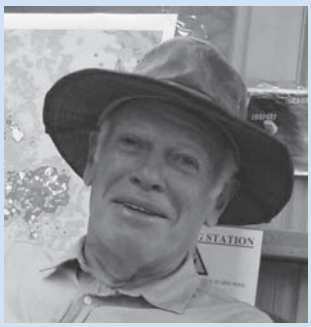
Lewis Albert Richardson: a pioneer of exploration geophysics in Australia



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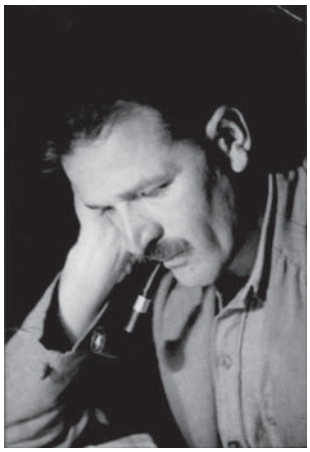


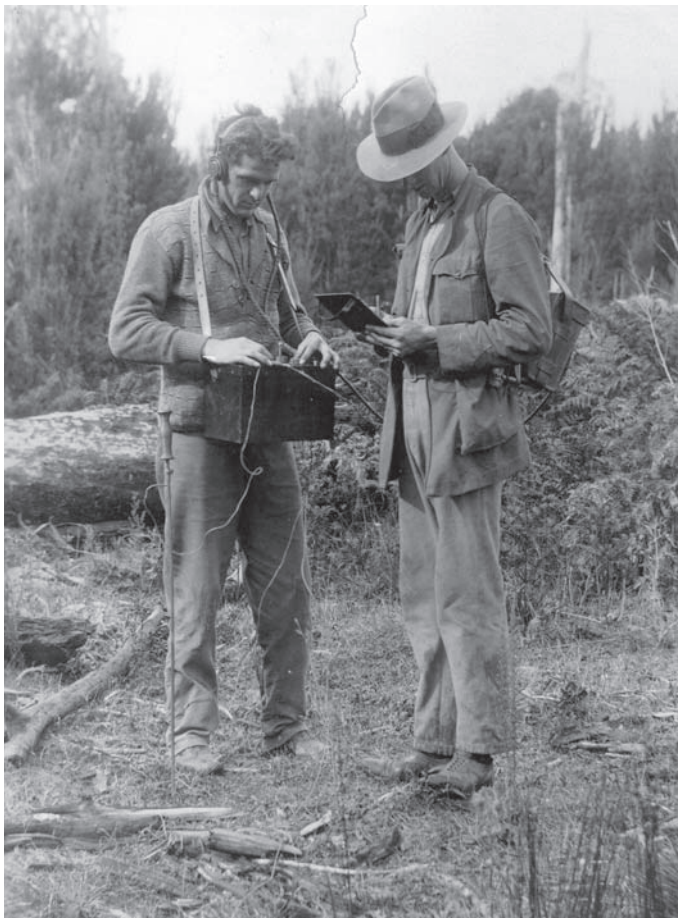
Lew Richardson ~1947.

A shooting star on the family farm may have signalled Lew Richardson's future career in the earth sciences. Lew was born on 29 April 1907 on 'Spring Farm', a small holding near Narellan, NSW producing high quality table grapes, stone fruit and apples for the Sydney market. On the night of 8 April 1928 a 367.5 gm meteorite landed on the farm, within metres of where Lew's father had been standing. Its dramatic light display and the accompanying shock waves were witnessed by Lew, who found it buried 'about six inches' into rocky ground the next morning. Very few people witness an incoming meteorite and then actually find that meteorite. According to the Australian Museum there have been only two such occurrences in recorded history in Australia. That meteorite is now held by the Australian Museum in Sydney and is called 'The Narellan Meteorite' (Hodge-Smith, 1931).

Lew Richardson was trained and worked as an articled surveyor before becoming involved in geophysics. Surveying was useful training for a geophysicist when you consider that the location of a geophysical measurement is just as important as the measurement itself. In 1928 Lew commenced his geophysical career in the Imperial Geophysical Experimental Survey (IGES), where he was attached to the No1 Electrical Party as a 'Field Assistant', a job that could be more correctly described as 'Trainee Geophysicist'. As a consequence of his surveying training and capability he was largely responsible for the survey work of the Party. He worked in most states of Australia until the end of the survey in 1930.

The IGES was funded by the British Empire Marketing Board and the Australian Commonwealth Government. Its object was '… not to prospect for minerals, but to test the applicability of various geophysical methods under field conditions in Australia which, it was considered, might be regarded as fairly characteristic of considerable portions of the British Empire' (Edge and Laby, 1931). This was a fantastic opportunity for Lew to work alongside internationally recognised scientists and engineers and to be at the 'leading edge' in exploration geophysics for the time. He also gained valuable experience on which geophysical techniques worked in Australia and which didn't. The techniques used included: magnetic, gravity, seismic, self-potential, resistivity, equipotential line, AC potential drop, and electromagnetic. The IGES conducted surveys in all states of Australia.

Following the end of the IGES in 1930, Lew continued his studies at Sydney University studying physics and mathematics up to tertiary level. However, with little financial resources and with the pressure of having to earn a living, he was unable to complete his studies to degree level. His survey training qualified him to be an Associate of the Institute of Surveyors, and in 1937 he was made an Associate of the Institute of



Conducting AC Potential Drop method during an IGES survey (Lew on left).

IGES field party conducting an equipotential survey (Lew is on the left).

Lew outside a hut used by IGES for gravity gradiometer measurements. This portable kapok lined canvas hut protected the gradiometer from temperature changes and wind.

Dr Bieler (on left) using the Bieler-Watson double detecting coil for electromagnetic measurements. Dr Bieler, an expert in electromagnetic methods from McGill University in Canada, joined the IGES as Deputy Director however he died at an early stage in July 1929.

Physics (UK), which was recognised at the time as an acceptable qualification for a professional position. During this period he worked for a while with Jack Rayner, carrying out magnetic surveys for Oil Search in Victoria. It was during those study years that he met Sir John Proud and established a connection that would become very significant down the track.

In June 1935 Lew was appointed 'Applied Geophysicist with the Aerial, Geological and Geophysical Survey of Northern Australia' (AGGSNA). With the AGGSNA party Lew completed extensive work in many areas of Northern Australia including Tennant Creek 1935–1937, Pine Creek, Wiluna, and Cloncurry. At Tennant Creek, Lew's work located and surveyed more than 20 magnetic anomalies due to deep sources. Testing of these anomalies by core drilling established beyond any doubt the presence of gold and copper ore at considerably greater depth than had been proved by existing workings. His geophysical analysis of the Peko No 1 anomaly (Rayner, 2007) showed potential for magnetic ore at depth and subsequent drilling discovered the large Peko copper deposit, which kick-started Peko Mines Ltd and ultimately the Peko-Wallsend Group.

The results of the AGGSNA work were not fully published at the time, and it wasn't until 1957 that the results were fully compiled in a landmark report by the BMR (Daly, 1957). The report illustrates the massive amount of field magnetometer work completed by Lew, all done with great care and precision using a Watts Variometer. In Daly's introduction he states 'No report on the magnetic surveys at Tennant Creek would be complete, however, without acknowledgment of the work of Mr L. A. Richardson, who was responsible for the planning and supervision of all the work.'

Lew's marriage in 1937 didn't deter him from completing the job, and he took his new bride back to Tennant Creek where they lived in a tent in the Honeymoon Ranges, some seven kilometres north of the township. When he set forth to the field with his magnetometer, he left my mother Beverly with a large .45 revolver to wave at any threatening four or two legged animals.

AGGSNA survey team, Lew in centre. The team is setting out to do a magnetic survey in a lake (not trout fishing).

Lew conducting a magnetic survey for AGGSNA in a lake near Wiluna WA, using a Watts Variometer (note the black knitted tie).

Lew tucked in for the night – a typical geophysicist's field accommodation in the AGGSNA days (not sure who or what he was going to shoot with that 12G Winchester at his elbow).

From 1938 to the end of AGGSNA in 1941 Lew was second in charge under Bob Thyer (Bob later became Director of the BMR) and he worked on many areas including Blair Athol coalfield, Croydon and Lolworth goldfield, Redbank copper and The Granites.

Following AGGSNA, together with the remaining geophysical staff, Lew was transferred to the Mineral Resources Survey, which was established in 1942 under Dr H. G. Raggat (the Mineral Resources Survey became the BMR in 1946). It was now wartime, and this organisation was directed to the exploration for minerals that were in scarce supply for the Allies, such as quartz, tungsten, uranium and copper. During this period Lew was also the principal observer of the absolute values of the magnetic field, upon which the Australian isogonic charts were founded.

In 1942, Lew was drafted into the Australian Military Forces to undertake scientific work. This included investigation of degaussing stations at Sydney, Fremantle and Darwin. Degaussing was a procedure whereby large coils were energised by DC current to produce magnetic fields to reduce the magnetic signature of ships so that they were less vulnerable to magnetic mines. Lew was also a member of the Australian Scientific Mission sent to Japan in early 1946, immediately after the end of the Pacific war. The purpose of this mission was to obtain information about the state of industry, science and the military in Japan, a country that had been opaque to the rest of the world for a long time. Lew's involvement included investigations into Japan's earthquake prediction technology and the availability of mineral resources in Japan, particularly uranium. His flight over Hiroshima had a profound effect on him and he brought home graphic descriptions of the devastation.

On Lew's return to Australia he was appointed as a Geophysicist with the newly formed Bureau of Mineral Resources, Geology and Geophysics (BMR), where he served as a party leader until his resignation in 1950. He resigned because it became clear to him that he would not advance in the organisation because of the hardening of the Public Service Board's attitude to people occupying professional positions without a university degree.

Lew then became an independent geophysical consultant – a fairly brave move at the time. His clients through the period 1950–1965 included most of the larger mining houses in Australia: EZ, WMC, BHP, Aberfoyle, ConsZinc, Australian Oil and Gas, Zinc Corp, Mt Isa Mines, and Peko-Wallsend. Peko-Wallsend was now expanding rapidly as several rich copper, gold, bismuth mines came into production at Tennant creek. The connection he made during his study years with Sir John Proud (Peko-Wallsend CEO), his earlier AGGSNA work at Tennant, and his involvement in the discoveries for Peko Mines at Tennant Creek lead naturally to a closer association with Peko, which became his largest client.

The magnetite hosted copper-gold deposits at Tennant Creek were not easy drilling targets for the following reasons:

- Most were in soil covered areas without outcrop to provide geological guidance
- The causative bodies were relatively small (but high grade) and easily missed by drilling
- The bodies were often steeply dipping and 'pipe-like' and required inclined drilling for a reliable test
- Cleavage of the country rocks caused the drill holes to deviate, sometimes perpendicular to the desired direction
- The high magnetic susceptibility of the magnetite lodes caused demagnetisation. Existing modelling algorithms could not take demagnetisation into account and gave erroneous interpretations.

Lew in Japan 1946 with Japanese geophysicists (Lew is third from the right).

Lew using a Worden gravity meter for oil exploration in the Oaklands Basin for AOG in the late 1950s.

It soon became evident to Lew that the available interpretive models were inadequate. At the time, interpretation methods were relatively crude. Magnetic anomalies could be modelled by comparing observed anomalies with calculated anomalies due to theoretical magnetic bodies shaped as spheres, or simple tabular shapes.

Together with UNSW mathematician Bruce Kirkpatrick, Lew developed algorithms and routines that enabled the calculation of magnetic anomalies due to ellipsoidal shaped bodies. The ellipsoid is the ideal model for the Tennant Creek magnetic bodies and can be used to accurately model a range of shapes from narrow pipes, to discs, to spheres and at any orientations, dip and plunge. This was a rigorous solution that took demagnetisation into account.

Lew's work was pivotal to the development of the Tennant Creek field and the growth of Peko-Wallsend as a major Australian mining house. It was also an important contribution to the science of geophysics.

During most of this period he worked with only one offsider. One of these was physicist Ian Sefton who went on to teach physics at Sydney University and, later, geophysicist Greg Kater. Following Greg's resignation in 1966, I jumped at the chance to work with my father. I was already heading down another path, and had commenced a career as a structural engineer with Transfield Corporation, but the lure of life in the bush, the excitement of the exploration industry and a fascination for the science was too much to ignore and I abandoned the engineering design office for a magnetometer and a gravity meter. Also, I was then privileged to have one of the best teachers in the field.

Lew and I established L. A. Richardson and Associates Pty Ltd (LAR) and expanded the business to meet the increasing demand from Peko and others. By 1969 we had a team of approximately 12 people, including geophysicists, mathematicians, engineers, surveyors and field geophysical technicians, and were applying geophysical methods to a wide range of commodities. Following in Lew's path, LAR was responsible for many ground breaking developments in the areas of magnetics, gravity, electromagnetics, downhole and airborne geophysics. We worked hand-in-hand with Peko's exploration division, Geopeko, on gold, base metals, tungsten, coal, uranium and mineral sands exploration in many parts of Australia. Geopeko was one of the most successful exploration groups in Australia through the 50s–80s, discovering seventeen deposits all of which became mines, including Ranger 1 (uranium), North Parkes (copper/gold) and Lake Cowal (gold). Lew and LAR made crucial contributions to many of those discoveries.

Lew targeted most of the discovery holes for Peko's earlier discoveries at Tennant Creek including Peko Deeps, Warrego, Ivanhoe, Orlando and Juno. Later, in LAR, we targeted the discovery holes for the Gecko, Argo, TC8, Juno residuals and Warrego residual deposits.

In the late 60s Lew began to have serious health problems, which slowed him down, but he continued to work until he died suddenly in January 1971. In recognition of his services to Peko-Wallsend, and the science of geophysics, Peko-Wallsend established the L. A. Richardson Memorial Prize by a gift of $5000 to the University of Sydney. The prize, valued at $200, is awarded annually to the student in final year in the Department of Geology and Geophysics who submits the most outstanding thesis on geophysics. I have had the pleasure of presenting this award many times.

Lew was a man of great courage, drive and intellect, but always very gentle and patient with others. I'm sure that many people in the exploration industry would remember him as a good listener and always a source of wise advice and encouragement.

There were many other facets of his life that are beyond the scope of this short account – his adventures on the Kowmung River in the Blue Mountains, his involvement with the Colong Committee, which stopped the mining of limestone on the Kowmung River, and his farming activities at Mittagong. These might be the subjects of another narrative.

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