



**ECONOMIC GEOLOGY  
RESEARCH UNIT**

University of the Witwatersrand  
Johannesburg



**THE HISTORY OF THE ECONOMIC GEOLOGY  
RESEARCH UNIT: 1957 - 1989**

**D.A. PRETORIUS**

- with a summary of the activities of the Unit  
for the period 1989 - 1993

**C.R. Anhaeusser**



**INFORMATION CIRCULAR No. 275**

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**1957 - 1989**

by

**D.A. PRETORIUS**

*(Professor Emeritus and Honorary Research Professorial Fellow,  
Economic Geology Research Unit, University of the Witwatersrand,  
P/Bag 3, WITS 2050, Johannesburg, South Africa)*

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**C.R. Anhaeusser**

*(Director, Economic Geology Research Unit)*

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**February, 1994**

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## THE ECONOMIC GEOLOGY RESEARCH UNIT: 1957 - 1989

### THE ORIGINS OF EGRU

The Economic Geology Research Unit (EGRU) was established as a direct consequence of the founding, in the mid-1950's, of the Research Institute of African Geology at Leeds University, England. This Institute was the recipient of a grant from the Anglo American Corporation of South Africa Limited, to allow it to carry out fundamental research into a wide range of aspects of African geology. Professor T.W. Gevers, the then head of the Department of Geology of the University of the Witwatersrand, believed that a strong argument could be advanced for creating a broadly-similar research group at the University in Johannesburg, to focus on geological topics in the southern portion, essentially, of the African continent. Dr. B.B. Brock, Consulting Geologist to the Anglo American Corporation, was sympathetic towards the suggestion, but the Corporation was of the opinion that it was a matter for the mining industry, as a whole, not itself alone, to consider. Brock undertook to bring the request from Gevers to the attention of the other mining groups, and they, in turn, referred it to the then Transvaal and Orange Free State Chamber of Mines.

A memorandum, dated 8 May, 1957, prepared by Gevers for the Anglo American Corporation, was submitted to the Gold Producers' Committee of the Chamber of Mines. In this memorandum, it was intimated that the Chamber also might be appealed to for the necessary grant. On 5 October, 1957, the General Manager of the Chamber informed the Principal of the University of the Witwatersrand that "the Gold Producers' Committee has decided that the Chamber should grant to your University for the purpose of the Post-Graduate School and Research Unit in Economic Geology, an amount of £8 000 per annum for a period of ten years commencing with the year 1957". A cheque for the first instalment of R16 000 was enclosed in the letter. A rider was added: "For domestic reasons the Gold Producers' Committee is anxious that no publicity should be given to this grant until possibly early in 1958....".

Eight months of intermittent, internal debate were to follow after the receipt of the first instalment of the grant, before the University reached a decision on the organizational structure, staffing, and responsibilities of EGRU. Advertisements calling for the filling of newly-created posts within the Unit first appeared on 29 May, 1958, a year since Gevers had prepared his memorandum. The original proposal had envisaged the appointment of one senior staff-member in the Post-Graduate School in Economic Geology and one senior research worker and three research workers in EGRU. The information sheet accompanying the advertisement made no mention of a Post-Graduate School and revealed that the drawn-out debates had reduced EGRU's permanent staff to three - a Director, with full professorial status, a Senior Research Fellow, and a Research Fellow. The closing date for applications was set at 31 August, 1958.

The information sheet indicated that: "The Unit will carry out research in collaboration with the geology and geophysics departments of mining houses, the Bernard Price Institute for Geophysical Research, the Leeds Research Institute of African Geology, and Government Geological Surveys in Southern Africa. The main emphasis of the Unit is to be on the structural control of ore genesis and the structural approach to ore finding - 'structure' to be interpreted in its broadest sense, and therefore including also sedimentation".

The man pre-selected by Gevers to fill the directorship declined the invitation, with the result that a short list of candidates was interviewed on 23 October, 1958. By 22 December, 1958, it had been decided that none of the applicants was of professorial standard or merited appointment as Director of EGRU. Consequently, the staffing structure was changed again, the number of permanent posts being reduced to three - a Senior Research Fellow and two Research Fellows. Gevers assumed the headship of the Unit, while administration and organization were assigned to the Senior Research Fellow who was obliged also to contribute to undergraduate teaching in the Department of Geology. Research policy and results had to be approved by and reported to, respectively, a Consultative Committee consisting of the Consulting Geologists of the then seven major mining groups which had endorsed the creation of EGRU. The Chamber of Mines, the Geological Survey of South Africa, and the Bernard Price Institute for Geophysical Research also were represented on the Committee.

The first Research Fellow commenced with the Unit on 1 June, 1959, the second on 1 September, 1959, and the Senior Research Fellow on 1 November, 1959. Two full years had elapsed since EGRU was founded on 5 October, 1957. As a result, the Unit was to have only eight years, and not the ten originally envisaged, to prove its value to the mining industry and to convince its sponsors that it should be allowed to continue, with further financial support, after the end of 1967.

After having arranged for the three staff appointments, as well as for the addition of a temporary Research Scholar who would work towards a post-graduate degree, and after having decided on the research topics to be pursued by all members of EGRU's staff, Gevers departed, at the beginning of December, 1959, for Europe on long leave. The first year of the Unit's active life then became the responsibility of Mr. (later Professor) Edgar Mendelsohn, Senior Lecturer in Economic Geology, and the Senior Research Fellow.

## THE DEVELOPMENT OF EGRU

### The Four Phases of Operation

The Unit was founded on 5 October, 1957, came into operation on 1 June, 1959, and ended the first phase of its history on 31 December, 1967, the end of the ten years covered by the original grant from the Gold Producers' Committee of the Chamber of Mines. During this period, EGRU was virtually an autonomous entity, funded, for the greater part, by the Chamber and responsible to the industry-dominated Consultative Committee. The University's financial contribution was very small.

Between June, 1959, and February, 1962, the Unit was housed in a prefabricated hut, north of the premises of the Department of Geology. The hut originally had served as the ex-servicewomen's residence in post-World War II years. The site is now occupied by the Sociology Building. In March, 1962, EGRU moved onto the Lower Ground Floor of the then new building erected for the Departments of Geology and of Mining Engineering. The existence of the Unit had not been taken into consideration when the new building was designed, and, from the start, the accommodation made available to the Unit was inadequate and unsuitable.

The second phase of the Unit's history extended from January, 1968, to May, 1977, a period of nine-and-a-half years compared to the eight-and-a-half years which defined the first phase. In a letter, dated 2 February, 1967, the Chamber of Mines indicated to the Principal that it was satisfied with the performance of the Unit and that it was willing to increase its annual support to R37 000, thereby allowing the appointment of further staff-members, on the expiration of the initial ten-year trial-period. Contrary to expectations, the University objected to the conditions attached to the grant, to the continuance of the Unit's established mode of operation, to the functions of the Consultative Committee, and to the semi-autonomous status of EGRU. Instead, it insisted that the Unit become an integral part of the University and that a Board of Control, appointed by the Council of the University, be the authority to which the Director of the Unit was responsible, thereby downgrading the role of the Consultative Committee and the Chamber of Mines. Almost a year of dispute, disagreement, debate, and negotiation culminated in a victory for the University, and, in a letter of 28 November, 1967, the Registrar indicated to the General Manager of the Chamber of Mines the manner in which EGRU would operate from 1 January, 1968, onwards. The University's financial support, in comparison to that from the mining industry, increased progressively thereafter.

The differences of opinion, which arose in 1967, between the University and the mining industry regarding the future of EGRU marked the beginning of a long period, up to the end of the 1970's, in which the Unit had to do battle for its continued existence. Repeated attempts were launched by various bodies and individuals within the University to alter the status and activities of EGRU. These campaigns ranged between, at best, complete absorption into the Department of Geology and, at worst, total disbandment and dismissal of all staff. This turbulent state of affairs was in marked contrast to the conditions which prevailed during the first phase of its history, when the Unit operated more closely to the mining industry than to the University.

During the whole of the second phase, EGRU was based in the Geology and Mining Building. As its staff and activities expanded, so the problem of accommodation worsened. It reached critical proportions in 1976, when the Department of Geology gave notice that it would have to occupy the Unit's space on the Lower Ground Floor in order to instal newly-acquired geochemical-laboratory equipment. Accommodation on the campus was at a premium in 1976-77, and the Unit was obliged to seek a new home farther and farther afield off-campus. Eventually, a University-owned house, formerly the property of the prominent Anderson mining family, was found in Parktown. Despite strong opposition in certain circles to the Unit's moving this distance off-campus, the Vice-Chancellor granted permission, on 14 March, 1977, for EGRU to relocate to "The Pines". The move from the Geology and Mining Building took place on 6 June, 1977, bringing an end to the second phase of the Unit's history.

The twelve years of the third phase, between 6 June, 1977, and 8 March, 1989, were, for the most part, highly productive and satisfying. For the first time, EGRU had adequate accommodation for both permanent and temporary professional staff and for technical, cartographic, and secretarial staff. Garaging was available for all the Unit's vehicles, store-rooms for field equipment and rock-specimen collections, workshops for thin- and polished-section preparation, and dark-rooms for photographic reproduction. Space was found also

for a small library, a lecture-room for undergraduate instruction and post-graduate courses, and a seminar-room. Under such conditions, it was possible to restore the close relations with the mining industry, which had been established during the first phase, and a suitable venue was available always for meetings of the Consultative Committee and with other groups from outside the University.

As in the second phase, the Unit was responsible to a Board of Control, nominated by the Council of the University, for the whole of the third phase. The Chairmanship of the Board changed at fairly frequent intervals, and the degree of interest shown by the Board in the activities and achievements of EGRU varied accordingly. Relations between the Board and the Unit were at their optimum in the mid- and late-1970's and in the first half of the 1980's. The University remained the main provider of funding, but increasing amounts of support were forthcoming from the C.S.I.R. and the Foundation for Research Development. As a consequence, the grants and other financial help from the mining industry assumed smaller proportions.

With advance of the 1980's, the University experienced ever-greater problems with acquiring adequate income to meet its obligations and intentions. One approach towards conserving financial resources, adopted by the University, was to close-down research units, as opposed to the larger research institutes, on the departure of the director. In the case of EGRU, the Director was due to reach mandatory retirement-age in the course of 1990. In accord with the then prevailing policy within the University, the Director was informed, on 29 July, 1987, that the Unit would be disbanded at the end of 1988 and that attempts would be made to accommodate the permanent members of staff, including the Director, elsewhere within the University structure up until their retirement or departure. This decision was greeted with dismay by the mining industry, and the Consultative Committee immediately set about trying to persuade the University to revoke its decision. The Committee expressed very strongly its wish to see the Unit continue and for the latter's name to be retained. The mining industry won over the University, and by 1 June, 1988, it was agreed that the Economic Geology Research Unit would not be disbanded, and the permanent members of staff were informed that an arrangement had been devised which would permit EGRU to continue to exist.

The end of the third phase saw the demise of the original Economic Geology Research Unit and the beginning of a very-much different successor Unit. On 8 March, 1989, the Deputy Director initiated the move back to the Geology Building on the East Campus of the University and commenced the integration of the successor Unit into the Department of Geology. A semi-autonomous and independently-operating Economic Geology Research Unit ceased to exist on that date, and the fourth phase of EGRU's history extends from that date onwards. The early stages of the fourth phase are not described in this history which has confined itself to a record of the original EGRU. The Director and a small segment of the staff continued to operate at "The Pines" until 31 December, 1990, when the Director retired, the old Unit disbanded, and "The Pines" vacated.

## Members of Staff

The first person to join the original Economic Geology Research Unit, as a Research Fellow, was C. Roering, on 1 June, 1959. R.B. Hargraves started on 1 September, 1959, as the second Research Fellow, and D.A. Pretorius on 1 November, 1959, as the Senior Research Fellow. These three pioneers were drawn from Sweden, the U.S.A., and the then Northern Rhodesia, respectively, but all were graduates of South African universities. The first research assistant, appointed to the temporary staff while working towards a post-graduate degree, was D.A.M. Smith who joined the Unit in January, 1960.

Hargraves resigned in July, 1961, and returned to the U.S. He was succeeded, as a Research Fellow, by H. de la R. Winter who was with the Unit from October, 1961, to June, 1965. When the future of EGRU was in dispute, at the end of the first phase of its history, Roering resigned and left in February, 1968. Years later, after he had become Professor of Geology at the Rand Afrikaans University, he renewed his association with the Unit, as a Visiting Research Fellow, between August, 1982, and December, 1985. Pretorius was made Director of EGRU in January, 1966, and became Professor of Exploration Geology in January, 1969, virtually ten years after he was interviewed for the position of Director/Professor. When he retired at the end of 1990, he had contributed 31 years of his professional career to the Unit.

Another member of staff with an exceptional record of service is C.R. Anhaeusser who was engaged as a research assistant in January, 1962, and advanced to Research Fellow, Senior Research Fellow, and Deputy Director, the last-mentioned promotion dating from January, 1979. At the end of 1990, he had been associated with the Unit for 29 years. In January, 1991, he became the Director of the reconstituted, successor Economic Geology Research Unit in the Department of Geology.

Other members of the original Unit who became Senior Research Fellows were: A. Button (April, 1967 - September, 1977); D.R. Hunter (November, 1970 - January, 1975); L.J. Robb (April, 1975 - April, 1977; February, 1978 - December, 1979; January, 1980 - February, 1982; and July, 1983 - December, 1987); W.D. Newham (April, 1979 - September, 1982); J.S.I. Schwellnus (January, 1981 - February, 1982); and G. Grohmann (April, 1982 - December, 1987). The initial dates indicate when they first joined the staff of the Unit and not necessarily when they became Senior Research Fellows. A. Button renewed his association between May and August, 1978 when he returned as a Visiting Research Fellow.

In addition to the senior members of staff, the following made outstanding contributions to the achievements of the Unit, either as Research Fellows or Research Assistants: E.J. Poole (January, 1961 - December, 1961); A.B. Simpson (January, 1962 - June, 1965); L.S. Steyn (January, 1962 - August, 1965); M.J. Viljoen and R.P. Viljoen (January, 1962 - March, 1964; and July, 1965 - January, 1968); G.C. Armstrong (January, 1963 - September, 1965); R. Saager (June, 1966 - February, 1969); W.E.L. Minter (January, 1972 - August, 1972); R.C.A. Minnitt (January, 1973 - March, 1979); N. Tyler (February, 1976 - May, 1978; F.M. Meyer (November, 1984 - December, 1987); and T.R. Marshall (January, 1985 - October, 1990).

Among the non-professional staff, singular contributions to the output of the Unit were produced by: L. Tyler, Secretary (June, 1962 - May, 1989); N.A. Gomes, Cartographer (December, 1974 - July, 1988); R.R. Lewis, Technician (October, 1979 - December, 1990); and A. Tlapu, General Assistant (January, 1981 - December 1990). Tyler's 27 years of service were surpassed only by those of Pretorius and Anhaeusser.

In the course of the first three phases (1957 - 1989) of EGRU's history, 54 graduate geologists carried out full-time research at the Unit for periods ranging from less than one year to more than 30 years. During this period, 24 undergraduate students in geology were employed as research assistants in the University summer vacations. Assistance was given to the researchers by eight cartographers/draughtsmen, at various times and for varying periods, by eleven technical assistants, and by thirteen secretaries.

The progress of research was advanced considerably by the contributions of Visiting Research Fellows who made their expertise available to members of staff for periods ranging from two to ten months at a time. Some were associated with the Unit on more than one occasion. In all 29 Visiting Research Fellows were hosted by EGRU, the more notable of these being A.O. Fuller, J.G. Ramsay, P.E. Cloud, A.E.J. Engel, L.L. Sloss, H.R. Wynne-Edwards, W.K. Hamblin, R.W. Hutchinson, S.A. Schumm, J.M. Guilbert, R. Saager, W.M. Schwerdtner, and P. Landais.

### **Control of the Unit**

From the inception of EGRU in October, 1957, to the end of December, 1965, when a Director was appointed, Professor T.W. Gevers acted as head of the Unit, while D.A. Pretorius was responsible for administration and the supervision of research. Professor E. Mendelssohn served as an adviser. As long as the Chamber of Mines was the main financial supporter, during the whole of the first phase, EGRU was accountable ultimately to the mining industry which maintained relations with the Unit through a Consultative Committee composed of the Consulting Geologists of the seven major mining groups which were then in existence. In addition, the first committee included Mr. M. Falcon, Technical Adviser to the Chamber of Mines, Dr. J. de Villiers, of the Geological Survey of South Africa, and Professor A.L. Hales, of the University's Bernard Price Institute for Geophysical Research. Gevers acted as Chairman of the Consultative Committee from its inaugural meeting on 24 September, 1959, up to its ninth meeting on 4 November, 1964, after which Pretorius assumed the chairmanship till his retirement at the end of 1990.

The Consulting Geologists who composed the first Committee included: Dr. R. Borchers (Rand Mines), Dr. B.B. Brock (Anglo American), Dr. M.G. Hearn (Anglo-Transvaal), Mr. D.J. Malan (J.C.I.), Mr. E.F. Marland (Union Corporation), Dr. R.A. Pelletier (New Consolidated Gold Fields), and Dr. N.L. Wilson (General Mining). Brock was instrumental in the founding of the Unit and remained an ardent supporter and valuable adviser up until his retirement at the end of 1964. Particular mention must be made of the considerable contribution to the guidance and development of EGRU by Hearn who was a member of the Committee for 18 years, up to his retirement at the end of 1977. A third enthusiastic supporter of the policy and work of EGRU was Malan who retired at the end of 1966. In later years, the Unit received strong support from Dr. H.C.M. Whiteside (Anglo

American; 1963-1972); Dr. W.S. Rapson (Chamber of Mines; 1965-1973); Mr. J. Fouché (General Mining; 1972-1987); Dr. C.T. Potgieter (General Mining Union Corporation; 1973-1982); Mr. C.F. Vermaak (J.C.I.; 1973-1982); Mr. B.F. Weilers (Gold Fields; 1973-1983); Dr. P.J. Pienaar (Anglo American; 1973-1983); Mr. A. Kriek (Rand Mines; 1974-1982); and Dr. R.P. Viljoen (Gold Fields; 1984-1989).

The 18th, and last, formal meeting of the Consultative Committee of the original EGRU took place on 25 June, 1986. Thereafter, only occasional, informal meetings of some members of the Committee took place at irregular intervals up to the end of 1990. From 1984 onwards, there was an apparent diminishing interest in EGRU on the part of the mining industry, although relations remained good and assistance continued to be readily forthcoming from several of the mining groups. The change was a reflection of developments in the attitude of the mining industry towards external research, of a diminution, in general, of research funding from all sources, and of looming uncertainty with regard to the future of the Unit after the retirement of the Director.

The achievements and reputation of the Economic Geology Research Unit were a response, to a very marked degree, to the interest shown in the Unit by the mining industry through the Consultative Committee and the Chamber of Mines. Without the industry's financial support and assistance in providing access to information in the files of mining companies and to mines and exploration areas, the Unit could have accomplished only a fraction of what the record shows to EGRU's credit over the thirty years of its operation between 1959 and 1989.

After the Unit was absorbed by the University on 1 January, 1968, and the greater part of the funding was drawn from sources removed from the mining industry, EGRU became accountable to a Board of Control appointed by the Council of the University. The majority of members was drawn from the academic staff of the University, with the Consultative Committee's being allowed two members and the Chamber of Mines two, while some of the Council appointees had affiliations with the mining industry. In addition to monitoring research policy and practice, the Board of Control focused extensive attention on the annual budgets of EGRU.

The first meeting of the Board of Control took place on 1 May, 1968, and its membership comprised Professor S.P. Jackson (Chairman), the Vice-Chancellor of the University, the Academic Adviser of the University, Professor T.W. Gevers, Professor L.O. Nicolaysen, Dr. M.G. Hearn, Dr. W.S. Rapson, Mr. V.C. Robinson, Dr. H.C.M. Whiteside, and the Director of the Unit. The original membership of ten had grown to sixteen, under the Chairmanship of Professor J.P.F. Sellschop, by the 22nd meeting of the Board on 18 July, 1990, the last meeting attended by the Director of EGRU, Professor D.A. Pretorius, before his retirement. The enlarged Board still contained only two representatives of the mining groups and two of the Chamber of Mines. During the whole of the second and third phases of the Unit's history, the structure of the Consultative Committee remained unchanged, and it persisted into the fourth phase when Professor C.R. Anhaeusser became the Director of the reconstituted successor Unit.

## Funding of the Unit

The Unit was founded on an annual grant of R16 000, for a period of ten years, by the Chamber of Mines. When the first staff were appointed in 1959, the grant was augmented to the extent of R3 500 by the University. EGRU thus was launched on a total revenue of R19 500, from which the salaries of three full-time members of staff had to be met, as well as all operating expenses and the purchase of small items of capital equipment. In the first year of the first phase of the Unit's history, 82 per cent of the funding came from the Chamber and 18 per cent from the University.

In 1968, the first year of the second phase, the total revenue had increased to R28 500, with R17 500 (62 per cent) coming from the Chamber, R3 500 (12 per cent) from individual mining companies for the carrying out of contract research, and R7 500 (26 per cent) from the University. Ten years further on, at the beginning of the third phase in 1978, income had increased substantially to R164 500, the Chamber providing R40 000 (24 per cent), mining companies R42 000 (26 per cent), the University R76 500 (46 per cent), and the CSIR, Nucor, the Geological Survey, and other sources R6 000 (4 per cent). When EGRU celebrated the 25th anniversary of its operational history in 1984, midway through the third phase, the annual revenue showed an even greater increase to R458 500 of which the Chamber provided R40 000 (9 per cent), the mining companies R134 000 (29 per cent), the University R248 500 (54 per cent), and the CSIR and other sources R36 000 (8 per cent). In the final year of the original Unit's existence, in 1990, no support was provided by either the Chamber or the University, funding to the extent of R102 500 coming from the mining companies and R75 500 from the FRD and other sources, making a total of R178 500.

For the first ten years of its operation, between 1957 and 1967, EGRU had access to an aggregate income of R281 000, of which R189 000 (67 per cent) was contributed by the Chamber of Mines, R18 500 (7 per cent) by the mining companies, R43 000 (15 per cent) by the University, and R30 500 (11 per cent) by the CSIR and other sources. Over the second ten years, between 1968 and 1977, when the Unit was absorbed by the University and control passed from the Chamber of Mines, the total income increased to R886 000, with R193 000 (22 per cent) coming from the Chamber, R195 000 (22 per cent) from the mining companies for the purposes of confidential contract research, R470 000 (53 per cent) from the University, and R27 500 (3 per cent) from the CSIR and other sources. For the first seven years, 1978-1984, of the third phase of EGRU's history, R2 090 500 was received, R290 000 (14 per cent) from the Chamber, R589 000 (28 per cent) from the mining companies, R1 147 000 (55 per cent) from the University, and R64 500 (3 per cent) from the CSIR and other sources.

Up to the time of its silver jubilee in 1984, the grand total of funding which had accumulated to EGRU amounted to R3 257 000. The Chamber of Mines had provided R672 000 (20 per cent), the mining companies R803 000 (25 per cent), the University R1 660 000 (51 per cent), and the CSIR and other sources R122 500 (4 per cent). The progressively diminishing role of the Chamber of Mines is reflected in the decline from 67 per cent in the first phase to 14 per cent in the first half of the third phase and the progressively more-dominant contribution of the University from 15 per cent to 55 per cent in the same periods.

The support of the individual mining companies for contract research by the Unit quadrupled from 7 per cent, in the first phase, to 28 per cent, in the third phase.

### **Communication of Research Results**

It was a condition of the original grant that the results of research carried out be communicated to the Consultative Committee and the Chamber of Mines with the minimum delay after the completion of the investigations. The generally long periods of time between submission of the results for formal publication in a recognized journal and the ultimate appearance of the paper were not acceptable to the sponsors. It was also required that the results be made available to the geology departments in the head-offices and on the mines of the member companies of the Chamber. It was decided that the results of the research would be written up in the form of Information Circulars, with restricted distribution according to a closed list of recipients. The name was suggested by R.B. Hargraves, and it was appropriate that Information Circular No. 1, issued in August, 1960, was authored by him. In later years, the list, although restricted, was expanded to include libraries at South African and overseas universities, research institutions, and geological surveys. Selected individuals, with interests in the Unit's fields of study, also were added.

In the first phase of EGRU's operational history, 40 Information Circulars were prepared between 1959 and 1967, in the second phase, 72 Information Circulars between 1968 and 1977, and in the third phase, 106 Information Circulars between 1978 and 1989. In all, 218 Information Circulars were prepared by members of the original Unit and their fellow workers between 1959 and 1990.

An Annual Report was required and 31 of these were compiled during the life of the original EGRU. Another important category of written communications was labelled Miscellaneous Reports, which were not sent to recipients of Information Circulars or submitted for formal publication. These reports ranged from annual reports to the CSIR and FRD, through confidential reports on research projects undertaken for mining companies, guide-books for field-excursions, and notebooks for post-graduate courses, to abstracts for both local and overseas conferences. Between 1959 and 1967, ten such Miscellaneous Reports appeared, 78 between 1968 and 1977, and 193 between 1978 and 1989, adding to a total of 281 Miscellaneous Reports compiled during the three phases of the Unit's history. In the first phase, 14 M.Sc dissertations and 6 doctoral theses were prepared by permanent and temporary members of the Unit's staff, during the second phase, 10 dissertations and 11 theses, and in the third phase, 10 dissertations and 5 theses, so that, in total, 34 master's dissertations and 22 doctoral theses emanated from the original EGRU.

From the research work carried out between 1959 and 1989, a total of 213 papers was published in internationally-recognized journals and books. If all types of communication are added together, then EGRU can be credited with 799 contributions in the first 31 years of its existence.

## EGRU's CONTRIBUTION TO TEACHING

### **Undergraduate Teaching**

Throughout its life, EGRU was concerned primarily with post-graduate research and instruction, as a consequence of which, up to the coming into operation of the successor Unit, teaching on the undergraduate level formed a minor component only of activities. From 1960 to 1990, Pretorius delived a course of lectures, to fourth-year students in the Department of Geology, on exploration geology. The main objective of these lectures was to show how the various courses they had taken during their four years of study might be integrated into devising the strategy and tactics of mineral exploration, particularly for Witwatersrand-type gold deposits and kimberlite-hosted concentrations of diamonds. One of the most important spin-offs of this series of lectures to undergraduates was the opportunity provided to select students who deserved encouragement to join the temporary staff of the Unit and work towards higher degrees on projects forming part of EGRU's overall programme of research.

As the University continued to provide an increasing proportion of the Unit's annual income, so expectations grew of a progressively larger contribution to undergraduate teaching. This was markedly so in the third phase of the original EGRU's life. Anhaeusser started giving full courses of lectures in 1980, and, by the middle of the ensuing decade, every member of the Unit's permanent staff was obliged to teach on the undergraduate level. In addition, single talks, as parts of other lecturers' courses, were presented frequently, and field excursions were organized and led, in order to bring the undergraduates into direct contact with the rocks and their contained mineralization.

### **Postgraduate Instruction**

The original proposal to establish an Economic Geology Research Unit at the University of the Witwatersrand mentioned the parallel creation of a Postgraduate School of Economic Geology. Although such a school never formally came into existence, EGRU made a major contribution to postgraduate education and training and fully met the requirements of the Chamber of Mines and the Consultative Committee in this regard.

The supervision of the research work of 56 candidates for higher degrees provided the front-line of postgraduate training. In that a great many of the dissertations and theses resulted from studies of direct interest and relevance to the mining industry and because a substantial proportion of the recipients of higher degrees subsequently joined mining companies, the programme of postgraduate research by members of the temporary staff proved of readily-acknowledged value to the geological departments of the various mining groups and companies. On occasion, industry geologists were seconded to the Unit for periods of up to two years, without the obligation to aim for higher degrees, so as to acquaint themselves, first-hand, with new concepts and techniques developed by EGRU. Instruction was carried to the head-offices and mines by means of individual talks, seminars, and short courses, such closed sessions facilitating the discussion of information confidential to the mining group, on the property of which the lectures were given. From 1980 to 1985, Pretorius contributed a series of lectures each year to the M.Sc. Mineral Exploration Course

which Rhodes University ran in Grahamstown, primarily for geologists from the mining industry.

Perhaps, the most significant contribution which EGRU made to continuing geological education on the postgraduate level lay in the short-courses presented, to participants from the mining industry and from universities in Southern Africa, by visiting specialists from overseas. These were run on a non- or minimum-profit basis, and, generally, the number of participants was restricted to less than 80, with geologists from industry enjoying preference in acceptance. In all, the short-courses were offered over a period of 12 years, the first being delivered in 1970 by Professor L.L. Sloss and the last in 1981 by Professor S.D. Scott. The holding of these courses was suggested by the Consultative Committee, while the selection of speaker and topic was the responsibility of the Director and Deputy-Director of the Unit. Postgraduate short-courses proved so popular that, by the end of the 1970's, a surfeit of such instruction was being offered by the Department of Geology at the University of the Witwatersrand and by other universities in South Africa. The Consultative Committee decided, in 1981, that it could no longer support the attendance of industry geologists at each short-course offered, and, with the consequent decline in revenue, those organized by EGRU became a financial liability and were discontinued after June, 1981.

The topics presented ranged from fluvial sedimentology, through sedimentary basin analysis, tectonic evolution and mineral deposits, porphyry copper deposits, massive sulphide deposits, and sandstone-hosted uranium deposits, to mineralization in high-grade metamorphic terranes. Five of the presenters were drawn from the U.S.A. and five from Canada. The most-well-received short-courses were those delivered by Professor H.R. Wynne-Edwards (1982), Professor R.W. Hutchinson (1974 and 1978), Professor S.A. Schumm (1975), Professor J.M. Guilbert (1976), and Professor W.M. Schwerdtner (1979).

### **EGRU's CONTRIBUTION TO RESEARCH**

#### **Fields of Study**

The Chamber of Mines and the Consultative Committee had agreed upon specific goals to which they wished the sponsored research of EGRU to be directed. These did not include regional geological mapping of the Damara Sequence and the detailed investigation of lithium- and beryllium-bearing pegmatites in what was then South West Africa. These projects had been selected by Professor T.W. Gevers who committed one of the three permanent members of staff and the first research assistant to investigations in Namibia. One of the first tasks of the Senior Research Fellow, on his arrival in November, 1959, was to placate the sponsors and establish precisely what lines the various facets of the Unit's research programme should follow. Thus began the close working relation between the Consultative Committee and EGRU, which ensured that future studies would be concentrated on, but not necessarily be restricted to, the geological problems and interests of the mining industry. This policy prevailed through the first, second, and third phases, between 1959 and 1989, of the original Unit's operational history.

The sponsors wished research to be focused on the gold-uranium mineralization of the Witwatersrand Basin. Other styles of gold deposits elsewhere in South Africa also were of

interest, and these included gold in the Archaean greenstone belts and mineralization of the Pilgrim's Rest variety. It followed that the Unit involved itself essentially in investigations of the Witwatersrand Sequence, the Barberton greenstone assemblage, and the Transvaal Sequence. As an adjunct to the Witwatersrand studies, it was agreed that possible correlatives of the sequence also be examined and that the stratigraphy of the Ventersdorp Sequence, which forms a blanket over Witwatersrand strata in a great many exploration areas, be clarified. A general guide-line emerged during the early meetings of the Consultative Committee that of the order of three-quarters of research time and effort should be allocated to these priority projects.

The remaining one-quarter of EGRU's activities was the prerogative of the Director and Deputy-Director and often was constituted by contract-research investigations sponsored by individual mining companies. Such free-ranging studies included, among others, those relating to tin mineralization in the Bushveld Complex, porphyry-copper mineralization in Namaqualand, copper mineralization in the Witvlei area of Namibia, copper-nickel mineralization in the Francistown area of Botswana, copper mineralization in the Sinoia-Mangula and Melsetter-Chipinga areas of Zimbabwe, copper mineralization in the Prieska-Pofadder area of the Cape Province, gold mineralization in the Murchison greenstone belt, alluvial diamonds in the western Transvaal, the distribution of diamondiferous kimberlite pipes in Botswana and Zimbabwe, the structural interpretation of the gravity field over Southern Africa, and the comparative Archaean and Proterozoic geology of the shield-regions of Brazil, the U.S.A., Canada, Australia, and Southern Africa. A good many other studies, of shorter duration, were undertaken of geological problems of more-restricted scope and dimensions.

### **The Transvaal Basin**

Through production in the Lydenburg-Vaalhoek-Pilgrim's Rest-Sabie region, the Transvaal Basin has proved to be the third-most important source of gold in South Africa. The Unit's contribution to a better understanding of its geology involved stratigraphic and sedimentological studies over the whole of the basin where exposed in the Transvaal. Subsurface investigations also were carried out where cores were available from Witwatersrand-exploration drilling in the Delmas, Magaliesburg, and Carletonville areas. In all, ten members of staff, were involved at one time or another, in the Transvaal Project.

The first studies were commenced in 1967 by A. Button and D.J. French, the former subsequently becoming the principal research worker into the evolution of the basin in the northern, eastern, and southeastern Transvaal. His studies terminated in 1977, after his internationally-acclaimed comparison of the Transvaal Basin and the Hamersley Basin of Western Australia. Another mapper who made, between 1976 and 1983, a substantial contribution to knowledge of the basin was N. Tyler who investigated the northwestern and southeastern segments.

The first researches into the nature of the gold mineralization in the Pilgrim's Rest and surrounding goldfields were recorded by L.J. Robb and N. Tyler in 1983. F.M. Meyer, in 1985, started a geochemical investigation of the mineralization, which continued up to 1988. The importance of stratigraphy in localizing ore-horizons and the role of lithology in

the concentration of gold mineralization were demonstrated by R. Tyler in 1987 and 1988. Geochronological data pointed to the influence of the Bushveld Complex in the generation and transportation of the mineralizing fluids.

### The Barberton Greenstone Belt

This Archaean remnant ranks as second in importance in the production of gold in South Africa. It also ranks second in the list of EGRU's significant contributions to a better understanding of South African geology and ore-deposits. The first members of staff to become involved in research in the Barberton Mountain Land were E.J. Poole, who, in 1961, initiated a study into the structural controls on the development of pay-shoots in the Agnes Gold Mine and, later in the same year, C. Roering who started a structural investigation of the Saddleback Syncline. Both undertakings received considerable assistance from Dr. J.G. Ramsay of the Imperial College of Science and Technology, London, who demonstrated the applicability of the quantitative examination of minor structures to the unravelling of the full tectonic history of the Barberton Greenstone Belt. Ramsay was the Unit's first visiting research fellow.

In 1962, C.R. Anhaeusser and M.J. Viljoen started their involvement in the Barberton Greenstone Belt, the former in the area around the Lily Mine, near Louw's Creek, and the latter in the area around the Consort Mine, near Noordkaap. Their names, together with that of R.P. Viljoen, who commenced his research in the Belt in 1965, were to become synonymous with the ensuing revolution in an understanding of the early evolution of the Earth. The Viljoens remained with the Unit up to 1968, whereas Anhaeusser pursued his interests in the geology of the Barberton Mountain Land up to end, in 1989, of the third phase of EGRU's history, when he transferred his research activities to the successor Unit. Another notable contributor to the studies of the various granites associated with the Belt was L.J. Robb, from 1985 onwards. In all, 15 members of staff undertook field work in the Barberton Greenstone Belt, between 1961 and 1989.

The research carried out by Anhaeusser and the Viljoens produced results that sparked drastic changes in concepts relating to the composition and development of the early-Archaean crust, not only in the Barberton region, but elsewhere in Africa and in Brazil, Canada, and Australia. The stratigraphic succession in the Barberton Belt was modified to a marked degree, and the Onverwacht assemblage, hosting the oldest members of the succession, was shown to contain ultramafic lavas; differentiated, layered ultramafic intrusions; komatiites, which rock-type was recognized for the first time in the Greenstone Belt; and a wide range of other mafic and felsic extrusives, intercalated with volcanoclastic and chemical sediments. Cyclic repetition was observed to be characteristic. In the initial stages of deciphering the origins and relations of the members of the complex pile of Onverwacht igneous and volcanic rocks, invaluable assistance and guidance came from Professor A.E.J. Engel of the University of California at La Jolla. Comprehensive investigations of the granitoid bodies surrounding the Barberton Mountain Land, undertaken by Anhaeusser and Robb for the most part, also led to a new appreciation of the geochemistry and geochronology of these other integral components of the Archaean crust. Primitive life-forms, recognized in Onverwacht chemical sediments, constituted a

comparative basis in the search for evidence of life on the Moon during the course of the Apollo Programme of space exploration.

The Barberton model of Archaean greenstone evolution was applied, with success, to re-interpretations of the geology and history of other greenstone belts in the Transvaal and of the classic greenstone terrane of Zimbabwe. Appreciation and application of the model were particularly conspicuous in the Yilgarn and Pilbara Blocks of Western Australia where Archaean assemblages host significant deposits of gold and nickel.

### **The Witwatersrand Basin**

In the realm of economic geology, worldwide, the Economic Geology Research Unit came to be identified more closely with the Witwatersrand Basin than with its other fields of study. As in the case of the Barberton Greenstone Belt, the Unit played an impressive role in developing new approaches to attempting to solve long-standing problems of genesis and distribution of gold and uranium in conglomerate reefs and other sediments, to predicting the trends and persistence of ore-shoots, to ore-reserve calculations, and to the selection of new areas for exploration. With respect to its involvement in Witwatersrand geology, the Unit attained optimum realization of the three main objectives set out in the original mandate given to it by the Chamber of Mines: (1) to carry out research relevant to the needs of mineral exploration in Southern Africa; (2) to provide an environment favourable to continuing education for employees of the mining industry; and (3) to improve liaison between the industrial and academic worlds.

In an examination, undertaken in 1959 and 1960, of where and how EGRU might make, in a relatively short period of time, an effective contribution to a better understanding of the influences on, and controls of, gold mineralization in the Witwatersrand, it became readily apparent that two fields had received but poor attention in the past - sedimentology and structure. R.B. Hargraves, in the latter part of 1959, embarked on a pilot sedimentological study of surface exposures in the Nigel-Heidelberg area and of underground workings on the East Geduld Mine in the East Rand Goldfield. By the end of 1960, it had been established clearly that the orientation, form, and variations in thickness of cross-bedded units throughout the stratigraphic succession could contribute substantially to reconstructions of the palaeogeography of, and the depositional environments within, the Witwatersrand Basin. At the beginning of 1962, L.S. Steyn commenced a pioneering, systematic, macrosedimentological study of the Livingstone Reefs on West Rand Consolidated Mine and adjacent properties, and R.P. Viljoen initiated the first, quantitative, microsedimentological investigation of the areal-distribution patterns of detrital minerals in the Main Reef and Main Reef Leader of the West, Central, and East Rand goldfields. Similar macrosedimentological studies were started, in 1963, by G.C. Armstrong on the May (Kimberley) Reef in Springs, Daggafontein, East Daggafontein, and Grootvlei mines in the East Rand Goldfield. In all these early sedimentological researches, advice and guidance were readily forthcoming from Dr. A.O. Fuller of the University of Cape Town.

Structural studies were started by D.A. Pretorius in 1960, underground in the mines of the Central Rand Goldfield. The workings of many of the older, smaller mines were inaccessible, and information on the faulting, folding, and disposition of the reefs could be

obtained only by the analysis of mine-plans extending back to the 1890's. Ultimately, the Unit built up a voluminous and unique collection of such old mine-plans from which a very large amount of information was abstracted with regard to dykes, faults, folds, extent of mining of the various reefs, pay-shoot trends and patterns of sedimentation on the mines of the Central Rand. Surface structural investigations were initiated by C. Roering in 1961.

The publication of R. Borchers's map of the surface and subsurface geology of the whole of the Witwatersrand Basin, in 1961, stimulated the beginning of basin analysis by Pretorius. In the following years, structural interpretations of the gravity and aeromagnetic fields over the Basin, stratigraphic analysis of borehole data, sedimentological information from mines, and syntheses of all levels of structural observations from within and around the Basin were employed in attempting to unravel the original extent and subsequent preservation of different formations within the depository.

By the closing years of the original Unit's life, systematic sedimentological studies had been carried out in all the goldfields of the Basin, either by staff members or by mining-company geologists seconded, to or working for higher degrees in EGRU. Some of these investigations embraced whole goldfields. Mineralogical, petrological, and geochemical research was undertaken on several of the more-important reefs. By the early 1980's, sedimentology had become an acceptable part of a mine-geologist's repertoire of observational techniques employable in the Witwatersrand Basin, and the opportunities declined, consequently, for members of the Unit to become involved in extensive sedimentological studies, as these were now being carried out systematically by the mining companies themselves.

To compensate, EGRU embarked, in 1983, on the first regional study of the postulated hinterland to the Witwatersrand Basin. L.J. Robb pioneered this research, which concentrated on the nature, alteration, mineralization, and age of granitoid rocks on all sides of, and within, the Basin. In the closing years of the original Unit's life, such studies formed the dominant proportion of activities concerned with the Basin. The recognition of granitoids with an age of emplacement and of hydrothermal alteration contemporaneous with that of the laying down of the gold-bearing sediments of the upper division of the Witwatersrand Sequence offered a whole new spectrum of potential sources and processes of mineralization.

Over the 31 operational years of the original Unit's existence, 25 members of the permanent and temporary staff became involved, at one time or another, in research into the stratigraphy, sedimentology, structure, mineralogy, petrology, and mineralization of the Dominion, West Rand, and Central Rand Groups of the Witwatersrand Sequence and into the petrology, geochemistry, and geochronology of the hinterland to the Basin. The possible Pongola, Uitkyk, and Godwan correlatives of the Witwatersrand Sequence were studied by seven of the staff and the Ventersdorp Sequence, covering much of the subsurface preservation of Witwatersrand strata, by six members.

## RECOGNITION OF EGRU'S CONTRIBUTIONS

That the original Unit satisfactorily discharged the mandate set by its sponsors is evidenced clearly by the fact that financial support continued by both the mining industry and the University up to its disbandment in 1990, twenty-three years after the expiration of the initial ten-year trial-period. Testimony to its success was provided by the industry's willingness to subvent two further research groups in South Africa - the Precambrian Research Unit at the University of Cape Town, in 1963, and the Institute for Geological Research on the Bushveld Complex at the University of Pretoria, in 1975. EGRU also provided the impetus for the establishment, in 1967, of the Institute of Mining Research at the University of Zimbabwe.

International recognition of the value of academically-based geological research to the mining industry came in the creation of two EGRU-inspired units overseas, one in Australia and another in Canada. The international geological community acclaimed the significance of the Unit's contributions to the advancement of knowledge by the many invitations from overseas universities and scientific societies to senior members of staff to accept visiting distinguished lectureships and to serve as keynote speakers at congresses in the fields of geology, exploration, and mineral economics.

The quality of research and the achievements of individual members of the Economic Geology Research Unit are reflected in the medals awarded: by the Geological Society, five Draper Memorial Medals, six Jubilee Medals, and six Corstorphine Medals; by the South African Biological Society, one Junior Captain Scott Medal; by the University of the Witwatersrand, one South African Association for the Advancement of Science Medal; by the South African Institute of Mining and Metallurgy, one Brigadier Stokes Memorial Medal; by the Geological Society of London, one William Smith Medal; and by the Society of Economic Geologists, two Lindgren Awards, one SEG Silver Medal, and one Penrose Gold Medal. Of the total of 25 medals won, four each were awarded to D.A. Pretorius, C.R. Anhaeusser, and M.J. Viljoen and two each to D.R. Hunter and R.P. Viljoen. Nine other members of the Unit won one medal each.

Such is the history of the original Economic Geology Research Unit which was founded by the Chamber of Mines in October, 1957, came into operation in June, 1959, was taken over by the University in January, 1968, moved off the campus in June, 1977, was split into two sections in March, 1989, and was finally disbanded in December, 1990. After the split, a successor Unit was established, which moved back to the campus, to become an integral part of the Department of Geology at the University of the Witwatersrand. The EGRU name lives on, and, under the Directorship of C.R. Anhaeusser, the new Unit, as did its predecessor, is discharging a commitment to advancing knowledge of South African geology and mineral deposits.

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D.A. Pretorius  
January, 1994

#### THE FOURTH PHASE OF EGRU: 1989 - 1993

On 8 March, 1989, began the transitional stages in the evolution of the original Unit towards a successor Unit. Whilst support for EGRU to continue remained encouraging it became clear that the Unit would have to adapt to the changed circumstances affecting the economy of the country as a whole as well as the diminishing fortunes of the Mining Industry and the University. With this realisation in mind a proposal for the future of EGRU was considered by the University in 1990 and the go ahead was given for its implementation during the years 1991-1995.

Rationalization of staff was seen to be essential in reducing costs and, with the support of Professor T.S. McCarthy, Head of the Geology Department, agreement was reached on the sharing of facilities and technical personnel. An ideal opportunity arose in 1989 for the Unit to relocate to the Geology and Mining Building on the East Campus of the University following the vacation of the Mining Department from their offices and workshop areas to new premises on the West Campus of the University. Also during 1989 the Earth Sciences Library vacated space in the same building and construction began on modifying the premises for EGRU office and storage usage. Unfortunately, the space initially proposed for EGRU had to be shared with the Department of Statistics who were also allocated offices in the same building and this resulted in difficulty being experienced in accommodating equipment, books, maps, and numerous other items that had accumulated in the original Unit over the past 30 years. The housing of rock collections also presented problems, with the Geology Department being inconvenienced by having to give up some of their storage area to EGRU.

Despite these difficulties the move of EGRU back to the Department of Geology proved to be successful and beneficial to both parties concerned. The principal benefit came about with the complete integration of staff and students and the initiation of multi-disciplinary research projects as well as the joint supervision of higher-degree students.

During 1989 and 1990 Professor D.A. Pretorius retained the Directorship of the Unit which continued as two operating sections. Professor Pretorius's section remained at "The Pines" in Parktown until it was disbanded on his retirement, as well as that of several other members of his staff, at the end of 1990. Also during this period Professor Anhaeusser continued as Deputy Director in charge of staff and students that made up the successor Unit's contingent and, on 1 July, 1989, was promoted to Ad Hominum Professor of Archaean Geology. Professor Anhaeusser was appointed Director of the Unit as from 1 January, 1991.

In recognition of his outstanding contributions to Economic Geology and for the almost 32 years of association with the Unit, the University of the Witwatersrand conferred on Professor Pretorius the titles of Professor Emeritus and Honorary Research Professorial Fellow for the period 1991-1994.

At the beginning of 1991 the restructured Unit consisted of a Director, two research officers, a secretary, and a laboratory hand, all funded by the University. The merger with the Department of Geology enabled the academic staff of the Unit to interact more closely

and to share more effectively the apparatus and the technical services available, including the rock thin-sectioning facility, the draughting and photographic services, as well as the X-ray fluorescence, fluid inclusion and stable isotope equipment. In addition, the Unit's financial matters, including the administering of EGRU funds and various staff and student grants, were controlled by an Administrative Officer permanently attached to the staff of the Geology Department.

As part of the merger arrangement the Unit agreed to contribute both financially and in terms of teaching and other services to the day to day activities in the Geology Department. Further, EGRU assisted with the co-ordination and promotion of earth science research and postgraduate studies in the two organizations and contributions were made to the day to day teaching and field excursions organized for students in the Geology Department. In addition, EGRU continued to contribute or arrange specialized courses and lectures for senior students in the Geology Department and for geologists associated with the South African mining industry.

The Unit also continued to promote the results of all the earth sciences research work undertaken in the combined EGRU/Geology Department, both in the existing Information Circular series and in local and international journals. Furthermore, EGRU attempted to promote closer liaison with the local geological and mining community (principally with mining companies linked to the Chamber of Mines of South Africa - who had supported EGRU's activities in the past by way of sponsorship) and the Geological Survey of South Africa. Both EGRU and the Department of Geology would, either singly or wherever appropriate together, attempt to assist the local geological community with research aimed at resolving particular problem areas of concern to the mining industry. Although an emphasis would initially be placed on research involving gold mineralization in its various geological settings, the Unit reserved the right to remain flexible so as to be able to address any geological or economic geological problem that arose or which attracted the interests of the staff and students available at any particular point in time. Finally, EGRU was to meet as regularly as deemed appropriate, with members of the Board of Control and the Consultative Committee, to ascertain the views of industry as to their research requirements.

With these aims and objectives the Unit embarked upon activities as it had done in years past, but with the added component of being able to interact with a wider variety of specialists in the Geology Department. This new initiative coincided, unfortunately, with a deepening depression in the state of the country's economy and, more particularly, in the fortunes of the South African mining industry. Whereas in the past the support for EGRU had been both moral and financial, the climate for research subvention deteriorated markedly, with fewer and fewer companies being prepared to grant aid for student projects unless these fell within their immediate areas of interest.

Offsetting some of this decline in financial support for the wide ranging geological interests being pursued by the Unit was funding made available for research by the Foundation for Research Development (FRD). An evaluation system, established by the FRD, enabled funds to be awarded to individuals or research teams (the latter comprising evaluated members) so that they might pursue their own interests and also those of higher degree students who qualified for studentship support. Depending upon the scientist's rating

the funding could also, in some cases, be sufficient to support one or more senior posts, thereby enabling scientists with specific skills and experience to be included in the research team. EGRU staff who qualified for FRD support were thus able to undertake research of their choosing but, wherever possible, this research was undertaken with a view to it being in the best interests of the mining industry and the country as a whole.

The support from the University and the FRD coincided with an increase in the degree of research accountability and competition for available funds. Prominent in this regard was the need to expand research output as recognition was increasingly based on the publication of results in accredited local and international journals for which subvention was also forthcoming from the Department of National Education.

### **Staff of EGRU**

The successor Unit, following the rationalization exercise, began early in 1989 with a depleted staff consisting of the Director (Prof. C.R. Anhaeusser) and the first FRD-funded Senior Research Associate (Dr. B. Cairncross). Mr. R.H. Boer joined EGRU on 1 March, 1989 as a Research Officer. Among the non-professional staff Mrs. J. Long, who had joined the Unit on the 20 October, 1986, continued as Secretary, and C. Njapha was appointed as a Laboratory Hand on 24 April, 1989.

Dr. Cairncross resigned from the Unit at the end of September, 1989 and was succeeded by Dr. M.C. Jackson who joined as the second FRD-funded Senior Research Associate from the beginning of August, 1990. Dr. W.U. Reimold also joined the Unit as Senior Research Officer as from 1 January, 1990, having been transferred to EGRU from the Schonland Research Centre of the University of the Witwatersrand. In March, 1991, Dr. J.F. Truswell joined the staff in terms of an arrangement between the Geological Society of South Africa, the Chamber of Mines of South Africa, and EGRU, with Dr. Truswell having been commissioned to write a new textbook on the "Geology of South Africa". Dr. Truswell's appointment terminates on 31 March, 1994. Dr. M.C. Jackson resigned at the end of December, 1992, his post being filled on 1 July, 1993, by Dr. A.F.M. Kisters, the third FRD-funded Senior Research Associate.

In the course of the fourth phase of EGRU's history 18 graduate geologists carried out research at the Unit for periods ranging from less than one year to more than 4 years. Visiting Research Fellows who contributed to the progress of research included Prof. C. Koeberl, T.J. Reynolds, Prof. R.J. Bodnar and Prof. H.L. Barnes.

### **Funding of the Unit**

From the time EGRU split into two separate divisions during the transitional phase of its existence in 1989 to the end of 1993, the Unit had access to an aggregate grand total of funding amounting to R3 555 687 for the 5 year period. When compared with the R281 000 for the first ten years (1957-1967), R886 000 for the second ten years (1968-1977), and R2 090 000 for the following 7 years to the end of 1984, the effects of inflation on the Unit's financial structure are dramatically brought into focus. A breakdown of the sources of EGRU's funding for the period 1989-1993 indicates that the University contributed

R2 189 851 (61,6 per cent), the FRD R672 137 (18,9 per cent) and other sources (including the Chamber of Mines, individual mining companies, and the Geological Survey) R693 699 (19,5 per cent). If the Chamber of Mines support for the salary and operational expenses dedicated to Dr. J.F. Truswell for his writing of the textbook on the "Geology of South Africa" is deducted from the "other sources" of funding the contributions from mining industry subventions and contract research drops by R253 600 to R440 099. This amounts to 12,3 per cent of EGRU's total support from the individual mining companies - a decline of 15,7 per cent from the 28 per cent enjoyed by the Unit in the third phase of its history.

### **Communication of Research Results**

In the fourth phase of EGRU's operational history 69 Information Circulars and 4 Annual Reports were published between March, 1989 and February, 1994. Miscellaneous Reports (as defined earlier on page 9) totalled 178 reports while 66 papers were either published, in press, or submitted for publication to internationally or locally recognized (DNE accredited) journals. During this period 3 Ph.D theses and 2 M.Sc dissertations were also completed by students associated with the Unit. In addition the Unit's staff were responsible for the editing or writing of 3 books. A fourth book on the "Geology of South Africa" is nearing completion and will be with the printers towards the middle of 1994.

Historically, EGRU's Information Circulars were distributed on a mailing list to local and international mining companies, geological research organizations and universities, as well as to scientists that had been associated with the Unit over the years. The service was provided free of charge for over 34 years. However, because of the marked decline in EGRU's subvention from the mining industry, it became clear that the Information Circular Series would have to be curtailed or even discontinued. A directive from the Board of Control that a charge be levied, in the form of a subscription, received good support when first implemented in 1993.

### **Undergraduate Teaching**

Professor Anhaeusser and Dr. Reimold contributed annually to the undergraduate teaching of students in the Department of Geology. Staff and senior students also contributed lectures or talks at Colloquia held in the Geology Department.

### **Postgraduate Instruction**

From 1989 to the end of 1993 members of the Unit's staff acted as supervisors or co-supervisors of 14 candidates registered for higher degrees (12 M.Sc and 2 Ph.D candidates). EGRU continued to contribute to, as well as assist with, the organization of postgraduate short-courses to participants from the mining industry and from universities. Some short-courses were presented at the request of individual mining companies and were specifically tailored for their requirements, while others were open to participation of the geological community at large. The topics presented in the latter category included hydrothermal fluids and the deposition of ore minerals with an emphasis on gold, silver and copper (Prof. H.L. Barnes, Pennsylvania State University, U.S.A.), instrumental neutron activation analysis (Prof. C. Koeberl, Univ. Vienna, Austria), the application of fluid inclusions to minerals

exploration and the understanding of ore deposits (T.J. Reynolds, Denver, Colorado, U.S.A.), and the application of synthetic fluid inclusions in experimental geochemistry (Prof. R.J. Bodnar, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, U.S.A.). A total of 9 short-courses were organized during the period under review. In addition, the staff of the Unit acted as guides on numerous field excursions organized at the request of mining companies to areas where EGRU staff or students were carrying out field studies. This included the organization of, and participation in, a Geological Society of South Africa Summer Field School to examine the Archaean Kraaipan successions and granites in the southwestern Transvaal, northwestern Cape Province and Bophuthatswana (November, 1991).

### **Fields of Study Involving EGRU Staff and Students**

The successor Unit continued to address research problems within the framework previously determined in its earlier history and where gold mineralization remained of specific interest to the mining industry. Ongoing studies relating to the Witwatersrand Basin included sedimentological and lithostratigraphic investigations of the West Rand Group in the Klerksdorp Goldfield (Dr. B. Cairncross); fluid inclusion studies in quartz veins and pebbles in Witwatersrand sediments (G.R. Drennan); an evaluation of the Vaalrand region between Heidelberg and Villiers (Prof. C.R. Anhaeusser); structural, geochemical, and chronological studies relating to Witwatersrand tectonics and the development of pseudotachylites in the central part of the Witwatersrand Basin, including the Vredefort Dome (Dr. W.U. Reimold); an evaluation of the Dominion Group of rocks on the Kaapvaal Craton and their influence and implications for the tectonic setting of the Witwatersrand Supergroup (Dr. M.C. Jackson); and research centred on the study of hydrothermal vein systems in the Elandsrand and Vaal Reefs Gold Mines, including fluid studies and  $^{40}\text{Ar}$ - $^{39}\text{Ar}$  dating of VCR-related pseudotachylite (Dr. W.U. Reimold, R.H. Boer and Dr. M.C. Jackson).

Continued work in the Transvaal Basin centred largely around the studies relating to the determination of the physico-chemical conditions of ore-formation, ore fluids, wall rock/fluid interaction, and the vertical evolution of fluids from the Archaean basement upwards to the Pretoria Group in the Pilgrim's Rest-Sabie Goldfield. An expansion of this study into other areas, such as the Malmani Goldfield was also undertaken (R.H. Boer).

Studies in the Archaean basement included a re-evaluation of the geology structure, granite evolution and mineralization potential of the Kraaipan Group in the northwestern Cape, Bophuthatswana and the Western Transvaal (Prof. C.R. Anhaeusser, O.T. Zimmermann and I.M. Jones); the structure and geology of the Kaapmuiden-Three Sisters area of the Barberton greenstone belt (E.A. Kohler); the geology and geochemistry of the Stolzburg and Rosentuin layered ultramafic intrusions, Barberton greenstone belt (Prof. C.R. Anhaeusser and J.E. Rodel); the Sterkspruit mafic intrusion, Badplaas area, eastern Transvaal (Prof. C.R. Anhaeusser and G.P. Conway); studies of the komatiite flow sequences and metasedimentary units found in the Schapenburg greenstone remnant, Barberton Mountain Land (Prof. C.R. Anhaeusser and I. Allen); investigations of the Goudplaas gneiss terrane in the Southern Marginal Zone of the Limpopo Belt (Prof. C.R. Anhaeusser); structural studies in the Murchison granite-greenstone terrane (Prof. C.R. Anhaeusser and Dr. R.C.A. Minnitt); structural studies in the Barberton granite-greenstone terrane (Dr. A.F.M. Kisters

and Prof. C.R. Anhaeusser); several projects on the Johannesburg granite dome, including geological, petrological and geochemical studies of the Zandspruit and Edenvale-Modderfontein granite-greenstone areas and gold mineralization in the Midrand area (Prof. C.R. Anhaeusser); studies in the Vredefort Dome area, involving the structure and geochemistry of Archaean greenstones and mafic/ultramafic intrusions, and investigations of the collar rocks around the Dome (Dr. W.U. Reimold, Dr. R.C.A. Minnitt, Dr. M.C. Jackson, and G. Pybus); and studies of the geochemistry and chronology of the pre- and post-Pongola granitoids in northeastern Natal (Dr. W.U. Reimold).

Researches in Namaqualand were centred mainly around structural studies relating to the occurrence and development of the economic copper-bearing host rocks in the Okiel Copper District. This involved field and underground mapping and the evaluation of steep structure and megabreccia development (Dr. A.F.M. Kisters and Prof. C.R. Anhaeusser).

Studies in the hinterland of the Witwatersrand Goldfield involved an examination of the geology of the Gaborone Granite and Kanye Volcanic Formation in southeastern Botswana (Dr. M.C. Jackson and K. Lowe).

Other projects undertaken by the staff and students of the Unit included the setting up of a new stable isotope extraction and fluid inclusion microthermometry facility in the Department of Geology (R.H. Boer) and investigations of impact structures resulting from meteoritic bombardment of the earth, including the Vredefort and Pretoria Saltpan areas and the Kalkkop Crater (Dr. W.U. Reimold and D. Brandt).

These and a number of other research projects undertaken at EGRU over the past 5 years were done in collaboration with members of staff of the Departments of Geology and Geophysics at the University of the Witwatersrand including: Prof. L.J. Robb, Dr. F.M. Meyer, Dr. C.B. Smith, Prof. R.G. Cawthorn, Dr. E.G. Charlesworth, Dr. T. Wallmach and Dr. R. Gibson. Numerous collaborators, locally and from abroad were also involved in the research programmes, some of whom included Prof. C. Koeberl, Dr. G. Gruau, Prof. P.R. Matthews, Dr. W.P. Colliston, Dr. F. Walraven, Prof. S.E. Kesler, Dr. T.W. Vennemann, Dr. J.R. Graney, Prof. E.K. Jessberger, Prof. R.J. Bodnar and Dr. M. Trieloff.

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C.R. Anhaeusser  
February, 1994.

## APPENDIX

### ECONOMIC GEOLOGY RESEARCH UNIT OFFICE BEARERS AND STAFF

#### CHAIRMAN - BOARD OF CONTROL

1959 - 1967*	
1968 - 1973	Prof. S.P. Jackson
1974 - 1978	Dr. N. Stutterheim
1979	Prof. R.P. Plewman
1980 - 1982	Prof. R.W. Charlton
1983 - 1984	Prof. P.D. Tyson
1985 -	Prof. J.P.F. Sellschop

\* Overall research programme of the Unit formulated by the Consultative Committee of the Unit, composed of members of the Transvaal and Orange Free State Chamber of Mines, the gold mining industry and the Department of Geology, University of the Witwatersrand.

#### DIRECTORS

1959 - 1965*	Prof. T.W. Gevers, Prof. E. Mendelsohn and Mr. D.A. Pretorius
1966 - 1990	Prof. D.A. Pretorius
1991 -	Prof. C.R. Anhaeusser

\* EGRU administered by D.A.P. while general policy and overall planning the responsibility of T.W.G., E.M. and D.A.P.

#### DEPUTY DIRECTOR AND READER

1979 - 1991	C.R. Anhaeusser
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#### SENIOR RESEARCH FELLOWS/OFFICERS

1959 - 1965	D.A. Pretorius
1970 - 1979	C.R. Anhaeusser
1974 - 1977	A. Button
1970 - 1975	D.R. Hunter
1983 - 1987	L.J. Robb
1979 - 1982	W.D. Newham
1981 - 1982	J.S.I. Schwellnus
1982 - 1987	G. Grohmann
1990 -	W.U. Reimold

### **RESEARCH FELLOWS/OFFICERS**

1959 - 1968	C. Roering
1959 - 1961	R.B. Hargraves
1961 - 1965	H. de la R. Winter
1964 - 1970	C.R. Anhaeusser
1968 - 1974	A. Button
1968 - 1970	P.A. Esselaar
1973	D.H. Lenthall
1975 - 1979	R.C.A. Minnitt
1980 - 1983	L.J. Robb
1984 - 1987	F.M. Meyer
1989 -	R.H. Boer

### **SENIOR RESEARCH ASSOCIATES**

1988 - 1989	B. Cairncross
1990 - 1992	M.C. Jackson
1993 -	A.F.M. Kisters

### **SENIOR TEMPORARY STAFF**

1982 - 1985	Prof. C. Roering (Visiting Research Professor)
1989 - 1990	Dr. J.F. Truswell (Senior Research Assistant)
1991 - 1994	Dr. J.F. Truswell (Senior Research Fellow)

### **HONORARY STAFF**

1991 -	Prof. D.A. Pretorius - Professor Emeritus and Honorary Research Professoriala Fellow
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### **VISITING RESEARCH FELLOWS**

1959 - 1960	Dr. A.O. Fuller (University of Cape Town)
1961	Prof. J.G. Ramsay (Imperial College, London)
1965	Prof. H.D. Pflug (University of Giessen, West Germany)
1965	Prof. P.E. Cloud (University of California, Los Angeles, California, U.S.A.)
1965	Prof. A.E.J. Engel (University of California, La Jolla, California, U.S.A.)
1971	Prof. L.L. Sloss (Northwestern University, Illinois, U.S.A.)
1971	Mr. W.B. Myers (U.S. Geological Survey, Denver, Colorado, U.S.A.)
1971	Prof. B. Nagy and Dr. L. Nagy (University of Arizona, Tucson, Arizona, Canada)

**VISITING RESEARCH FELLOWS (continued)**

1972	Prof. H.R. Wynne-Edwards (Queen's University, Kingston, Ontario, Canada)
1973	Prof. W.K. Hamblin (Brigham Young University, Provo, Utah, U.S.A.)
1974	Prof. R.W. Hutchinson (University of Western Ontario, London, Ontario, Canada)
1974	Dr. F. Barker (U.S. Geological Survey, Denver, Colorado, U.S.A.)
1975	Prof. S.A. Schumm (Colorado State University, Fort Collins, Colorado, U.S.A.)
1976	Prof. J. Guilbert (University of Arizona, Tucson, Arizona, U.S.A.)
1976	Prof. B. Nagy (University of Arizona, Tucson, Arizona, U.S.A.)
1977	Prof. L.B. Gustafson (Australian National University, Canberra, Australia)
1978	Prof. R. Saager (University of Cologne, West Germany)
1978	Dr. A. Button (Campbell College, North Carolina, U.S.A.)
1978	Prof. R.W. Hutchinson (University of Western Ontario, London, Ontario, Canada)
1979	Prof. R. Saager (University of Cologne, West Germany)
1979	Prof. K.L. Williams (University of Sydney, Australia)
1979	Prof. W.M. Schwerdtner (University of Toronto, Canada)
1981	Prof. S.D. Scott (University of Toronto, Canada)
1981	Dr. S. Adams (Consultant, Colorado, U.S.A.)
1982	Prof. R. Saager (University of Cologne, West Germany)
1982	Prof. S.D. Scott (University of Toronto, Canada)
1983	Prof. R. Saager (University of Cologne, West Germany)
1983	Prof. R.W. Ojakangas (University of Minnesota, Duluth, Minnesota, U.S.A.)
1983	Dr. N. Tyler (Bureau of Economic Geology, Austin, Texas, U.S.A.)
1987	Dr. P. Landais (CREGU, Nancy, France)
1989	Dr. G. Gruau (University of Rennes, France)
1990	Prof. H.L. Barnes (Pennsylvania State University, U.S.A.)
1991	Mr. T.J. Reynolds (Fluid Inc., Denver, Colorado, U.S.A.)
1991	Prof. R.J. Bodnar (Virginia Polytechnic and State University, Blacksburg, Virginia, U.S.A.)
1992 - 1993	Prof. C. Koeberl, (University of Vienna, Austria)

**EGRU STAFF, STUDENTS AND ALUMNI  
AWARDS FOR PUBLICATIONS, THESES AND ACHIEVEMENTS  
1959 - 1994**

**THE GEOLOGICAL SOCIETY OF SOUTH AFRICA**

**Draper Medal** (*for outstanding contributions to advancing geological knowledge of Southern Africa*)

- 1977 D.A. Pretorius  
1984 M.J. Viljoen and R.P. Viljoen  
1987 C.R. Anhaeusser

**Jubilee Medal** (*for the best paper published during the year in the "Transactions" or "South African Journal of Geology"*)

- 1970 D.R. Hunter  
1974 A. Button  
1977 C.R. Anhaeusser  
1983 L.J. Robb and C.R. Anhaeusser  
1989 R.W. Hutchinson and R.P. Viljoen  
1991 L.J. Robb, F.M. Meyer, M.F. Ferraz and G.R. Drennan

**Corstorphine Medal** (*for the best thesis submitted during the year to a South African University*)

- 1963 L.S. Steyn  
1964 M.J. Viljoen  
1968 C. Comins née McLachlan  
1975 R.C.A. Minnitt  
1980 M. Wuth  
1981 A. Clay  
1992 S.W. Kedda

**Honours Award** (*for outstanding contributions to the Geological Society of South Africa and the Geological Fraternity in South Africa*)

- 1982 C.R. Anhaeusser  
1991 R.P. Viljoen

**A.L. du Toit Memorial Lecture**

- 1973 D.A. Pretorius  
1993 D.R. Hunter

**Presidents**

1985 C.R. Anhaeusser  
1986 R.P. Viljoen  
1988 M.J. Viljoen

**Honorary Secretaries**

1972-1974 D.R. Hunter

**Honorary Editors**

1983 - C.R. Anhaeusser

**SOUTH AFRICAN INSTITUTE FOR MINING AND METALLURGY**

**Brigadier Stokes Memorial Medal**

1993 D.A. Pretorius

**GEOLOGICAL SOCIETY OF LONDON**

**William Smith Award**

1990 D.A. Pretorius

**SOUTH AFRICAN BIOLOGICAL SOCIETY**

**Junior Captain Scott Medal**

1964 M.J. Viljoen

**SOCIETY OF ECONOMIC GEOLOGISTS, U.S.A.**

**The Penrose Gold Medal Award** (*for recognition of a full career in the performance of unusually original work in the earth sciences*)

1989 D.A. Pretorius

**The Society of Economic Geologists Silver Medal Award** (*for excellence in original work in the geology of mineral deposits*)

1988 C.R. Anhaeusser

**Lindgren Award** (*for published research representing an outstanding contribution to economic geology*)

1978 M.J. Viljoen and R.P. Viljoen

**SEG Distinguished Lecturer** (*selected on the basis of pre-eminence in economic geology*)

1973 D.A. Pretorius

**SOUTH AFRICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE**  
*(medal for the best thesis submitted at a university in South Africa)*

1987 T.R. Marshall

**HIGHER DEGREES AWARDED**

**D.Sc.**

1. C.R. Anhaeusser (1983)

**Ph.D's**

- |                              |                           |
|------------------------------|---------------------------|
| 1. D.A.M. Smith (1962)       | 13. R. Mason (1970)       |
| 2. C. Roering (1964)         | 14. M.J. Viljoen (1970)   |
| 3. A.T. Mehliss (1964)       | 15. R.P. Viljoen (1970)   |
| 4. H. de la R. Winter (1965) | 16. W.E.L. Minter (1973)  |
| 5. J.F. Wilson (1966)        | 17. A. Button (1973)      |
| 6. D. McN. McKinnon (1967)   | 18. K.A. Eriksson (1978)  |
| 7. D.R. Hunter (1968)        | 19. R.C.A. Minnitt (1979) |
| 8. P.J. Ryan (1968)          | 20. M.B. Watchorn (1981)  |
| 9. C.R. Anhaeusser (1969)    | 21. L.J. Robb (1981)      |
| 10. W.B. Hempkins (1969)     | 22. T.R. Marshall (1990)  |
| 11. J.F.M. Sims (1969)       | 23. R.E. Myers (1990)     |
| 12. D.A. Pretorius (1970)    | 24. A.F.M. Kisters (1993) |

**M.Sc's**

- |                           |                                    |
|---------------------------|------------------------------------|
| 1. C. Roering (1960)      | 10. E.J. Poole (1965)              |
| 2. N.C. Gay (1963)        | 11. G.C. Armstrong (1965)          |
| 3. C.R. Anhaeusser (1964) | 12. L.A. Collins (1967)            |
| 4. M.J. Viljoen (1964)    | 13. A.G. Knowles (1967)            |
| 5. L.S. Steyn (1964)      | 14. C. Comins née McLachlan (1968) |
| 6. R.P. Viljoen (1964)    | 15. A. Button (1968)               |
| 7. D.M.V. Manson (1964)   | 16. D.H. Jones (1969)              |
| 8. P.J. Ryan (1964)       | 17. D.H. Lenthall (1970)           |
| 9. H.V. von Rahden (1964) |                                    |

**M.Sc's (continued)**

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|-----|-------------------------|-----|----------------------|
| 18. | K.A. Eriksson (1979)    | 28. | M. Wuth (1981)       |
| 19. | C.J.B. Dreyer (1975)    | 29. | A.N. Clay (1981)     |
| 20. | R.C.A. Minnitt (1975)   | 30. | T.R. Marshall (1987) |
| 21. | P.E. Paizes (1976)      | 31. | G.R. Drennan (1988)  |
| 22. | B.A. Wyatt (1976)       | 32. | M.F. Ferraz (1989)   |
| 23. | M. Kübler (1977)        | 33. | R. Tyler (1989)      |
| 24. | L.J. Robb (1977)        | 34. | S.W. Kedda (1992)    |
| 25. | N. Tyler (1978)         | 35. | J.E. Rodel (1993)    |
| 26. | R.F. Tucker (1980)      |     |                      |
| 27. | P. Camden-Smith* (1980) |     |                      |

\* P. Camden-Smith was awarded an M.Sc. degree at the University of Cape Town (1980), but undertook much of his research whilst a Research Assistant at EGRU during the period 1978-1979.

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