

OFFICERS OF 42ND GEOLOGICAL SECTION, SOUTH AFRICAN ENGINEER CORPS: GEOLOGISTS AND GEOPHYSICISTS WHO CREATED A UNIQUE UNIT THAT SUPPORTED THE BRITISH ARMY DURING THE SECOND WORLD WAR

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Abstract

Within British and Commonwealth forces of the Second World War, 42nd Geological Section was the only unit in which geologists and geophysicists deployed as a team into campaign areas. Water supply was a problem in many arid or semi-arid regions, and the section used geophysical methods (primarily surveys by electrical resistivity) to locate optimum sites for drilling boreholes to abstract potable groundwater – methods utilised also by the German Army but not otherwise by the British. Mobilised in August 1940, the section was operational first in East Africa and subsequently North Africa, the Middle East and the Mediterranean region until the end of the war. By September 1943, its core strength comprised five officers and 33 other ranks, commonly and widely deployed as detachments of one officer plus about seven other ranks. In total, thirteen officers are known to have served with the section, the first three from the Geological Survey of South Africa. Most were exceptionally well qualified and many achieved distinction in their civilian careers after the war. The section provides a little-known example of the significant specialist skills contributed by the South African Engineer Corps to the Allied war effort.

Introduction

During the Second World War, as during the First, many military units were formed to support the British Army by recruitment of men with specialist engineering skills. Some engineering units initially comprised officers and men recruited directly from civilian organisations with equivalent technical functions. Put in uniform although given minimal military training, they provided skilled support essential to the combat troops in campaign areas. Examples of such units raised within the Royal Engineers (the 'RE') include –

- boring sections that drilled wells to secure or enhance water supplies in key military locations;
- quarrying companies that produced the aggregate necessary to repair or enhance road and rail supply routes and to construct temporary airfields rapidly; and
- tunnelling companies that excavated military facilities underground safe from artillery or aerial bombardment.¹

Specialist units were similarly raised within the South African Engineer Corps (the 'SAEC'). These included 42nd Geological Section, important as in 1940, the first geological team ever to be raised in support of the British Army and until 1943 the only such team in existence.² Moreover, it was the only geological team ever to support British forces through operational deployment in campaign areas and the only team to support British forces in wartime by means of geophysical survey.

This account is focused on the officers who founded the section in South Africa and who developed it on campaign first in East Africa, subsequently in North Africa, the Mediterranean region and the Middle East. Since such specialist engineering skills might well be required in future arid-zone conflicts it addresses several questions:

- Who were the officers?
- Which qualifications made them suitable for appointment?
- Did their careers after the war indicate that they were men of particular ability?

For brevity, the question of what they actually did must be addressed in a separate publication.³

Foundation of the section

According to its official War Diary, 42nd Geological Section SAEC was mobilised at Zonderwater in August 1940.⁴ Zonderwater, near Cullinan and some 35 km east of Pretoria, was at that time, the Engineer Training Centre: a desolate camp where "almost every man who served in the SAEC started his full-time soldiering".⁵

Formation of the section at this particular time reflects Italy's entry into the war as an ally of Germany on 10 June 1940, following German victories in Western Europe.⁶ The Italians hoped to make territorial gains at the expense of British and French colonies in Africa, and soon attacked British and Commonwealth forces in Sudan, Kenya and British Somaliland. All of Somaliland had been overrun before the end of August. Moreover, on 13 September, Italian forces in Libya began to attack eastwards into Egypt. To support the United Kingdom (UK), South Africa had declared war on Germany on 6 September 1939, but its early contribution to the British war effort had been limited. However, the Italian actions of 1940 stimulated a greater response, including expansion of the SAEC – a corps established as such only in 1922. This had started the war with 54 officers and 585 other ranks, but expanded soon afterwards to about 250 officers and 7 250 other ranks in 36 units, including two boring sections and one water supply company.⁷ During hostilities, its strength rose to some 16 000 men, belonging to over 70 different units – including 42nd Geological Section.

From February to June 1940, those engineer units already in existence were called up in turn for one month's continuous training prior to being deployed for full-time service. "From June onwards engineer units were called up and new units formed as fast as training facilities and equipment became available."⁸ Also in June, the first SAEC units left South Africa for operational deployment in Kenya, elements of a water supply company amongst them. Soon afterwards, 42nd Geological Section was duly mobilised at Zonderwater on 26 August, and left on 26 September, having thus completed the training then standard for engineer units.⁹

Water supply was perceived to be a potential problem for troops operational in arid or semi-arid combat areas. The role envisaged for the section was that it would use geophysical methods to prospect for potable groundwater, and that groundwater would be exploited by drilling boreholes in those regions where surface water supplies were inadequate for military needs. At the sites recommended, 36th Drilling Company SAEC would drill boreholes. The geophysical methods comprised two techniques whose principles had become widely known before the war but whose applications had been developed by the Geological Survey of South Africa: surveys by means of electrical resistivity (Figure 1) and also by vertical force magnetometer.¹⁰ The German Army had employed electrical resistivity surveys in prospecting for groundwater from even earlier in the war, but it was not a technique used by the British Army or to a significant extent by the Geological Survey of Great Britain.¹¹

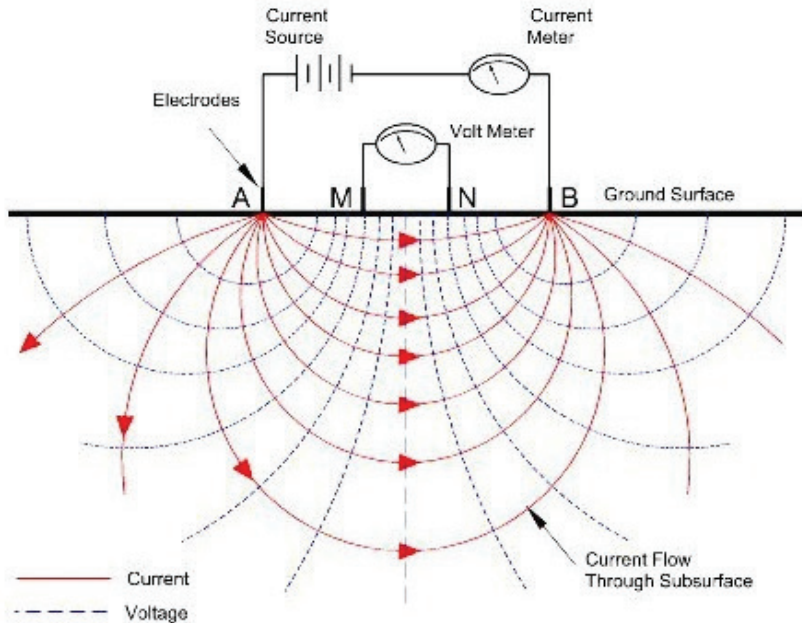


Figure 1^a. Basic principles of ground survey by means of electrical resistivity¹²

The official manpower ‘establishment’ for 42nd Geological Section on mobilisation is not recorded in its initial War Diary. However, by September 1943, it is known to have comprised five officers and 33 other ranks (Table 1), plus a lance corporal, a private and five local drivers/batmen attached in supporting roles.¹⁴ From War Diary entries and published accounts, it seems that it functioned at about this strength for the five years 1940 to 1945. During that time, the section operated by deploying detachments from its headquarters base. A detachment for resistivity survey typically comprised one officer, two technically qualified non-commissioned officers (NCOs), four ‘labourers’ (one to move each of the four electrodes shown on Figure 1), plus a spare ‘labourer’, and drivers and cooks as required.¹⁵

Table 1. Establishment of 42nd Geological Section at 21 September 1943.¹⁶

No.	Rank	Role
1	Major	Geologist
2	Captains	Geologists
1	Captain	Geophysicist
1	Lieutenant (Lt)	Physicist
1	Warrant officer class 2	Laboratory technician geological
4	Staff sergeants	Laboratory technicians geological
3	Sergeants	Laboratory technicians geological
2	Corporals	Laboratory technicians geological
1	Corporal	Electrician
1	Corporal	Clerk
1	Lance corporal	Clerk
1	Corporal	Surveyor’s mate
1	Lance corporal	Surveyor’s mate
10	Sappers	Surveyor’s mates
1	Corporal	Motor mechanic
3	Sappers	Motor mechanics
3	Sappers	Fitter’s mates
1	Lance corporal	Cook

^{1a} A measured current from a battery source is passed into the ground between metal rods driven into the ground to form electrodes A and B, and the potential difference is measured between similar rods forming electrodes M and N. This provides information on the electrical resistivity of the subsurface rocks through which the current is passing. By increasing the spacing of electrodes, information can be gained on rocks at increasing depth (‘electrical drilling’). By maintaining a constant spacing but moving the set of electrodes according to a grid pattern, information can be gained on variation in rocks at constant depth within the surveyed area (‘electrical mapping’).¹³

Geological aspects of the work of this unique unit have been mentioned in two presidential addresses to the Geological Society of South Africa,¹⁷ in a series of publications immediately after the war describing water supply in the Middle East campaigns,¹⁸ and in three more recent publications.¹⁹ Information gleaned from these sources is supplemented with data from the unpublished War Diaries of 42nd Geological Section and of the contemporary ten boring sections RE to demonstrate here that 13 officers (Table 2), many of them men of particular ability, led the section and thereby pioneered the use of geophysics in prospecting for groundwater for the British Army.

Table 2^b. Officers known to have served with 42nd Geological Section, in ranks and 1940s, years indicated.

Name	Birth–Death	Ranks	40	41	42	43	44	45
Herbert Francis Frommurze	1899–1960	Major	[Aug	Aug]				
Gordon Lyall Paver	1913–1988	Capt/Major	[Aug	+	+	+	+	+]]
Douglas James Simpson	1912–1991	2Lt/Capt	[Aug	+	+	late]		
Howard Digby Roberts	1913–1971	2Lt/Capt	[Sep	+	+	+	+	+]]
D. B. O’Shea	not known	Lieut	[Oct	Feb]				
E. R. Wilders	not known	Lieut/Capt	[Oct	May]				
Anton Linder Hales	1911–2006	2Lt/Lieut	[Dec	+	+			
Albert Huddleston	1914–1961	2Lt/Lieut		[+]				
Rupert Borchers	1908–1997	2Lt/Lieut		[+	+	+]]		
Donald McNally McKinnon	1913–1992	Sgt/Lieut	[x	x	x	+		
Graham Charles Lloyd Clarke	1912–2009	Sgt/Capt			[x	+	late]	
Andrew Osmund Thompson	1920–2006	Lieut					[early	+]]
[Nathan] Lowenstein	[1918–1982]	Lieut				[Oct	+	

^{2b} Square brackets and month = start and end dates of service where known; + = year of known commissioned service with the section; x = year of known service, not initially commissioned; first name and so dates for Lowenstein lack confirmation.

Mobilisation in South Africa

With the assistance of the director of the Geological Survey of South Africa, Dr SH Haughton, 42nd Geological Section had formed and was led initially by three men appointed from the staff of the Survey: HF Frommurze, DJ Simpson and GL Paver (Table 2).²¹ They were soon to be joined by a mining geologist, H Digby Roberts.

At that time, Herbert Frommurze was the head of the Survey's groundwater and geophysics group.²² Born in Cape Town, he had graduated from Transvaal University College, Pretoria, in 1921. He soon joined the Survey and from 1930 worked principally on water supplies. In 1936, he was awarded a DSc degree for a thesis on the water-bearing properties of the major geological formations in South Africa, based on the records of some 22 000 boreholes. This was soon published as a Survey memoir.²³ Moreover, he was to become President of the Geological Society of South Africa in 1942 and his presidential address focused on the "scientific methods of water finding".²⁴ It is thus evident that he was a hydrogeologist of considerable experience and standing at the time of his appointment to lead 42nd Geological Section. He served in the early months in the rank of acting major but in February 1941, he was promoted to the rank of temporary major, with effect from 1 November 1940.²⁵ He was recalled to the Survey at the end of August 1941, as 42nd Geological Section prepared to move from East to North Africa.

Gordon Paver was one of the first two geophysicists to have joined the Survey's staff in 1934.²⁶ Earlier that year, he had graduated in England from Pembroke College in the University of Cambridge, having studied chemistry, mineralogy and geology, but achieved a BA degree with only 3rd class honours.²⁷ Based on his Survey work, he completed a PhD in South Africa on magnetic anomalies in South Africa and their correlation with geological and mineralogical occurrences, finalised some two years after his war service had begun.²⁸ He was serving within 42nd Geological Section in the rank of acting captain by October 1940, and was promoted to temporary captain with effect from 1 November.²⁹ He was later to be twice 'Mentioned in Despatches' for meritorious service, first as a captain after Allied victory in the East African Campaign (in 1941) and second as a major after victory in North Africa (in 1943).³⁰ As a temporary major, he was appointed MBE (a Member of the Most Excellent Order of the British Empire) in 1944.³¹ The War Diary of No. 5 Boring Section RE drilling in Egypt records a visit by him on 7 November 1945, confirming that he was still serving in the Geological Section and as a major, for some months after the hostilities of World War II had ended.³²

Douglas Simpson was the second of the two geophysicists to be appointed to the Survey in 1934.³³ Born in Kimberley, he had achieved an MSc degree at the University of Cape Town in 1933 (a DSc was to follow, in 1952).³⁴ Like Paver, he also completed a geophysics PhD thesis based on Survey work, and finalised this after his war service had begun.³⁵ Like Frommurze, he was to become President of the Geological Society of South Africa after completion of war service: his address on "water and warfare" was to become an authoritative source of information about 42nd Geological Section.³⁶

He also was serving within it by October 1940, although only in the rank of second lieutenant (2Lt).³⁷ Promoted to the rank of temporary lieutenant with effect from 26 February 1941, and later captain, he was 'Mentioned in Despatches' following his release from military duties to return to the Survey late in 1943, the year in which Allied forces achieved final victory in North Africa.³⁸

Digby Roberts was born in India, at the important hill station of Kalimpong in West Bengal.³⁹ He later graduated in England as an Associate of the Royal School of Mines, so from the Imperial College of Science and Technology, and with a BSc degree from the University of London, of which Imperial College was then a constituent college.⁴⁰ He registered at the Royal School as a mining geologist from 1931 to 1938; worked from 1936 to 1939 for the Anglo-American Corporation in Northern Rhodesia (now Zambia); was an Associate of the Institute of Mining and Metallurgy in the United Kingdom; and from 1940 to 1946 served in the South African Engineer Corps, finally in the rank of major.⁴¹ He was 'Mentioned in Despatches' contemporaneously with Simpson,⁴² who noted that Digby Roberts joined 42nd Geological Section before it left South Africa (thus in September 1940).⁴³ Its War Diary confirms that Roberts arrived in Kenya on 10 October with the vehicles of the unit, in the rank of 2Lt.⁴⁴ There is ample evidence both from the War Diaries of Boring Sections RE and from some of Paver's publications on water supply in the Middle East campaigns that Digby Roberts served with 42nd Geological Section until the end of the war, for much of that time having been promoted to the rank of captain.

Thus the core leadership of 42nd Geological Section was formed from the geophysical branch of South Africa's Geological Survey: three men who had developed their technical skills by working together over the previous six years, and continued to do much the same thing in uniform as they had done in civilian life. All four officers had many years of university education and professional experience that had formed them into competent geoscientists. A month at Zonderwater had seemingly transformed them also into trained soldiers, 'officers and gentlemen'.

Operational deployment in East Africa

On 26 September 1940, 42nd Geological Section left Zonderwater by rail and embarked at Durban for northward movement by troopship to Kenya, where its headquarters were established near the capital city, Nairobi.⁴⁵ There "a succession of geologists ... joined the Unit either for training or to be with a geological unit".⁴⁶ Entries in its War Diary record specifically that four new officers joined the section in East Africa (Table 2):

- Lt DB O'Shea from 7 October 1940;
- Lt ER Wilders from 24 October;
- 2Lt AL Hales from 17 December; and
- 2Lt A Huddleston in succession to O'Shea on 12 February 1941.

Other entries indicate that they were all soon actively participating in the work of the unit, as detachments prospected for groundwater in regions that would facilitate the concentration and advance of British and Commonwealth troops within Kenya, and thereafter operations in Abyssinia (Ethiopia) and Somaliland.

Lt O'Shea was attached to the section from the Water Unit of the East Africa Force.⁴⁷ A War Diary entry for 3 March 1941 shows (inconsistently with an earlier record) the date of his attachment as 14 rather than 7 October 1940; that he came from the East African Engineers; and that he ceased to be attached on 12 February 1941 on transfer to CRE (Command Royal Engineers) Kenya North.

Lt Wilders was attached to the section from 54 Field Company of the East Africa Engineers according to an early entry in the War Diary, from 1 Field Company according to a later entry.⁴⁸ He is recorded as 'Captain Wilders' by 1 December 1940, so had been promoted quickly. He ceased to be attached with effect from 24 May 1941, on posting to an Engineer Transport Unit.

Anton Hales was born in Mossel Bay, in the Cape Province of South Africa.⁴⁹ He graduated from the University of Cape Town with a BSc in physics and mathematics at the age of 18, then an MSc at 19, and took up appointment as a junior lecturer in mathematics at the University of the Witwatersrand in Johannesburg in 1931 at the age of only 20. However, after one year in post, he was awarded a scholarship to study mathematics in England at the University of Cambridge, where he graduated from St John's College in 1933. He returned to South Africa, as a junior lecturer and eventually senior lecturer in applied mathematics at the University of the Witwatersrand. While there, his research focused primarily on geophysics and on seismology, for which he received a PhD degree from the University of Cape Town in 1936. Appointed to 42nd Geological Section as a second lieutenant, he arrived "from the South" (i.e. South Africa) on 17 December 1940, and was later promoted to the rank of temporary lieutenant, with effect from 4 May 1941.⁵⁰ Simpson records that he continued to serve even after the unit had moved from East to North Africa, where the "instrumental side" of the section was under his control.⁵¹

Albert Huddleston was born in northern England, at Millom in Cumberland.⁵² In 1937, he graduated from the University of Durham, with first-class honours in geology, and began employment in Africa as a geologist with Gold Coast Selection Trust, moving to an appointment with the Gold Coast Geological Survey in 1939. However, in June 1939, as war loomed, he was commissioned into the Royal West African Frontier Force and was subsequently to serve in East Africa with West African, East African and South African engineer units until he was demobilised in 1944, in the rank of captain. He was appointed to serve with 42nd Geological Section, as a lieutenant, in February 1941, and remained in East Africa when the unit moved north to Egypt in September.⁵³

At this time, the section included several sergeants and corporals, a number of 'Sappers' with European names who were subsequently to achieve higher rank, and

from December 1941, at least 20 privates with African names from the East African Military Labour Service.⁵⁴

Of the four officers who led the section into East Africa, Maj Frommurze returned to South Africa in August 1941. By then, Allied victory in the campaign had been assured, and his expertise was required at the Geological Survey of South Africa. Moreover, at over 40 years of age, he was less suited than younger officers for the likely operational demands of campaigns in North Africa, and he had trained a worthy successor, Gordon Paver. Captain (Capt.) Paver duly led his three SAEC lieutenant colleagues, Douglas Simpson, Digby Roberts and Anton Hales, when the section was re-deployed in September 1941 – to support General Headquarters (GHQ) of the British Army's Middle East Command, in Egypt. The three officers who had joined in East Africa from East or West African units (Capt. Wilders and Lts O'Shea and Huddleston) were all re-assigned in East Africa.

Operational deployment in North Africa and beyond

Allied victory over the main Italian forces in East Africa had been achieved in May 1941, and isolated pockets of resistance were crushed in the following months,⁵⁵ while 42nd Geological Section was consequently redeployed to North Africa, where conflict continued. It set up its base near Cairo during September. "By this time the Unit's organization was well established with the instrumental side under the control of Lt A. Hales and the strength of the Unit augmented by Lt R. Borchers".⁵⁶ Other officers were to join later (Table 2), DM McKinnon and GCL Clarke on promotion from the ranks of the unit. However, the only War Diary for the section preserved in the UK's National Archives for the period after leaving Kenya, is for a single month, October 1943.⁵⁷ Information on assignments can be gleaned from a variety of sources but it is therefore less complete here than for East Africa. Certainly, detachments from the section were to serve not only in Egypt but, consistent with the ebb and flow of battle, westwards as far as Algeria. Primarily from a detachment based in Beirut, they deployed also on tasks eastwards into Palestine (now Israel), Transjordan (now Jordan), Syria, Lebanon, Iraq and Iran. They operated on the Mediterranean islands of Malta and Cyprus and, following the final surrender of German and Italian forces in North Africa (in Tunisia, in May 1943), supported operations in Italy and in Greece.

Rupert 'Bill' Borchers was born in Cape Town, and graduated from its University with a BSc degree in 1928 and an MSc in 1930.⁵⁸ He worked as a field geologist in Northern Rhodesia (now Zambia) from 1931 to 1932. Employed from 1933 by the African and European Investment Company, he became leader of geological work surveying the Odendaalsrust gold field in the Orange Free State.⁵⁹ In this, he demonstrated the value of geophysical investigations (based on measurements from several thousand magnetic stations, and a much smaller number of gravimeter stations) prior to drilling in a relatively uncharted area: effectively the studies for which he was awarded a DSc degree by the University of South Africa in 1950. However, he gave up leadership of the project in June 1940 for military service. He seemingly joined the section soon after its arrival in Egypt in September 1941.⁶⁰ He served with it until 1943, the year of Allied victory in North Africa.⁶¹

‘Don’ McKinnon was born in Canada.⁶² He graduated from the University of British Columbia with a BA degree in 1937, and moved to South Africa to join the Anglo-American Corporation, being sent to undertake geological mapping in Northern Rhodesia (now Zambia). Three years later he transferred to work in the East Rand goldmines of South Africa. He gained an MSc at the University of the Witwatersrand in 1940, but seemingly enlisted in the ranks of the SAEC during that year. “D. M. McKinnon” was serving with 42nd Geological Section in East Africa in the rank of sergeant by December 1940.⁶³ Evidently he was later commissioned. “Lieutenant McKinnon” is named as one of three officers serving with the section in a memorandum summarising military geological work in the Middle East in 1943, a document seemingly prepared by the geologist staff officer at GHQ Middle East Command, Capt. (later Maj) FW Shotton RE.⁶⁴

Graham Clarke was born in England, at Margate in Kent.⁶⁵ He was educated initially at Wellington College, a school founded in 1853 as a memorial to the Duke of Wellington, victor over the French Emperor Napoleon at the Battle of Waterloo in 1815. Subsequently, he entered Trinity College in the University of Cambridge, where he read Natural Science (chemistry, physics and geology), graduating in 1933. He then began a career as a schoolmaster, first in London, then at the prestigious Hilton College in South Africa where he taught chemistry and physics. Following German victories in Western Europe in May 1940, he was one of the young teachers at the College who rushed to join the armed forces. He joined the Royal Natal Carbineers, an infantry unit of the South African army, and was sent first to East Africa, then the Western Desert of Egypt. Believing his scientific training could be put to better use, he transferred to 42nd Geological Section in 1942, and thereafter served in Lebanon, Syria, Palestine, Egypt, Cyprus and Greece, until released to return to Hilton at the end of 1944, at the school’s request. He is shown with the rank of sergeant on the title page of a handbook completed in April 1943.⁶⁶ However, he was a lieutenant when posted from Cairo to Beirut in October 1943.⁶⁷ There he assisted Capt. Simpson and was soon to succeed him, being quickly promoted to the rank of captain.

Andrew Thompson was born in Pondoland, South Africa.⁶⁸ He graduated from the University of Pietermaritzburg with a BSc in 1939, an MSc in 1940, and was studying for a PhD when he abandoned studies in 1942 to volunteer for service with the Union Defence Force. “With the rank of lieutenant he was dispatched to the Middle East in January 1944 within the 43rd Water Treatment Section.”⁶⁹ Paver acknowledged him for field supervision of geophysical surveys with Capt. Simpson in Transjordan.⁷⁰ If he did this with Simpson rather than after him, the surveying must have taken place before Simpson returned to South Africa in late 1943. However, Paver also credited him with compiling detailed surveys of surface water supplies in the region – which were conducted at least partly in 1945, since he visited No. 5 Boring Section RE at work in the region on 4 June of that year.⁷¹ Seemingly, he had joined the section by 1944, was used most significantly in regions east of the Nile, and served until released from the SAEC in January 1946.⁷²

A 'Lieutenant Lowenstein' was posted to the section in October 1943 to take over Lt Clarke's duties at its headquarters.⁷³ He is known to have visited sites in Egypt on behalf of the section and Maj Paver to guide drilling by No. 4 Boring Section RE in February and April 1944, so his service was long enough to have been significant.⁷⁴ It seems likely that he was the "N. Lowenstein" elected a student member of the Geological Society of South Africa in 1940, and transferred by election to member in March 1941, when resident at Heidelberg in the Transvaal.⁷⁵ His address as listed by the Society remained the same until shown as Johannesburg in 1946, at the end of the war.⁷⁶ There are no contemporary members of the Society in either category with the same surname, and his presumed age on ceasing to be a student would fit well with the age to initiate military service as a junior officer. He was soon to present a paper on a geophysical survey of part of South West Africa (present-day Namibia), at a Geophysical Conference of the University of the Witwatersrand, Johannesburg, held on 27 to 29 July 1949, a survey appropriate to his presumed military expertise.⁷⁷ The only match in initial and likely age with a male person in South African death records is with Nathan Lowenstein, born 31 July 1918, who died in September 1982.

Names of those other than officers do not normally occur in published records, but Staff Sergeant CJ Freeman BSc was one of the four authors of a handbook on geophysics compiled by the section.⁷⁸ He was serving with the unit by December 1940, but then only in the rank of 'Sapper'.⁷⁹ Additionally, Paver and Digby Roberts exceptionally record their thanks to Staff Sergeant Van der Stok, Corporal DE McCleod-Elliott BSc, and Corporal G Stagman MSc for reconnaissance work in east Persia (now east Iran).⁸⁰ It seems likely that Staff Sergeant Van der Stok was the Sapper of that name who was posted to the section on 5 August 1941, another example of the promotion that could be achieved within the unit by some of its long-serving members.⁸¹ McCleod-Elliott had been elected a student member of the Geological Society of South Africa in 1938, when his address was given as Sherwood Star Mine, Southern Rhodesia.⁸² With three science graduates within this group of four, it is evident that some NCOs as well as officers were well qualified in terms of academic achievement.

Thus, with the addition of Lt Bill Borchers soon after its arrival in Egypt, the section was led by five SAEC officers, consistent with the establishment shown in Table 1. Of these, Gordon Paver soon held the rank of major, Douglas Simpson and Digby Roberts both became captains, and Anton Hales presumably held the appointment of "physicist". Paver, Simpson and Roberts were all 'Mentioned in Despatches' after Allied victory in North Africa in recognition of their meritorious service. Presumably it was that victory and change in operational priorities that allowed Capt. Simpson and Lt Borchers, probably also Lt Hales, to be released from military service in the latter part of 1943.

In the remaining years of the war, Sergeants McKinnon and Clarke were commissioned from the ranks of the section to fill vacancies as lieutenants (Table 2). Clarke was rapidly promoted to fill the captain's vacancy created by Simpson's departure, but was released in 1944. Lts Thompson and Lowenstein also filled

vacancies during late 1943 or early 1944 to maintain the unit's strength of about five officers. Gordon Paver and Digby Roberts served with the section until the end of the war, although Paver was temporarily detached to serve as the staff officer (Geology) at Middle East Command's General Headquarters, following the return to the United Kingdom of Capt. FW Shotton.⁸³ Paver's military service seemingly came to an end after November 1945. Digby Roberts served with the SAEC until 1946, achieving finally the rank of major and so perhaps command of 42nd Geological Section after Paver.

Concluding remarks: civilian careers after the war

Many of the officers who served with 42nd Geological Section are known to have developed distinguished careers after the war. Of those who founded the unit in South Africa, Frommurze returned in 1941 to the Geological Survey of South Africa. In 1942, he was elected President of the Geological Society of South Africa and in 1948 he became assistant director of the Geological Survey.⁸⁴ Paver returned to the Survey seemingly in early 1946, but soon left to become a consultant.⁸⁵ Simpson returned to the Survey in late 1943, and became President of the Geological Society of South Africa in 1959.⁸⁶ Digby Roberts returned to civilian employment in 1946, initially with the Irrigation Department at Pretoria, but from 1947 to 1955 as senior geologist at the Central Mining and Investment Corporation, and thereafter as a consultant mining geologist.⁸⁷ His membership of the South African Institute of Mining and Metallurgy was cancelled in 1969, when he moved to Australia to become senior geologist with Austin-Anderson (Australia) Pty Ltd.⁸⁸ He died in Toowoomba, Queensland, on 12 November 1971.⁸⁹

Of the officers who joined later, in East Africa, Hales returned to a distinguished academic career as a geophysicist, first in South Africa at Witwatersrand and Cape Town, from 1954 as director of the Bernard Price Institute of Geophysical Research, and from 1955 as founding professor of the Department of Geophysics at Witwatersrand.⁹⁰ In 1962, he moved to the United States of America to become the founding director of the Geoscience Division for the Southwest Centre of Advanced Studies, later to become the University of Texas at Dallas. Subsequently, he became a professor at the Australian National University, before final retirement back to the United States. Huddleston returned to the Gold Coast Geological Survey in 1944 but transferred to a similar appointment in Kenya in 1946.⁹¹ He returned to the Gold Coast to become deputy director of the Geological Survey in 1952 but retired and returned to Kenya in 1956. He then took up an appointment with the Uganda Geological Survey from 1959 until his early death, in Uganda, at the age of 46.

Of those who joined even later, in North Africa, Borchers rejoined the African and European Investment Company, as field manager, in 1943.⁹² In 1948, he joined Rand Mines Limited, where his experience in fieldwork, mine work, geophysical surveying and prospect drilling motivated many changes in its geological department. He was appointed a consulting geologist at the company in 1957, and became President of the Geological Society of South Africa in 1961. McKinnon on demobilisation

became chief geologist to Nchanga Copper Mines in Northern Rhodesia (Zambia), and subsequently developed an influential career in the Southern African mining industry.⁹³ Clarke resumed his duties of teaching and as a housemaster at Hilton College, becoming head of the Science Department until leaving in 1948 for a career in South Africa's industry and, following retirement, as secretary for the Association of Private Schools.⁹⁴ Thompson initially joined the Hydraulic Branch of the Public Works Department in Nairobi, Kenya, and then transferred to the Mines and Geological Department there in 1950.⁹⁵ He became deputy director of the Northern Rhodesia Geological Survey in 1959, joined the South African Geological Survey in 1964, and moved to the Southern Rhodesia Geological Survey in 1970 – until retiring to South Africa in 1980. Lowenstein remained a member of the Geological Society of South Africa until at least 1970, from an address in Johannesburg.⁹⁶

South African officers had demonstrated significant leadership and technical ability within 42nd Geological Section during the war: boreholes for water drilled with their guidance had achieved a significantly higher ratio of success than boreholes drilled without it.⁹⁷ They thus typically demonstrated the same abilities and notable success in academic or other geologically professional life in the years after the war.⁹⁸

Endnotes

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- ¹ See comprehensive overviews by EPF Rose. "Groundwater as a military resource: Development of Royal Engineers Boring Sections and British military hydrogeology in World War II". In EPF Rose & JD Mather (eds), *Military aspects of hydrogeology*. London: Geological Society, 2012. 105–138; EPF Rose. "Quarrying Companies Royal Engineers in World War II: contributions to military infrastructure within the UK and to Allied forces during the North African, Italian and NW Europe campaigns". In EPF Rose, J Ehlen & UL Lawrence (eds), *Military aspects of geology: Fortification, excavation and terrain evaluation*. London: Geological Society, 2018, in press; EPF Rose. "Tunnelling Companies Royal Engineers in World War II: excavation of bomb-proof facilities in France, Gibraltar, Malta and the UK". In Rose *et al. op. cit.*
- ² In both World Wars the British Army used only one or two military geologists per operational theatre, embedded as staff officers within the Engineer branch at General Headquarters. Only two teams of geologists additional to 42nd Geological Section were ever raised to support them, both in 1943 and to compile terrain intelligence remote from campaign areas, one in India at Calcutta the other in England at Oxford. See EPF Rose. "Credit due to the few: British field force geologists of World War II". In H Häusler & R Mang (eds), *International handbook military geography, Volume 2: Proceedings of the 8th International Conference on Military Geosciences, Vienna, 15–19 June 2009*. Vienna: Truppenamt, Ministry of Defence, 2011. 429–442; EPF Rose. "British military geology in India: Its beginning and ending". *Royal Engineers Journal* 119/1. 2005. 46–53; EPF Rose. "Oxford's Secret Sappers of the Second World War: Terrain intelligence by military geologists". In

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- ³ EPF Rose. “Military prospecting for groundwater by geology and geophysics: Work by 42nd Geological Section (South African Engineer Corps) in Africa, the Middle East and the Mediterranean region during the Second World War”. In H Smit & J Bezuidenhout (eds), *African military geoscience*. Stellenbosch, Sun Media, submitted 2017.
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- ⁸ *Ibid.*, p. 10.
- ⁹ WO 179/948 *op. cit.*
- ¹⁰ The principles and practice of geophysical prospecting were established before the war, and those utilised by 42nd Geological Section described in a handbook that summarised their application to 1943. AB Broughton Edge & TH Laby (eds). *The principles and practice of geophysical prospecting: Being the report of the Imperial Geophysical Experimental Survey*. Cambridge: Cambridge University Press, 1931; GL Paver, DJ Simpson, CJ Freeman & GCL Clarke. *The location of underground water by geological and geophysical methods*. Cairo: South African Engineering Corps, 1943.
- ¹¹ An *Erdelektrischer Erkundungstrupp* was deployed as a reconnaissance unit to assist water supply and military geology reconnaissance units deployed by the German Army on the Western Front in Germany, France and the Low Countries from 1940, and *Wehrgeologenstelle 12*, deployed by the German Army to North Africa from February 1941, made significant use of electrical resistivity surveys in its search for potable groundwater. H Häusler & D Willig. “Development of military geology in the German Wehrmacht 1939–45”. In EPF Rose & CP Nathanail (eds), *Geology and warfare: Examples of the influence of terrain and geologists on military operations*. London: Geological Society, 2000. 141–158; D Willig & H Häusler. “Aspects of German military geology and groundwater development in World War II”. In Rose & Mather *op. cit.*, pp. 187–202.
- ¹² Paver *et al op cit*; <http://en.openei.org/wiki/Direct-Current_Resistivity_Survey>
- ¹³ Paver *et al op cit*; <http://en.openei.org/wiki/Direct-Current_Resistivity_Survey>
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- ¹⁵ Reported by DJ Simpson. “Water and warfare”. *Proceedings of the Geological Society of South Africa* 63. 1960. xix–xlii.
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- ¹⁸ A series “Water supply in the Middle East campaigns” was published in parts numbered I to XI. FW Shotton. “I. The main water table in the Miocene limestone in the coastal desert of Egypt”. *Water and Water Engineering* 49. 1946. 218–226; FW Shotton. “II. Perched water supplies above the main water table of the Western Desert”. *Water and Water Engineering* 49. 1946. 257–263; H Addison & FW Shotton. “III. Collecting galleries along the Mediterranean coast of Egypt and Cyrenaica”. *Water and Water Engineering* 49. 1946. 427–436; FW Shotton. “IV. Water supplies adjacent to the Cairo-Alexandria desert road”. *Water and Water Engineering* 49. 1946. 477–486; FW Shotton. “V. The desert between the Nile delta and the Suez Canal”. *Water and Water Engineering* 49. 1946. 529–540; GL Paver. “VI. The south-eastern desert of Upper Egypt (Red Sea hills)”. *Water and Water Engineering* 49. 1946. 653–662; GL Paver. “VII. Syria and the Lebanon”. *Water and Water Engineering* 50. 1947. 61–76; GL Paver. “VIII. Cyprus”. *Water and Water Engineering* 50. 1947. 247–256; GL Paver. “IX. Palestine”. *Water and Water Engineering* 50. 1947. 381–293; GL Paver. “X. Trans-Jordan”. *Water and Water Engineering* 50. 1947. 442–449; GL Paver & H Digby Roberts. “XI. Persia and Iraq”. *Water and Water Engineering* 51. 1948. 84–93, 136–145.
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boreholes were drilled with a 55% success rate, compared to only 31% success
for 90 boreholes drilled without Geological Section recommendation; Paver,
“VIII. Cyprus” *op. cit.* notes that 19 boreholes were drilled in Cyprus, of which
84% were successful, compared to only 46% success for 46 boreholes drilled
without the Section’s recommendation.
- ⁹⁸ I am grateful for their efforts to locate biographical information to Wendy
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