

Broughton Edge: was he the father of exploration geophysics in Australia?



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Broughton Edge was the Director of the Imperial Geophysical Experimental Survey (IGES) (1928–30) and, subsequently, the co-author of the report on the IGES (Broughton Edge and Laby,

To begin with, what is his name?

His name is variously written as:

‘A B Broughton Edge’, as in the title page and the “List of Contributors” to the report on the IGES (*op cit*).

‘A Broughton Edge’ as signed by himself in his Chairman’s report to the IGES report and as referred to by A C D Rivett, in his Preface to the IGES report.

‘Edge’ only, by others (Day, 1966–67; Rayner, 2007). Rayner’s reference to the report of the IGES is, ‘Edge and Laby, 1931’. To extend the variations further, Day’s reference to the report is “Edge, A B B, and Laby, T H (eds.), 1931”.

The initial ‘A’ is for “Arthur” and, oddly, the other initial ‘B’ is also for Broughton. His full name is, therefore, Arthur Broughton Broughton Edge.

A UK Birth Index for his birth has, “Edge, Arthur Broughton” and a Death Register has “Edge, Arthur B B”, with the second ‘B’.

As a witness to his father’s death in 1951, he is listed as Arthur Broughton Broughton-Edge”, with a hyphenated family name. Johan de Beer (de Beer, 2011), also refers to “Arthur Broughton-Edge” with a hyphen.

In the index to the IGES report, “Broughton Edge” is included, but also ‘Edge, Broughton’.

I choose to use ‘A B Broughton Edge’ as it appears to be the most common usage in Australia.

All but one Australian newspaper referred to him as “Mr Broughton Edge”. The one exception was “Sir Broughton Edge”, although he was never knighted.

1931). As the IGES was responsible for the first serious use of a number of geophysical methods in Australia, does this make Broughton Edge the ‘father of exploration geophysics in Australia’? Could the term ‘father’ refer to his production of ‘sons’ amongst the Australian staff of the IGES? This claim has been made of his behalf. Johan de Beer, in his review of early mining and mineral exploration geophysics in southern Africa, stated “Interestingly enough, Broughton-Edge is regarded as the father of exploration geophysics in Australia” (de Beer, 2011). Can this claim be substantiated?

Existing biographies of Broughton Edge

Being an Englishman, Broughton Edge attracted only short entries in Australian dictionaries and biographies. My intention in this article is to expand on his biography from his time in Australia, and with a geophysical emphasis.

The short entry for Broughton Edge in the *Encyclopedia of Australian Science* (1993), states that he was born in the United Kingdom in March 1895, and died in the UK in October 1953. During his life, he served in the Royal Artillery from 1914 to 1918, obtained his BSc in 1922 from the Royal School of Mines, and practiced as a “consultant geologist (*sic*)” from 1922 to 1940. In addition, he became a Member of the Institute of Mining and Metallurgy, and received an MBE. His full name with affiliations could, therefore, be shown as “A B Broughton Edge, MBE, BSc, ARSM, MIMM”.

For ‘Published Resources’, the above encyclopedia refers to his entry in *Physics in Australia to 1945* (Home, 1995) and also an entry in *Trove* (2009), National Library of Australia. *Physics in Australia to 1945* adds to his biographical details with three references to publications: his paper to the AusIMM in 1928 (Broughton Edge, 1928), his paper to the *Chemical Engineering and Mining Review* (Broughton Edge, 1931), and his co-editorship of the report of the IGES (Broughton Edge and Laby, 1931).

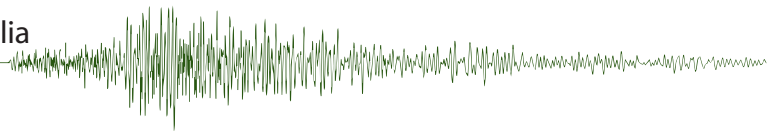
A search of his name in *Trove* and www.newspapers.com provides seven newspaper items (see Appendix 1), and an additional reference to his co-authorship of a book with Bruckshaw and Rayner, both prominent appointments to the IGES (Broughton Edge et al., 1931a)¹. A search for this reference in the State Library of NSW revealed, instead, another publication by Broughton Edge and co-authors Ferguson and Shaw - also members of the IGES (Broughton Edge et al., 1931b)².

Broughton Edge’s experience before coming to Australia

In the Introduction to the IGES Report (Broughton Edge and Laby, 1931, pp. 2–3), written by Broughton Edge, it is claimed that the Survey was in a strong position with regard to electrical methods “since the advantage of several years practical experience in Spain, Portugal and South Africa was available”.

¹This reference is a reprint of those sections of the IGES report on the subject of Electrical methods (Part 1 Ch. 2 and Part 2 Ch. 3).

²This reference is a reprint of the section of the IGES report on Electrical prospecting surveys in Australia (Part 1 Ch. 3).



It is not made clear in this Introduction if Broughton Edge had experience in Spain and Portugal, either alone or with others³.

As for Broughton Edge's experience in South Africa, the Report of the IGES (*op cit*) states in a footnote to page 50 that A Broughton Edge, in 1925, devised a "three contact ratio arm bridge" for the A.C. Potential Ratio method and it "was first used in N. Rhodesia [now Zambia] during that year". Furthermore, de Beer (2011) states, "In 1925 and 1926, the British geophysicist (*sic*) Arthur Broughton-Edge conducted experimental geoelectrical surveys in the Northern Rhodesian (Zambian) Copper Belt" and supports this claim with a publication on the history of mining in Northern Rhodesia.

Also, the Introduction to the IGES Report (*op cit*, p. 3) states that "Mr S. H. Shaw, BSc, ARSM, AIMM, and Mr J. C. Ferguson, BSc, were approved [for the IGES], both of whom had two years' previous experience in South Africa". It is believed that these men were assistants to Broughton Edge in Zambia.

A footnote to page 237 of the IGES Report indicates that Broughton Edge devised self-potential equipment for use in Cyprus⁴.

Such experience, particularly as it was with the electrical method, qualified Broughton Edge to fill the position of Director of IGES, as one criterion developed by the Sub-Committee of the Committee of Civil Research (Sub-Committee, 1927) was that "the geophysicist-leader should have a special knowledge of the electrical method and of electricity generally"⁵. The committee later conceded that "The number of such geophysicists is, however, strictly limited" and securing "a leader possessing the necessary ...qualifications", will be "The most difficult problem". The appointment of Broughton Edge would therefore seem to be to his credit.

On the other hand, B W Butcher (1984, p. 34) reveals that A C D Rivett, who was then Chief Executive Officer of CSIR, "was skeptical about...the professional competence of Broughton Edge". Rivett was, however, persuaded by his superiors that Broughton Edge was "a consultant and not connected with any commercial organization" (presumably meaning that he was acceptable as an independent scientist).

The ship's passenger log of the 'Windsor Castle' has "A B Edge" arriving in London from Cape Town on February 6, 1928 and gives his intended address as "Council of Scientific and Industrial Research [CSIR], Australia House, London". Could this be where he was to be interviewed, or briefed, for the directorship of the IGES?

Broughton Edge's movements in Australia

The ship's log of the 'ss Orsova', which arrived in Fremantle from London on May 1, 1928, lists "Mr A Broughton-Edge" as

³There is evidence of Broughton Edge having traveled in this area at this time. A search of ships' logs in the UK shows "Edge, Arthur, geologist", travelling from Lisbon, Portugal to London on the 'Desna' in May, 1922 and again on the 'Gelria' in July 1923.

⁴Cyprus was a British colony from 1925 and, therefore, a natural place for a British geologist to work.

⁵As to 'electricity generally', we learn below (see Broughton Edge as a geophysicist) that he developed and modified electrical equipment.

being on board, and gives his last permanent address as "Africa"⁶. Evidence of his movements in Australia after disembarkation is provided in newspaper reports (see Appendix 1). From these we learn that just three days after arrival he was in Kalgoorlie, and then Melbourne, via Adelaide, on May 8. There he met the Australian Geophysical Executive Committee, the body with oversight of the IGES in Australia and which included H W Gepp and E C Andrews (more on these men and their relationships to the IGES is provided in Henderson, 2013 and 2017). We also learn he was in Brisbane on July 26.

On the 17 August 1928, Broughton Edge gave a lecture in Melbourne to the Australasian Institute of Mining and Metallurgy⁷. The lecture was summarised in a paper in the *Proceedings of the AusIMM* titled 'Geophysical prospecting' (Broughton Edge, 1928). Almost half of the twelve pages was devoted to electrical methods, by far the largest discussion of the five methods named. Radioactivity was given a short mention, as well as gravity and magnetics, but seismic was only listed and not discussed.

There is no evidence that Broughton Edge had experience in methods other than electrical and electromagnetic methods, and certainly not seismic. In his Introduction to the report of the IGES (*op cit*), Broughton Edge wrote, "This branch of geophysical work [seismic methods] was entirely in the hands of certain geophysical companies" (Broughton Edge and Laby, 1931, p. 3).

In general, "Broughton Edge joined T H Laby on a number of occasions in publicising the Survey [the IGES] and its likely benefits to groups whose influence and support were thought necessary to its success" (Butcher, 1984, p. 36).

On one occasion during the operation of the IGES, Broughton Edge met a delegation of local officials of Kadina, South Australia to explain why the IGES would not be surveying in their area. Perhaps to offer some hope for the future, it was reported that he "mentioned that a number of Australian university graduates that had been working with the [IGES] would continue with similar work if private enterprise should require it" (*The Kadina and Wallaroo Times*, 1929). Evidently, Broughton Edge thought the graduates in the IGES had learnt enough to be employable in the future.

I have not found a photo of Broughton Edge (other than one taken at his wedding in England in 1935 – see below). Granted, photos of geophysical surveys were not common at this time, but it is surprising that one was not thought appropriate, at least as a memento of his time in Australia.

Broughton Edge as a geophysicist – geophysical instrument developments

On ships' logs, Broughton Edge declared his occupation as 'geologist' (even on returning from Australia). No doubt the term 'geophysicist' was still new at this time, and not generally

⁶We know from above that Broughton Edge did travel to London before coming to Australia, but apparently he did not consider his stay there, of only a few months, as 'permanent'. Note also the use of the hyphenated family name.

⁷Butcher (1984, p. 37) adds; "with the assistance of splendidly prepared slides which aroused great interest".



Photo of Muriel and Arthur B Broughton Edge at their wedding in 1935.

understood. Nevertheless, his appointment by the Sub-Committee (1927) was as a geophysicist. Some newspaper reports (see Appendix 1) have him, at least, as leader of a 'geophysical party'.

There are good reasons to describe Broughton Edge as a 'geophysicist' rather than a 'mining geologist'.

Firstly, the IGES report (*op cit*) has, in a footnote to page 50, that Broughton Edge, in 1925, devised a "three contact ratio arm bridge" for the A.C. Potential Ratio method and it "was first used in N. Rhodesia [now Zambia] during that year". For this, British Patent Application No. 19120/30 is held in his name (Broughton Edge, 1925). Figure 1 is a schematic of the principle of the A C potential ratio method showing the three ground contact electrodes, two 'ratio arms' and headphones to detect a balance in potential and phase. Figure 2 is a photo of the ratiometer in use with headphones (shown diagrammatically in Figure 1) and an amplifier⁸.

Secondly, the IGES Report, in a footnote to page 237, states, "This instrument [referring to a potentiometer] and non-

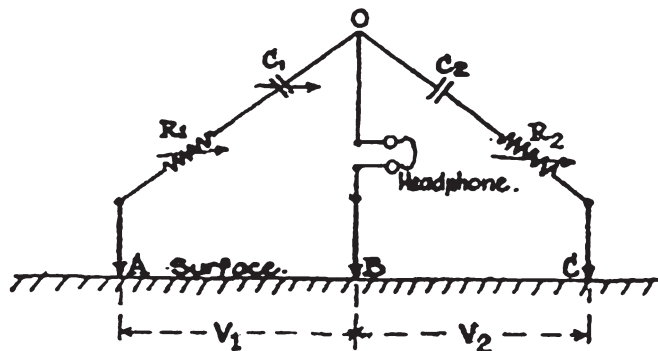


Figure 1. A schematic of the principle of the A C potential ratio method, showing: three ground contact electrodes, A, B and C; two 'ratio arms'; AO and CO and headphones in BO (from Broughton Edge and Laby, 1931, Fig. 31).

⁸Can any reader identify the operator?



Figure 2. A photo of the ratiometer in use with headphones and an amplifier on the operator's back (from Broughton Edge and Laby, 1931, Fig. 33).

polarising electrodes... were designed originally by A Broughton Edge. Figure 3 is a diagram of the panel arrangement of the potentiometer (incorporating a galvanometer) for self-potential measurements. Figure 4 is a diagram of two types of non-polarizing electrodes with "Type A" designed by Conrad Schlumberger and "Type B" as modified by Broughton Edge to provide "increased stability and portability".

It is clear that Broughton Edge understood electrical methods and designed geophysical instruments; therefore, I contend that he should be called a geophysicist. He also co-authored a valuable compilation of current knowledge of most methods of exploration geophysics in the report of the IGES (Broughton Edge and Laby, 1931). His other publications and a patent are also the achievements of a geophysicist.

After Australia

The ship's log for the 'Alcantara' shows 'Arthur Edge, geologist', travelling from Lisbon to arrive in Southampton on 5 June, 1931 and gives his 'Country of last permanent address' as Australia⁹.

⁹Butcher (1984, p. 38) states that he "returned to the UK late in 1929". While it is possible that he left in that year, and may have visited Lisbon in transit, by giving Australia as his last permanent address he, presumably, didn't consider any other stop along the way as permanent.

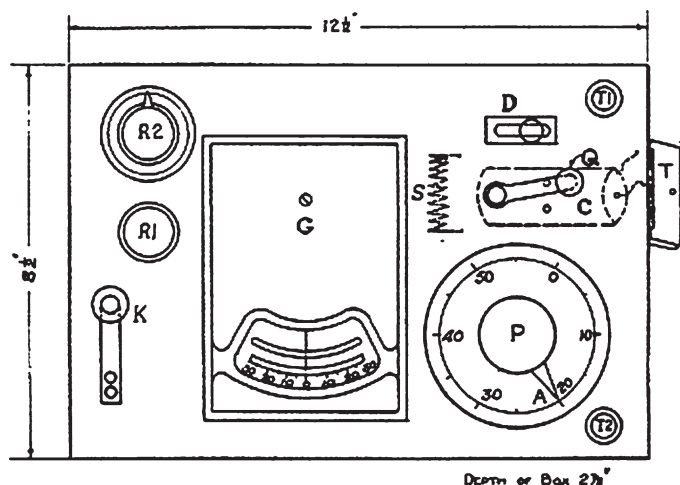


Figure 3. A sketch of the panel arrangement of the potentiometer designed original by Broughton Edge, where G is a galvanometer and T1 and T2 are potential electrode sockets (from Broughton Edge and Laby, 1931, Fig. 179).

Back in England, Broughton Edge (1932) presented a paper to the Royal Society of Arts on the general topic of geophysical methods (not just electrical methods as with his AIMM paper). In a preceding introduction to the author (by an unknown person), Broughton Edge is described as “one of the first British geologists (*sic*) to carry these methods into practice”, a plausible claim. This continues with high praise for Broughton Edge including “when it was decided to send an expedition (*sic*) to Australia... there was no doubt that Mr. Broughton Edge was the man to lead it”. His paper is described as “the first public opportunity...since the completion of the work [IGES] to testify to the smoothness and the skill with which the investigations were carried out”.

In 1933, Broughton Edge was awarded the ‘Lyell Medal’ of the Geological Society of UK for his “significant contribution to the science by means of a substantial body of research”. This was undoubtedly for his involvement in the IGES and the publication of its report.

The value of Broughton Edge to Australia

Broughton Edge was certainly the first British geologist to come to Australia with experience in exploration geophysics, at least in electrical methods. Although he was only in the country for two years, from 1928 to 1930, his leadership in the IGES provided training to a number of Australian graduates at that time. As we have seen, he believed those graduates would be capable of operating geophysical surveys by themselves and, indeed, some went on to conduct their own surveys. Later some of these graduates became section leaders in the Aerial Geological and Geophysical Survey of Northern Australia AGGSNA (1935–1940), and later in the Bureau of Mineral Resources (BMR). More on these subsequent exploits is given in Thyer (1979, pp. 246–9).

Also, Thyer (1979, p. 248) notes that “Three of the six geophysicists appointed [to the AGGSNA] had received their training with the IGES”¹⁰. In that sense, perhaps, Broughton Edge was a ‘father’ to these young trainees and, as such, the “father of exploration geophysics in Australia”.

¹⁰These young geologists included, J M (Jack) Rayner, L A (Lew) Richardson, T F (Bob) Thyer, E L (Eric) Blazey, and N H (Norm) Fisher.

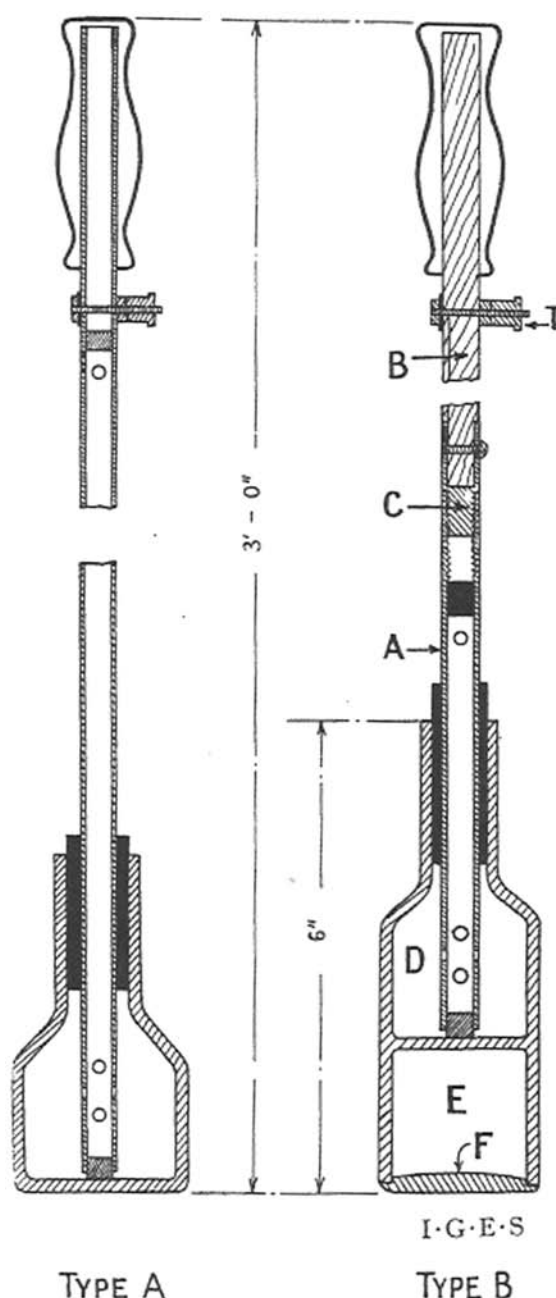
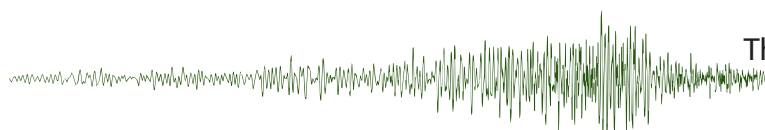


Figure 4. Drawings of two types of non-polarising electrodes, Type A after C Schlumberger and Type B originally designed by Broughton Edge (from Broughton Edge and Laby, 1931, Fig. 180).

References (see newspaper references separately as Appendix 2)

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- Broughton Edge, A. B., 1928, Geophysical prospecting: *Australasian Institute of Mining and Metallurgy Proceedings*, **71**, 87–98.
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- Thyer, R. F., 1979, Georoots – Early geophysical prospecting in Australia: *Bull Aust Soc Explor Geophys*, **10**(4), 244–251. doi:10.1071/EG9790244
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- this form of scientific prospecting, would visit Australia next year to organize investigation by this means [the IGES] and also train Australian graduates".
- On March 14, 1928, the *Adelaide Advertiser* newspaper in a short, 56 word article (*The Advertiser*, 1928), reported that "Mr Broughton Edge of the London (*sic*) School of Mines, will arrive in Australia shortly". "He will be assisted by several specially selected Australians".
- After his arrival in Australia, the following newspaper reports allow us to follow Broughton Edge's progress through key cities in 1928.
- On May 5, 1928, *The Sydney Morning Herald* has two separate items on page 18 referring to Broughton Edge (*The Sydney Morning Herald*, 1928). One item of 320 words under the heading "A hopeful experiment", reported that "Mr A. Broughton Edge" was the leader of the survey party and that he was at present in Australia.
- Also on the same page, in a 150 word article headed "Geophysical Survey. Expert's arrival. Kalgoorlie" (*op cit*) it was reported that "Mr Broughton Edge, leader of the geophysical (*sic*) party arrived in Kalgoorlie yesterday [May 4], and left for Melbourne to-day, where he will confer with the Commonwealth authorities...". "Whilst in Kalgoorlie he spent most of his time inspecting the mines". That evening he was given a civic reception by the Mayor of Kalgoorlie who "expressed the hope that the Federal authorities would decide to commence ...on the Golden Mile" (the gold mine at Kalgoorlie). Broughton Edge, it is reported, said "nothing would give him greater pleasure", but that "He could not say, however, what his programme would be until he consulted the Federal authorities". This was a suitably diplomatic reply at this early stage. As it transpired, the only IGES survey made in WA was in the Northampton mineral field, near Geraldton, 475 km north of Perth, using electrical methods.
- The Kalgoorlie *Western Argus* of May 8, 1928, in an article giving much more space (1100 words) to the "civic reception" in Kalgoorlie, reported that the reception was in the presence of over 20 people including members of the WA Chamber of Mines and WA School of Mines (*Western Argus*, 1928). Mr Broughton Edge was introduced as "one of the world's leading authorities on the comparatively new science of geophysics". This was prior to his departure on the "trans-Australian train" (he later arrived in Adelaide on or before Monday May 7 and Melbourne on May 8).
- On May 9, 1928, *The Argus* of Melbourne reports that Broughton Edge arrived in "Melbourne from Adelaide yesterday morning" (*Argus*, 1928). Its 490 word article largely repeats earlier reports but advises that "He had conferred with the Government geologists in Western Australia and South Australia and would consult the Government geologists in each of the other States before beginning operations". A piece of confirmatory information here is that Broughton Edge "arrived in the Commonwealth three weeks before ...Mr S. H. Shaw, one of Mr Edges's assistants".
- On May 28, 1928, the *Examiner* newspaper, of Launceston, in 127 words, reports that "Applications are now being invited in Australia for the appointment of physicists, geologists and surveyors". "...several members [of the party] are yet on the water between England and Australia. The first of these, Mr. J. C. Ferguson, a highly trained assistant who has spent some years

Appendix 1. Newspaper reports concerning Broughton Edge

The IGES had a high public profile from the time it was first mooted, gaining considerable exposure in newspapers. Not all reports are entirely reliable or original, but some reveal useful information. Those with reference to Broughton Edge are included here, with informative details underlined. See Appendix 2 for references given here.

The first mention found by the author of Broughton Edge in an Australian newspaper, is in the Murwillumbah *Tweed Daily* of August 8, 1927 (*Tweed Daily*, 1927). In 100 words, with a heading "Seeing Underground", it is reported that the then Prime Minister, Mr. Bruce, announced Australia's involvement in the IGES and that "Sir (*sic*) Broughton Edge, who is an expert in

with Mr. Edge in Rhodesia, is on the Orvieto..." (*Examiner*, 1928).

On July 26, 1928, the *Brisbane Courier*, in 137 words, reported that Broughton Edge "conferred" with the [Queensland] Minister for Mines (Mr A J Jones) together with the Chief Geologist, Mr B Dunstan. Also, "He will attend a special meeting of the Queensland Oil Board" (*Brisbane Courier*, 1928).

Appendix 2. References for newspaper articles

Argus, 1928, Geophysical survey – Mr. Broughton Edge arrives. (Melbourne, Vic.) 9 May, p. 10. <http://trove.nla.gov.au/newspaper/article/3951889>

Brisbane Courier, 1928, Geophysical Surveys – Mr. Broughton Edge's visit. (Qld.) 26 July, p. 16. <http://trove.nla.gov.au/newspaper/article/21310483>

Examiner, 1928, Geophysical Prospecting. (Launceston, Tas.) 28 May, p. 6. <http://trove.nla.gov.au/newspaper/article/51480131>

The Advertiser, 1928, Geophysical prospecting. (Adelaide, SA) 14 March, p. 13. <http://trove.nla.gov.au/newspaper/article/47464058>

The Sydney Morning Herald, 1928, (a) Geophysical survey-expert's arrival – Kalgoorlie; (b) Geophysics – plans for survey – "A Hopeful experiment" – Canberra. Friday. (Sydney, NSW) 5 May, p. 18. <https://www.newspapers.com/newspage/122351820>.

Tweed Daily, 1927, Seeing underground – geophysical prospecting. (Murwillumbah, NSW) 8 Aug., p. 2. <http://trove.nla.gov.au/newspaper/article/194738910>

Western Argus, 1928. Geophysical survey – Mr. Broughton Edge – Civic reception. (Kalgoorlie, WA) 8 May, p. 22. <http://trove.nla.gov.au/newspaper/article/34429795>

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