with the remit, aims and limitations of geological work in Malawi. He reports direct to the President, who is also the Minister of this Department.
- 4.2.3 We presented to him the first copy of the Report on Uranium prospectivity in Malawi, recently completed by Mr U.Mc.L.Michie (IGS). We also discussed the various programmes on Industrial Minerals (see 4.5.1 below), the geological constraints on energy resources alternative to coal and renewable natural resources in Malawi, and the methods by which a survey of Lake Malawi could be undertaken.
- 4.2.4 Regarding Lake Malawi, which covers nearly half the country in area, false hopes were not generated. However, a pre-requisite to any ultimate geological survey was, we pointed out, heavily dependent upon a bathymetric survey which is long overdue. It is expected that fisheries and ship navigational requirements will result in this Survey shortly. It is not recommended that the proposal made in the 1978 Report (3.1.2), for an IGS Continental Shelf Divisional officer to advise on a shipborne geophysics programme, be maintained.
- 4.2.5 Despite a proposal having been considered (1978 Report, 3.1) that Dr Johnson become Commissioner for Mines, Geology and Water Resources, this was not effected owing to the reconstitution of the Ministry. A mining engineer has not been recruited as Inspector of Mines. The feasibility study for coal (1978) has shown no need for further developments in that area, and Dr Johnson sees no immediate need for a mining engineer. An Inspector of Mines on short-term appointment is being considered, probably best recruited from Zambia.
- 4.2.6 The PS and his colleagues expressed their warm appreciation of the UK aid programmes and for the work of Dr Johnson and Dr Crow, and their predecessors. The PS endorsed the proposal outlined in 4.1.3.

4.3 British High Commission

- 4.3.1 Dr Johnson and I met the new High Commissioner, Mr Bill Peters, who had only been in office for a few days (on transfer from Argentina). He displayed exceptional enthusiasm for, and interest in, the geological programmes in Malawi. Our discussions ranged over the fields of current concern, and he asked specifically for a set of geological maps and memoirs (we received a reminder the next day, on return to the Zomba office!).
- 4.3.2 Staffing aspects were discussed with Mr Peters and, later, with Mr Magnus Todd (Engineering Adviser) and Mr Stewart (Second Secretary Aid). The matter of the 2 Geologist posts (4.1.4) was raised as also was the vexed question of the short-term post in Geophysics which was applied for but which application appears to have been lost somewhere in transit.

This Department is not pressing this one, but the new Department concerned with Water Resources is re-applying (see below). Since we had not discussed the Geophysics post in depth at this stage, the HC will be fully advised later by Dr Johnson and Mr Chilton.

- 4.3.3 The main training requirements, as discussed, is for B.Sc. courses. In contrast to the reactions in Botswana and Swaziland, the need in Malawi is not for overseas A-level training. Chancellor College of the University of Malawi provides for good physics, mathematics and chemistry which, after the first 2 years of their degree course, would be equivalent to UK A-levels. Unfortunately, there is a decline in Primary Schools standards which may prejudice this scheme.

4.4 Department of Lands, Valuation and Water

- 4.4.1 Informal discussions took place first, in the Department, with Mr D.R.C. Grey (IGS) and Dr A.N. Mandeville (IH), both on TC appointment. Both are enthusiastic and happy with their programmes. Also present was Mr S.M. Mainala (one of the local Groundwater Geologist PO's, the other being Mr R.D. Kafundu). Mr Mainala is very capable and is in danger of being lost to the Hydrogeology section unless his long overdue promotion occurs.
- 4.4.2 The training programme in hydrogeology is being run locally (see 4.1.11). In addition, two VSO graduates (Miss C Carr from Canada and Miss I Richardson from the UK with an M.Sc. Hydrogeology, London University) are taking over the borehole siting programme as from this month (I met them in Zomba).
- 4.4.3 The Malawi Government envisages rapid growth of this small Department, including developments in geomorphology, evaluation (chiefly surface-water master plan), and utilisation (present usage patterns etc.) The Government is responsible for the drilling aspects (Borehole Fund) although IGS could usefully consider some short-term input. The well records (4000 boreholes) have been badly maintained and are being restored.
- 4.4.4 One major concern is with pollution problems, nitrate levels being very high in several localities. This is not only due to lax legislation on human and livestock proximity to wells, but also to the wide usage of nitrogeous crop fertilisers. The UN is reluctant to fund, because of UK funding involvement. Some work could be done by testing water samples at IGS Hydrogeology in Wallingford. A short advisory visit by Dr Adrian Bath of IGS would be helpful. Ultimately, and soon, a chemist will be needed, to study the regional patterns of water chemistry (of paragraph 4.1.6, although the needs of more than one Department indicate an overall national need for a Government Chemistry Laboratory).
- 4.4.5 The main topic of discussion was an urgent need for a geophysicist, to evaluate current methods (eg resistivity) and to investigate alternative methods (eg hammer seismic) as well as the application of Deep Geophysics methods in the drought-prone Shire Valley region. An AI is on its way for a short-term (3 months) geophysicist secondment. However, our discussions revealed that this short-term appointment would be on the lines of that of Mr P.J. Chilton, which proved so successful that is, to evaluate the programmes ahead of a longer term appointment. There is almost certainly a need for a geophysicist to be shared on a 70:30 basis between this Department and the Department of Agriculture and Natural Resources, on something like a 2-3 year secondment. No local expertise is available at the level of scientific ability required.

- 4.4.6 Dr Johnson and I then met Mr Muntale (Deputy Secretary in charge) and Mr Farrant (Deputy Secretary, Water Engineer-in-Chief; British born and ex-Kenya).
- 4.4.7 General enthusiasm was expressed for the UK aid and the quality of the personnel. Mr P.J. Chilton has proved particularly valuable, integrating quickly with local requirements on his short-term secondment and due to return in March for longer-term secondment. On his short-term visit he was able to co-ordinate the programme requirements (IGS Report, 1979).
- 4.4.8 Several of the relevant points raised in paragraphs 4.4.1 to 4.4.5 were discussed, particularly in regard to the geophysicist post, for which the urgency was endorsed by the DS in charge.
- 4.4.9 The IGS second-hand equipment being used on hydrogeology training programmes will require replacement next year.
- 4.5 Mineral Developments in Malawi
- 4.5.1 Industrial Minerals This is the most important topic currently under way, and the scope is virtually unlimited. The Malawians enjoy this type of work and recognise its importance. There is UNIDA sponsorship (Department of Trade and Industry interests) and UNDP involvement (Department of Agriculture and Natural Resources interests). The broad remit is "Development of the brick-making industry and inventory of industrial ceramic raw materials". There is not enough work for an engineering geologist apart from a consultancy basis on certain developments, and Dr Crow has adapted well to this aspect for present purposes. In regard to silica-sand glass production, a German team had not been optimistic in its report. However, the Geological Survey have found that Dambo sands provide an excellent source. Provided with excellent geological map coverage, they have delineated flanking quartzite ridges and thence the valley Dambo-deposit, white derivative sands from aerial photographs. A glass plant is currently being designed, and a new Company being formed. UNIDA are sending a team to set it up. ODA have commissioned the furnace design. The plant is to be at Lilongwe or Blantyre.
- 4.5.2 Pottery clays are being prospected both from weathered anorthosites and as a by-product from the glass sands.
- 4.5.3 Vermiculite British Gypsum had applied for a mining lease but due to problems a local company is now going ahead. That company has also applied for a lease to develop kyanite deposits.
- 4.5.4 Corundum Negotiation for a mining lease, by a South African company, is still taking place.
- 4.5.5 Radioactive Minerals The Italian organisation AGIP negotiated for an exclusive prospecting licence in the extreme north of Malawi but this has been rejected. The report by Mr U.Mc.L. Michie (IGS) will form a basis for the Department to consider prospects afresh.

- 4.5.6 Coal A feasibility study (1978) of the Ngana field in the far north indicates that it is the most promising of the 4 small coalfields so far discovered. Ngana is large in terms of Malawian coal consumption since their extensive forestation programmes provide for a very large combustible timber resource. The Ngana study has shown that the grade is low, such that 1/3rd - 2/3rd volume would be lost in washing to produce coal suitable for burning in the present boiler plants located in the south. However, it is feasible to mine at Ngana for an industry to be located in the north, designed to burn low-grade coal.
- 4.5.7 Fertilisers The Tundulu carbonatite contains 2-3 million tonnes of ore averaging 12% P_2O_5 . There is still the problem of separating the phosphate-bearing minerals from the carbonates. A batch of ore was sent to Warren Springs Laboratory over a year ago, and the results are awaited. No urgency was expressed, because currently nitrogeneous fertilisers are in use. Phosphatic fertilisers will be needed in 5 years time, so some forward planning is required.
- 4.5.8 Rare Earths The mining lease awarded to Lonhro, to mine the Kangankunde deposit for strontianite, has included the requirement to mine monazite as well. Some mineral dressing problems are being investigated in Johannesburg.
- 4.5.9 Airborne Geophysics Survey Request was sent to CIDA in September 1979 (about £1 million). The outcome is awaited eagerly, since hopes of discovering new metalliferous deposits are pinned to this project, which was so successful in Botswana. The Malawi authorities are convinced of its value. If CIDA cannot fund it, application will be made to the EEC. A geophysicist will be needed to interpret the results, perhaps on a continuing shared basis with the hydrogeology programmes.
- 4.6 Acknowledgements I am grateful to Dr R.L. Johnson for arranging my programme and for his hospitality. I should also like to thank Mr A.R. Stobbs for his hospitality in Lilongwe.

