
HISTORY of PETROLEUM EXPLORATION

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Chapter 2

DISCOVERY OF THE 'OFFICER BASIN'

Petroleum exploration in the South Australian sector of the Officer Basin from 1954 in essence has comprised basic surface mapping, exploratory and stratigraphic drilling, a few limited gravity and magnetic surveys, and cursory seismic traverses. The sedimentary basin underlies the Great Victoria Desert. The remoteness and desolation of the inhospitable, almost inaccessible and largely uninhabitable region hindered exploration and limited interest in its hydrocarbon prospectivity. But these were factors which led to a large part of the area being proclaimed as the North-West Aboriginal Reserve in 1921 and being used for the United Kingdom–Australia missile testing program from 1946 to 1980 and for the British nuclear tests from 1952 to 1963.

One aspect of the preparation for the testing of long-range missiles and atomic weapons was the commencement of modern geological work in the region. Hydrological surveys by the then Mines Department assisted in establishing sites for these programs. As a consequence of this, and a growing interest in South Australia's petroleum prospectivity, the first indications of the basin came through a Bureau of Mineral Resources (BMR) small-scale reconnaissance aeromagnetic survey in 1954, which indicated some thick sedimentary sequences (Quilty and Goodeve, 1958).

Earlier announcements about the petroleum prospectivity of the far west and northwest of South Australia had not been very encouraging. For example, although there had not been any drilling for oil in the far west, in 1944 the Government Geologist, Dr Keith Ward, discounted the Precambrian rocks of the northwest because there were then no producing oilfields of Precambrian age in the world (Ward, 1944).

The introduction of specialists and advisers with expertise in new exploration techniques, such as improved drilling standards and equipment (rotary and percussion drilling replacing cable tool drilling), geophysics (seismic, gravity and aeromagnetic surveys) and theoretical constructs for investigating buried structures rather than deposits (as the oil search demanded), was critical to the search after World War II (O'Neil, 1982, 1995). Evidence of the new approach was seen in the efforts of the Frome-Broken Hill Co. Pty Ltd, in conjunction with the BMR, in the east of the State immediately after the war (O'Neil, 1996a).

Until the mid-1950s, the whole of the far west and much of the northwest was still known geologically as the Eucla Basin. This comprised an area of ~388 500 km² in western South Australia and southeastern Western Australia,

including 178 700 km² of the Nullarbor Plain. The Mines Department commenced a geological survey, for minerals, in the northwest in 1953 under geologist Reg Sprigg, who later claimed to have referred informally to the area as the Officer Basin and that it was formally named in 1954 by F.H. Quilty and P.E. Goodeve (Sprigg, 1983). Although Quilty and Goodeve did report indications of a basin from the results of their survey across the area to as far east as Oodnadatta in May 1954, they did not refer to it as the Officer Basin. The separation of the basin into the Eucla and Officer Basins was, however, recorded in the 1959–60 Annual Report of the Mines Department. It can be assumed that the name of the basin is related to Mount Officer and Officer Creek, which extends from the Musgrave Ranges via Fregon west of Everard Ranges and into the northern part of the basin.

EARLY EUROPEAN EXPLORATION

In September 1873 during his second trip into the South Australian interior, Ernest Giles and another party member, William Tietkens, had an 'encounter' with an estimated 200 male Aborigines. Shots were fired by the Europeans in retaliation for the spears thrown. The Europeans escaped unharmed; Giles did not record if there were any black casualties. However, he acknowledged that the usual cause of Aboriginal aggression throughout the history of land exploration by Europeans in Australia was white trespass on black land (Giles, 1889). He named the river at the scene of this confrontation 'The Officer'; it was renamed Officer Creek six decades later. A hill to the northeast of the creek and west of Mount James-Winter was named Mount Officer — C.M. Officer was a contributor to the fund raised by Baron Ferdinand von Mueller in Melbourne for this expedition (Manning, 1990).

Several exploration parties visited the far west and northwest of South Australia in the quest for water supplies, overland stock routes or pastoral land, and to establish lines of transport or communication. Some of these explorations were also made with an interest in the geology or mineralogy of the land. Edward John Eyre's overland journey during 1840–41 to central and Western Australia attempted to link South Australia with its colonial neighbour. On the way, Eyre passed through the southern margin of the basin. In 1870, John Forrest, travelling Eyre's route in reverse, was the first person to cross from west to east.

Ernest Giles made five trips to the interior of Australia between 1872 and 1876, the first two (1872 and 1873–74) using horses and the next three camels. The 'ships of the desert' were the preferred means of transport for most of the

explorations in the outlying regions. Giles was accompanied by Tietkens on the second to fourth trips: Tietkens himself continued exploring and later led the Central Australian Exploring Expedition in 1889 (Tietkens, 1890). It was in September 1873 during his second trip that Giles named Officer Creek.

At that time an expedition by William Gosse was trying to find a route from the Overland Telegraph line (completed in 1872) to the west coast (Gosse, 1874). Gosse and his party reached Mount Davies in the Tomkinson Ranges in that August, followed a month later by Giles. In 1874, John Forrest travelled from the west to the Overland Telegraph line to the south of Oodnadatta across the area of the Musgrave Block. In the same year, J. Ross examined the area for fresh water supplies and explored for pastoral land west of Lake Phillipson (Ross, 1875; Jack, 1931).

During Giles' fourth expedition, which went from Beltana to Port Augusta to Perth during May to July 1875, he despatched Tietkens and Jess Young to examine the area north of Ooldabinna. Giles spelt this as 'Yooldil-beena', meaning 'swamp where I stood to pour out water'. It was a native well northwest of Tietkens Wells, which was 70 km north of Ooldea. They went slightly north of latitude 28°, between 130° and 132° longitude, to a point which was approximately the boundary of the Musgrave Block and the Officer Basin. Giles had hoped that they would find sufficient water supplies to establish a route from Fowlers Bay to the Musgrave Ranges, but this was not to be. Even Tietkens' Wells, sunk in 1875, were abandoned as one was dry at 18 m and the other was very saline at 37 m. Tietkens returned to the vicinity to supervise further water drilling operations in 1879 (Gara, 1994).

Ernest Giles' fifth expedition, between November 1875 and April 1876, was from Geraldton in Western Australia, across the Gibson Desert to the Overland Telegraph line, and to Blinman in South Australia in an easterly traverse through the far northeastern reaches of the Officer Basin (including the Musgrave Ranges, Mount Officer, The Officer, Everard Ranges and Alberga River).

Between 1883 and 1892, the South Australian Lands Department undertook triangulation surveys of the area and the colonial borders (Carruthers, 1892). Carruthers Depot was named after Jonathon Carruthers, the Department's surveyor. During 1891–92, the Elder Scientific Exploring Expedition under the sponsorship of Sir Thomas Elder and command of David Lindsay, and including geologist Victor Streich, crossed part of the area while travelling from Warrina, a railway siding on the Marree–Alice Springs railway line to Coolgardie, during an investigation into central and Western Australia (Lindsay, 1891; Streich, 1892).

There were repeated requests from members of the public and through debates in Parliament for the northwest region in the vicinity of the Musgrave Ranges to be examined. This interest focused on the likely mineral (especially gold) potential of the area, the possible expansion of the railway network to the ranges and the expectation of unlocking more land for pastoralists and agriculturalists, in particular to help relieve the unemployment being endured in the 1890s depression (O'Neil, 1982). Thus, Government Geologist H.Y.L. Brown was sent to Western Australia to examine the

Coolgardie region, which he visited between October and December 1895. He reported that the country north of the Nullarbor Plain adjacent to the Western Australian border was a continuation of the geological formation in Western Australia and so it could be gold prospective. But the prospecting to then had been cursory and the vast area to the Musgrave Ranges required a more thorough examination (Brown, 1896). Brown himself was an inveterate explorer and between April and June 1896 he explored the western part of South Australia from Ooldea north for ~160 km, returned to Ooldea and then went to Mount Eba and Marree (Brown, 1898–99).

Other explorers or prospectors identified with the area include J. Lamb (1894), A.H. Warman (~1900) and W.J. Cockrum (~1900). The 1896–97 South Australian Stock Route Expedition, under Captain S.G. Hübbe with William Murray in the party, took nine months to travel from Oodnadatta to Kalgoorlie (Hübbe, 1897). Murray then recorded the position of The Officer more precisely (Hübbe, 1897). In 1900, a party from the North-Western Prospecting Syndicate of Western Australia reached Oodnadatta after suffering various hardships, including encountering strong resistance from Aborigines in South Australia's northwest (*Advertiser*, 11.4.1901).

Between 1897 and 1903, Richard Maurice undertook at least eight expeditions relating to the Great Victoria Desert while living for most of this period at Pidinga, 128 km northwest of Fowlers Bay. He recorded data on the plants, animals and landscape as well as collecting mineralogical, biological and ethnographical specimens. During 1898–99 he travelled north from Fowlers Bay across the desert, through the Everard Ranges to Stuart (later Alice Springs), and west to Hermannsburg Mission Station in the Northern Territory. His 1901 expedition was accompanied by William Murray. This search for water and pastoral land included some mineral examination, and attempted to fill in the gaps between the expeditions of Giles and Lindsay. They crossed southwest to northeast from Ooldea to Tallaringa Well (an Aboriginal soak), Oolarinna Spring and the Everard Ranges, and back to Ooldea by a westerly route. Then the party went from Ooldea to Punthanna Native Well and west-northwest past Pat Auld's Vat to the western border (Jack, 1931). During this exploration they saw evidence of the visits by the Western Australian prospectors, Warman, Cockrum, and the Lindsay and Hübbe expeditions. The party camped on The Officer while travelling to Oolarinna and Ooldea; and again when they went to the Northern Territory in 1902 (George, 1904; *Advertiser*, 11.4.1901). In 1902, Maurice and Murray went north from Fowlers Bay to the Kimberley district in Western Australia. The mineral specimens they collected were given to the Mines Department for analysis.

The South Australian House of Assembly passed a motion in December 1901 that the Government undertake a mineralogical examination of the country between Tarcoola, the Musgrave Ranges and the northwest of the State. In the following December, the Government North-West Prospecting Expedition, including Lawrence Wells, Herbert Basedow and Frank George set forth (Wells and George, 1904; Basedow, 1905, 1914). Between April and September 1903 the party journeyed northwest from Oodnadatta to 'Todmorden', Alberga River, Mount Mystery, Krupps Hill

and Indulkana (the far northeastern extent of the basin), and returned. The expedition helped to fill in gaps of the Elder and Horn expeditions; the Horn Scientific Expedition had gone to central Australia from Oodnadatta in 1894 (Winnecke, 1896). The North-West Expedition found little conclusive evidence of valuable minerals but H.Y.L. Brown doubted its results because of the short time available to prospect properly. Instead he relied on his own impressions of the region and of geology in suggesting that gold and other mineral discoveries would be made there.

In April 1904, Brown again left Adelaide and visited the region from Lake Phillipson to the Wildingi granite (Brown, 1905; Jack, 1931). His route took him slightly west of Mount Byilkaora and north to the Northern Territory border, Stuart Range area, 'Todmorden', Indulkana, Alberga and Bitchera Creek.

Using Maurice's camels and equipment, Frank George (then a Mines Department surveyor) led a prospecting expedition in 1904 from Fowlers Bay to northwest of Lake Dey Dey and across the State border to the Boundary Dam salt lakes in Western Australia. He named Lake Maurice, which had been discovered but not named by Ernest Giles in 1875, and reported that gold and other metallic mineral discoveries were unlikely in the region (George, 1905). Another of his Government prospecting expeditions, during 1905–06, went to the southwest of the Northern Territory; upon George's death, Murray (then with the Mines Department) took charge and the party went to the Buxton and Davenport Ranges from Oodnadatta via 'Todmorden' and Indulkana (George, 1907).

Between 1912 and 1917, the east–west Trans Australian Railway across the Nullarbor Plain was constructed by the Commonwealth Government in the southern part of the basin. The geological and surveying work for this project was naturally directed towards ensuring the best possible route for the line.

The year 1914 was one of severe drought in the State but it was at the end of this year that the Assistant Government Geologist, R. Lockhart Jack, made the hazardous trek to the Musgrave Ranges. The expedition was a geological survey and an examination for water supplies, minerals and possible pastoral land south of the ranges. The noted ornithologist, Captain Samuel White, accompanied Jack to 'Todmorden',



Lockhart Jack's party leaving for the Musgrave Ranges from Wantapella Well on 'Indulkana' in 1914. The Government Astronomer, George Dodwell, is in the lead with his dog, Speck, not far behind.
(Photo N679)

96 km northwest of Oodnadatta where the Government Astronomer, George Dodwell, joined the group (AR*, 1914; Jack, 1915). Jack was unimpressed with the mineral possibilities there.

Also during that year a petroleum specialist, Arthur Wade, was appointed by the State Government, at the request of several parties interested in discovering petroleum, to investigate several supposed oil-bearing areas in the State (Wade, 1915). Wade's brief examination of lower Eyre Peninsula, essentially the coastal region, extended west to Streaky Bay. He reported in passing that gas in connection with mound springs, petroleum-like streaks on Streaky Bay and a 'bitumen' discovery at one locality were not evidence of oil or gas seeping to the surface. His expectations of the State's petroleum potential were not encouraging and he dismissed the possibility of petroleum supplies being found in this region in particular.

For the next 40 years there was little activity or even interest in the mineral or petroleum prospects of the basin. In 1917, Talbot and Clarke from the Western Australian Geological Survey travelled east as far as Mount Gosse and the western Musgrave Block. In 1925, Ward and Jack visited an area lying beyond the occupied pastoral holdings in the northwest and reported on prospecting for water there, and two years later they inspected areas of the far west where water supplies might be located (AR, 1925, 1927). Prior to leaving the Department in 1931, Jack investigated the geology north and northwest of Tarcoola and went to 'Wilgena', 'Commonwealth Hill', Coober Pedy, Tallaringa Well amongst other sites on the periphery of the basin (Jack, 1931).

Several of these explorers are renowned for the heroic and epic nature of their journeys. Nevertheless, their endeavours rarely met their expectations: the land was not conducive to supporting large populations, it was not good enough for pastoral and agricultural pursuits, nor did it provide substantial water supplies. Just as these desired outcomes were not achieved, the mineral and petroleum potential remained to be tested more thoroughly. From the mid-1950s, however, geological, geophysical and drilling exploration were to generate limited information from sparse programs.

WEAPONS TESTING

As part of a fledgling effort to bring South Australia into the atomic age, such was the interest being generated by the State's uranium supplies at Mount Painter and Radium Hill from the mid-1940s, the desert then seemed an apt site for tests on long-range weapons and atomic bombs (Morton, 1989; O'Neil, 1996b). Although they originated as discrete projects, the tests overlapped in the initial period after the atomic tests were moved to the Australian mainland in 1953. In the context of limited resources, the harsh environment and the same British, Australian and South Australian political masters, it made practical sense to share equipment, facilities, communications, transport and working time (Morton, 1989). For example, the Native Patrol Officers scoured the desert in respect of both projects as did Len Beadell in establishing sites and routes, planes from the Maralinga

*Annual Report, under varying titles, issued by the Mines Department.

atomic tests were decontaminated at the long-range weapons base at Woomera (named after a non-local Aboriginal spear throwing and carrying implement) and the Mines Department conducted groundwater investigations and drilling for both projects.

A major missile testing range operated in South Australia from 1946 to 1980 under joint United Kingdom and Australian control. The general firing direction was from Woomera over the South Australian desert towards the northwest of the continent. Thus, part of the Officer Basin fell within the Woomera Prohibited Zone, an area under the control of the Australian Government, to which access was restricted. All people were required to be issued with a permit from the authorities at Woomera before entering this area and movement within the area was often under scrutiny, at least in theory if not in practice. In 1954, for example, when the Australian Mining and Smelting Co. was considering a work program as part of its licence commitments, Premier Tom Playford wrote to Prime Minister Robert Menzies on behalf of the company to secure access to the zone.

On the mainland, two atomic bombs were exploded in 1953 at Emu Field, ~500 km west of Woomera and 250 km west of Coober Pedy, in the prohibited zone and in the firing line of the rocket range (Symonds, 1985). The first (Totem 1) was exploded at Emu on 15 October 1953. Some Aborigines have attributed a 'black mist' passing over 'Wallatinna' and 'Welbourn Hill' from this test as a cause of their ill health (Lester, 1993).

Emu, a remote claypan, was difficult to access and the logistics of the exercise meant that after a second test there, the atomic program was moved to a site 80 km north of Watson on the Trans Australian Railway. The new site, Maralinga (an Aboriginal word meaning 'thunder'), is 177 km south-southwest of Emu. Seven bombs were tested there between September 1956 and October 1957. 'Minor trials' of small nuclear weapons, which dispersed plutonium, continued at Maralinga until 1963 and the site was abandoned in 1966. Clean-up exercises in 1964 and 1967 were found by the Australian Royal Commission into British Nuclear Tests in Australia (1984–85) to have not only been ineffectual but also made the site more dangerous. As a result of this most recent inquiry, MESA has been associated with preparations for the current clean-up operation.

The Mines Department undertook geological and drilling work for both atomic testing projects. This began in 1947 when Assistant Government Geologist Tom Barnes prepared a hydrological survey with some geological work in the northwest for the Long-Range Weapons Project (AR, 1947). A preliminary data search by the Department for the area of the atomic tests included checking the region west of the north-south railway line to the Western Australian border, and north from the Trans Australian Railway to the Northern Territory border (O'Neil, 1995). Over the years (and even after he became the Director of Mines in 1956), Barnes continued his special hydrological investigations. Through the 1950s, percussion-drilled deep and shallow bores were sunk at Maralinga for underground water and for special purpose bores. The water work continued into the 1960s.

The Federal Government's Petroleum Search Subsidy Scheme from 1957 subsidised stratigraphic drilling but required the results of work programs to be published or else the funding was likely to be refused (Passmore, 1994). As exploration in the Officer Basin required clearances from the authorities in charge of both Woomera and Maralinga, security concerns meant that permission was also necessary before results could be published.

POST-WORLD WAR II GEOLOGICAL EXPLORATION

In 1953, a Departmental party led by Reg Sprigg and including Ron Coats went to Mount Davies on a mineralogical expedition essentially to investigate uranium deposits, but some of the samples collected showed traces of nickel. (A gold lease had been pegged in the area by the prospector Cockrum in 1900.) In 1954, Special Mining Lease 20 was pegged by Gold and Mineral Exploration NL in the Mount Davies area of the Musgrave Block adjoining the Officer Basin. The lease was taken over by Southwestern Mining Ltd in 1955. In this period, the Department sank eight bores for private hirers in the vicinity, of which three were productive (AR, 1955). Nickel mineralisation in the northwest province continued to attract attention into the next decade. In November 1965, a low-level survey of parts of the MANN and WOODROFFE 4-mile sheet areas was flown by the Department as part of an investigation into basic and ultrabasic rocks in the area, which was the prime focus of the regional mapping and nickel investigations.

Regional geophysical surveys were conducted spasmodically in the Officer Basin after the first aerial survey in 1954. Aeromagnetic surveys over the far northwest, including the Tomkinson, Mann and Birks Gate Ranges, were flown by BMR in June 1960. The Mines Department was mapping in the field: this focus was essentially mineralogical, with nickel in the Tomkinson Ranges being the target. Nevertheless, in 1960, the first field work on petroleum in the basin commenced. On behalf of Exoil, the Department's Geophysics Section ran a single ground traverse of gravity and magnetic observations from Ooldea north along the 131° line of longitude across the Officer Basin using a helicopter to transport the equipment. The survey, which gave further evidence of a basin, was conducted along the eastern perimeter of Maralinga because permission was refused to enter the area (Mumme, 1961).

Petroleum industry exploration is reviewed in a section below. The following refers to some of the State Government work. During 1961–62, a Departmental geologist accompanied a brief aerial reconnaissance of the southern Officer Basin and part of the Eucla Basin with Exoil representatives. A Departmental seismic crew was operating west of Emu Field: international seismic crews were also introduced to the basin under contract for reflection and refraction seismic surveys. During 1964–65, the Department's Seismic Geophysics Section spent 3½ months in the South Australian part of the Eucla Basin on reconnaissance work and detected a sedimentary trough at a much greater depth than anticipated. A seismic reconnaissance was made from Maralinga to north of Emu and then from Emu to Mabel Creek (AR, 1965–66).



Refuelling the helicopter during the Officer Basin gravity survey in May 1962. (Photo T3372)

Although the Department was then scaling down its large-scale seismic operations, it ran a seismic survey in the eastern Officer Basin in July 1966. The combined seismic reflection, seismic refraction and gravity survey was run as a single traverse across a marked aeromagnetic low beginning at Emu 1 and extending 122 km north to the lower reaches of the Officer Creek. This was considered as ‘probably the most difficult seismic traverse’ the Department had ever undertaken as the dune-covered terrain comprised east–west trending, scrub-covered sand ridges which made access difficult even with the use of a bulldozer. The mobile camp was serviced with fresh water from either Maralinga or ‘Everard Park’, making for long hauls. The water for drilling was saline, and was obtained from shallow bores near Emu Field and bulldozed soaks 80 km north of Emu. The reflection shooting indicated a probable thick sedimentary section in the north of the basin (AR, 1966–67; Wopfner, 1969, 1970).

During the 1960s, the Department was concerned to increase the quantity and quality of exploration in the basin and to expand the evolving knowledge of the basin’s geology. The first significant geological traverse of the Tallaringa Well area was made in 1966 by Departmental geologists Bruce Webb and Bryan Forbes, although Brown and Jack had made the first geological investigations there decades before (Benbow, 1993). In the mid-1960s, the Department re-examined all of the rock samples from the basin and used the services of Amdel for petrographic testing of new samples. Departmental petroleum and regional mapping geologists visited the basin to investigate sedimentary rock



The Officer Basin seismic survey, looking south along the survey line from shot point EO 155, in 1966. (Photo N16912)

outcrops. Reconnaissance work, including two regional helicopter surveys of the Officer and Eucla Basins during 1968–69, helped to define targets and further delineated the margins of the basins.

From the early 1970s, the Department also undertook stratigraphic drilling, including Mount Willoughby 1 (November 1970), Wallira West 1 (Arckaringa Basin, March 1971), Marla 1 and Manya 1 (September 1974), and Murnaroo 1 (November 1976). Marla 1 and Manya 1 were on the far eastern perimeter of the Officer Basin. Also drilled were Marla 1A and 1B; drilling problems caused Marla 1B, ~20 m from Marla 1A, to be abandoned at 379 m (Pitt *et al.*, 1980).

However, the Department’s basic exploration work then was often curtailed because of funding constraints. The cessation of field work in the basin came at a critical time; the similarity between the sequences in the basin and those at Palm Valley and Mereenie in the Northern Territory required further assessment. During 1971–72, the drilling of a major well on the southern shelf of the Munyarai Trough was not carried out due to lack of funds, but a ground traverse was conducted between Everard and Watson, and some experimental seismic work was recorded from Wallatina Waterhole into the Munyarai Trough. During 1972–73, seismic profiling produced poor results in a narrow extension of the basin in the east; on the northern margin, south of the Everard Ranges, gravity, magnetic and seismic data were recorded. In 1974, the Department continued its seismic operations in the eastern Officer Basin and recorded 140 km.

Mapping and drilling in the Musgrave, Everard and Tomkinson Ranges in the northwest (particularly at Mount Davies for nickel) continued during the 1960s and into the 1970s. But, by the mid-1970s, access to the area for the Department and mining and petroleum companies had become increasingly more restricted. Despite the promising indications of potential mineral wealth in the area and the vastly underexplored petroleum potential, Departmental and company work programs ground to a halt there (O’Neil, 1995).

ABORIGINAL LAND RIGHTS AND EXPLORATION ACCESS

The Aboriginal occupants of the area had several different clan backgrounds but they are now labelled broadly as Pitjantjatjara and Maralinga people, though within these groups there are strong tribal and regional differences: for example, ‘According to missionary Violet Turner, Ooldea Soak ... was visited for ceremonial purposes by “Kukatats from Tarcoola, the Minnings from Eucla, the Aluridjas from the Musgraves, the Wongapitchers from the Mann Ranges”.’ (Mantingley and Hampton, 1988, p.235). However, for much of the period, the Aborigines were treated as a monocultural race and this is evident in the promotion of reserves for their protection and improvement or, in some cases, to ease their presumed passing. Daisy Bates, at Ooldea from 1918 to 1934, was one who attempted to retain the Aboriginal people’s independence.

For its part, the Mines Department had elsewhere confronted the question of Aborigines, their relationship to the land and mining by Europeans. In 1905, the Department reserved land near Parachilna for Aborigines to use in their traditional way. Another instance occurred after Jack's trip in 1914 to the Musgrave Ranges; in 1919 he reported on the desirability of establishing a reserve for Aborigines in the northwest (Jack, 1919). An important development followed when in 1921 the State Government gazetted more than 56 700 km² of the land as the North-West Aboriginal Reserve to safeguard the Aborigines against encroachment by white people, be they settlers or transient interest groups such as miners and prospectors. Additions were made to the reserve in 1938, 1949 and 1974; by 1949, the area proclaimed in South Australia was 71 500 km², which with additional areas in Western Australia and Northern Territory formed the Central Aboriginal Reserve.

Establishing reserves for Aborigines began soon after South Australia was colonised, but those reserves were intended to be places where Aborigines would be 'Christianised and civilised'. The North-West Aboriginal Reserve, however, was in part more of a case of 'out of sight, out of mind', as was the nearby Ernabella Mission (run by the Presbyterian Board of Missions) which combined the religious theme with an encouragement of Aboriginal culture after it was established in 1937 in the Musgrave Ranges (O'Neil, 1995). The United Aborigines Mission, founded at Ooldea in 1933, closed in 1952 and the people were moved to Yalata Aboriginal Reserve, ostensibly because of the impending long-range weapons and atomic tests. Amata (then 'Musgrave Park', 130 km west of Ernabella) was founded in 1961; later reserves were established at Fregon and Indulkana, the latter in 1968 from a small section of the Granite Downs pastoral lease.

The reserves were not inviolate for all time and they were subject to European intrusion for defence, mineral and petroleum exploration, and geological mapping. However, companies wishing to work in the North-West Aboriginal Reserve had to observe rather strict guidelines in their relations with the local Aborigines. In 1954, when the Australian Mining and Smelting Co. was proposing its licence commitments, the Director of Mines wrote to the Aborigines Protection Board to request information on access conditions. The company subsequently advised him that it did not intend to enter any areas covered by the Aboriginal reserves although it did not have a map showing these (MESA file 2658/1953).

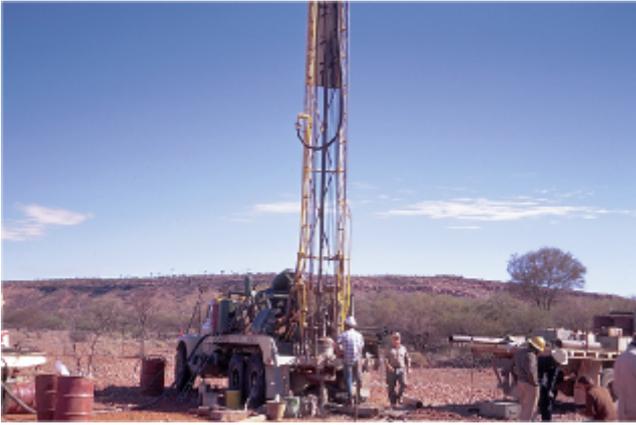
The South Australian Government's *Aboriginal Lands Trust Act 1966*, prepared by Don Dunstan when he was Attorney-General and Minister of Aboriginal Affairs from 1965 to 1967, set the pace for the nation on legislation and policies on Aboriginal affairs. A Government proposal to provide compensation to the Aboriginal people to ensure to them control of mineral rights in any lands held as Aboriginal lands was defeated in the Legislative Council. The Government instead signed an Indenture with the Aboriginal Lands Trust to the effect that all royalties for any mining on Aboriginal Lands Trust land would be paid to the Aboriginal Lands Trust.

1. Each member of any party entering the reserve to supply two personal references of character from reputable persons preferably Justices of the Peace, Government Officials, Ministers of Religion, the Director of Mines [or the company's Managing Director].
2. Each member to supply a medical certificate to the effect that the person is in good general health and is not suffering from any contagious disease.
3. That the leader of any party give an assurance that he will do all in his power to prevent any members of the party from clashing with the aborigines, will not encourage or permit the aborigines to congregate near any camp and that the leader will accept the responsibility of seeing that none of the party are intimate with female aborigines.
4. That no member of the party shall remove from the reserve nor trade with the aborigines for any ethnological specimens and shall not distribute to the natives any goods or chattels by way of barter or exchange.
5. That the leader of the party shall supply the Aborigines Protection Board with regular reports covering the numbers and conditions of any aborigines encountered and places where they met, any incidents which occurred between the party and the aboriginals, and anything of general interest to this Department.

On 1 April 1954, the Secretary of the Aborigines Protection Board wrote to the Director of Mines (MESA file 2658/1953) stipulating the guidelines for persons wishing to enter an Aboriginal reserve on behalf of the Australian Mining & Smelting Co. Ltd.

Under the Act, the Aboriginal Lands Trust was authorised to hold land titles in trust on behalf of Aborigines in South Australia. The Act did not permit Aboriginal land owners to negotiate mining agreements; the *Mining and Petroleum Acts* applied to Trust land but could be subject to additional conditions. The Act was amended in 1973 to permit Aboriginal communities to control mining and exploration on Trust land, which was then exempted from the *Mining and Petroleum Acts*; exploration and mining activities could not be prohibited, but the Trust and an individual community could stipulate conditions of access and operation, and the Governor could proclaim these special conditions. The Government could grant money to the Trust from exploration lease payments or mining royalties obtained through activity on Trust land. However, the Trust preferred to seek more titles to land rather than engage in managing the titles acquired, an activity which, in its view, was the responsibility of the Aboriginal communities concerned. Up to 30 June 1984, the Trust held 485 585 ha of land; as there had been no mining on this land, no mining royalties had been paid (Mattingley and Hampton, 1988).

The North-West Aboriginal Reserve included part of the Officer Basin which, in contrast to Jack's earlier views, was now considered to have mineral and petroleum prospectivity. Since World War II, the Department had sought to promote exploration opportunities in the area by mapping and drilling, especially in the 1960s, and companies such as Southwestern Mining, Exoil and Conoco had explored in the area too. In 1972, the Governor of South Australia, Sir Mark Oliphant,



A Mayhew drilling plant at site 4 on the Indulkana Aboriginal Reserve, July 1970. Ordovician sandstone of the Indulkana Range is in the background to the north. (Photo T12568)

included the Musgrave Ranges, Ernabella and Everard Park in a tour that he made to inspect the Aboriginal situation in the State.

An Australia-wide campaign for Aboriginal land rights had been stimulated and intensified by the Aboriginal tent 'embassy' on the lawns of Parliament House in Canberra between January and July 1972. Almost immediately upon the election of the Whitlam Federal Government in December 1972, A.E. Woodward QC was commissioned to inquire into Aboriginal land rights in Federal territories. In May 1974, the Woodward Commission recommended that Aborigines should receive title where traditional land ownership in Aboriginal reserves and other unalienated Crown lands could be shown, and in alienated land where traditional land ownership could be demonstrated or if title was socially and economically desirable. The Commission considered that mining on reserves should be allowed but only with Aboriginal consent, except where mining was in the national interest. Aboriginal claims to mineral rights were rejected.

Following the State's pioneering legislation on Aboriginal land and in accordance with the Woodward Commission's recommendation, in May 1974 the Dunstan Government announced an important initiative. In respect to mineral exploration and mining, Aborigines living in the area concerned were to be consulted so that they would fully understand the proposed work and, upon consenting to it, could participate in the venture to the fullest extent that they were able. Only in matters of State or national importance would Cabinet consider over-riding this (AR, 1973-74).

Government officials met with the Aboriginal people at Yalata early in July 1974 to discuss implementation of the Government's rules. Meanwhile, active exploration was held over in 1974 and 1975 when the Pitjantjatjara people and the Departments of Mines and Community Welfare undertook to identify and locate Aboriginal sacred sites in the reserve. In a sense this continued the concern for the local Aborigines that had led to the Reserve's creation. For example, seismic lines were to be positioned so that sites of significance would be avoided, training and employment were offered to some Aboriginal people to work with the exploration parties, and

the land would be open under protection so that the Department and companies could go there amicably by agreement. An industry and Departmental preference for completely unrestricted access was not likely.

The crews would occasionally help Aboriginal groups during Departmental field trips to the Musgrave Ranges area of the reserve. In September 1976, Departmental geologist Colin Gatehouse and other Government officials consulted with the Aboriginal people, and at Coffin Hill (on the northern perimeter of the Officer Basin) Gatehouse completed some jobs for the Aborigines. During the course of their discussions with him concerning exploration and mining in that area, the tribal elders made known their wish for the land to be transferred to them.

There was increasing public interest in handing back land to the Aboriginal people (Toyne and Vachon, 1984). Based on experiences of Aboriginal communities in the Northern Territory, particularly through the impact of mining companies and their activities, the Pitjantjatjara and Yankunytjatjara communities in the northwest of the State formed the Pitjantjatjara Council in 1976. The Department had already experienced some difficulty in getting its scientific parties into Pitjantjatjara country, and this was a warning of tougher times to come. The council pursued its claim to land title without reference to the Aboriginal Land Trust, arguing that, because the Pitjantjatjara's link with the land and their lifestyle had been maintained, then their land should not be subject to other Aboriginal people who had lost their traditional ways. Premier Dunstan's election policy in 1977 committed the Government to implementing land rights for the Pitjantjatjara people and, in November 1978, Parliament considered the *Pitjantjatjara Land Rights Bill*. Its passage was delayed by the Premier's resignation because of ill-health and the subsequent electoral defeat of his successor in September 1979. A modified version of the Bill was finally passed by the Tonkin Government on 4 March 1981, though it was not proclaimed until October of that year.



The Mines Department drilled for water in and around the North-West Aboriginal Reserve in 1970 and 1971 on behalf of the Department of Aboriginal Affairs. Four engine-driven and seven hand-operated pumps, four windmills and storage tanks were installed to provide water supplies for the Pitjantjatjara people. Being erected by the Department at Indulkana in 1971 were this 5000 gallon tank on a 30-foot stand and 48-foot windmill. (Photo T21773)

Minister of Community Welfare

Dear Sir

We want this areas. So we can try to get this land for us. So we have meeting at Coffin Hill all old people want this Land this is what they want. 39 Gilpi wati have been this meeting and we been wrote the Line on the map showing or country Some Old Gilpi write name on map to show they true country and after this meeting we want Mr Busbridge and Mr Nicholas to come to Indulkana for meeting so we can have meeting in Dec the 6 and we want this country for all the people with name underneath Manage Iltur Community.

Punch Thompson	Taylor
Windlass	Jim Pingey
Jimmy Stewart	Willy
Mike	Willy Murray
Punch	Dan
Jack Cox	Murray
Jack Windlass	Harry Wiland
Ray Ayaiya	Charlie Tunkin
Paddy	Wilbur Brooks
Charlie Tambo	Mark Anderson
Tommy	Tommy Queama
Micky Norman	
King Everard	Bob Jones
Jimmy David	Jack Baker
Taylor	Harry
Con	Joe Windlass
Larry	Jimmy N.
Old Everard	Killy B.
Mike	

Transcript of a letter written to the Minister of Community Welfare, Ron Payne, by a group of Pitjantjatjara males (Gilpi – tjilpi – an old man or elder of the group; wati – a man) at Coffin Hill in the North-West Aboriginal Reserve on 27 September 1976. Not all signatures could be transcribed accurately and the second list provides additional names of some of those who signed the map of the North-West Aboriginal Reserve.

The Ministers of Mines and Energy wanted to ensure that the Bill would not totally block that land off for any future exploration and development; a lengthy process of protest, extensive negotiation and consultation about the legislation with the Aboriginal people ensued. Although successive Governments supported the concept of land rights, they opposed sterilising huge tracts of land from any activity at all for all time. The Department's previous investigations in the Pitjantjatjara Lands, in particular into the potential for petroleum, had aroused interest from companies and, with the land rights issue apparently resolved, access to the Officer Basin was encouraged by the Department, especially because of traces of oil bleeding from Byilkaooora 1, a stratigraphic well drilled in May 1979 at Mount Byilkaooora in the northeastern reaches of the Officer Basin. Although the Minister had previously called for expressions of interest in the area from companies, it was still too early to become excited about oil because the Pitjantjatjara were concerned with winning their battle for land rights, and a proposed exploration program was continually deferred.

The original *Pitjantjatjara Land Rights Bill* had established Anangu Pitjantjatjara (Pitjantjatjara people of central Australia) as a legal entity with title to 'nucleus' lands, that is the North-West Aboriginal Reserve and any pastoral leases in the region held by Aborigines. It also proposed a right to claim 'non-nucleus' land, such as nearby pastoral leases held by non-Aboriginal people, and a right to ban exploration and mining on their land. The Tonkin Government objected particularly to these latter proposals and, in February 1980, Premier David Tonkin announced that mineral exploration would be allowed on non-nucleus lands. In addition, the Government announced there would be a working party to register sacred sites on Pitjantjatjara land but this idea was unacceptable to the Pitjantjatjara Council and the sacred sites working party proposal lapsed without the party holding a meeting.

Further negotiations resolved the claims to the non-nucleus lands, the controls over exploration and mining, the rights of opal miners at Mintabie, and the Granite Downs lease. The Government incorporated significant concessions to the mineral ownership, royalty and disturbance provisions of the Bill. The inalienable freehold title to 102 630 km² of arid Reserve land and vacant Crown land was vested in Anangu Pitjantjatjara. Some non-nucleus land at Granite Downs was to be included in the deal, from 2008 when the leases expired, but no further claims were to be allowed there, nor could other vacant Crown land on pastoral leases outside the Reserve be claimed. Exploration and mining were not banned, but the Pitjantjatjara people could stipulate conditions of access and operations and were entitled to compensatory payments for disturbance to their land, people and way of life. The Minister of Mines and Energy retained the right to appoint an independent arbitrator if exploration or mining was vetoed or allowed but subjected to conditions to which the mining company objected. The economic significance of a mining project to either the State or Australia would be a prime consideration for over-riding the Pitjantjatjara's interests. The opal miners were granted a 21-year lease for the township of Mintabie.

The transfer of the land title to Anangu Pitjantjatjara was made at a ceremonial occasion presided over by Premier Tonkin on 4 November 1981 near Ernabella. Yami Lester (1993, pp.148-149) recalled the occasion:

I'll always remember the premier's speech that day. He said: 'All the world and the people of South Australia are watching you and what you're going to do with this land'. So I often remind Anangu about that: 'They're watching you'. If we don't do the right thing on this land, the Government is always watching to take it away. And that's the thing I can't understand. It's hard! We know this has always been our land. We got the stories, we got the culture; we got the language; we got the Law – our own Law. So why is the white man saying we're watching you, watching what you're going to do? The land was ours all the time. OK, we didn't have a piece of paper, but it was still ours.

While the Act recognised Aboriginal interests, the subsequent closure of the land to exploration, and often to entry, indicated that in practice the mining and petroleum industries were discouraged.

During the process of proclaiming the *Pitjantjatjara Land Rights Act*, the Department had eight applications involving 16 companies under consideration for exploration in the area. However, after so long in the balance, the Government's immediate moves to encourage exploration on Pitjantjatjara land did not give the Pitjantjatjara time to adapt to the new regime. In 1980, a consortium led by Haematite Petroleum Pty Ltd (the precursor of BHP Petroleum) had already applied for a Petroleum Exploration Licence (PEL) in the Officer Basin in Pitjantjatjara land.

After about a year of negotiating the process broke down when discussing the question of up-front payment of compensation for exploration work (the seismic lines, roads, airstrips, etc.) for disturbing the homelands out from Indulkana, Mimili and Fregon. The Bannon Government, elected in November 1982, maintained support for land rights but downplayed the significance of the mining sector and so indicated to companies to give the Pitjantjatjara time to think through and discuss the issues. The Act was now being interpreted in a way which had not been intended so that exploration could be frustrated or denied. But the outcome was one which really pleased neither the Government nor the Department. Another decade was to pass before real progress was made to resolve land access issues.

While the Act specified compensation for disturbance, Haematite refused to budge on the issue of paying compensation up-front for disturbance to the land during the initial exploration. Claiming that arbitration would involve expensive legal fees, Haematite also did not want to establish a precedent for the mining or petroleum industries by paying compensation (McRae *et al.*, 1991; *Advertiser*, 11.7.1984; MESA confidential file SR 27/2/43). The Government's understanding was that there would be no up-front payments for exploration; compensation clauses would apply if a resource was found. In July 1984, the Haematite consortium withdrew its licence application.

The *Maralinga Tjarutja Land Rights Act 1984*, although similar in many respects to the *Pitjantjatjara Land Rights Act 1981*, modified the conditions for mining on Aboriginal land; 'exploration' was defined more clearly than under the Mining and Petroleum Acts, sacred sites were excluded from initial



South Australian Premier David Tonkin and Pantju Thompson on 2 October 1980 signing an agreement enabling the Pitjantjatjara Land Rights Bill to proceed. (Photo 32375)



Premier Tonkin symbolically proclaiming the Pitjantjatjara Land Rights Act at Ernabella on 4 November 1981. (Photo T23104)

tenements, the Minister of Aboriginal Affairs was to be involved in decision making, and compensation for work or disturbances in the exploration phase was limited to that allowed in the Mining and Petroleum Acts (McRae *et al.*, 1991). The new Act generally limited the Yalata (southern Pitjantjatjara) Aborigines' influence over mining on their land. A resort to arbitration was retained at the production stage but the requirement for the Yalata Aborigines' consent for access to their land was lessened. Compensatory payments to the Yalata Aborigines were maintained for exploitation agreements. The freehold title to the 76 420 km² of Maralinga Tjarutja land was granted on 6 December 1984; the land grant document was presented ceremoniously on 18 December 1984 near Maralinga.

While it was fine in theory that companies and Aborigines might negotiate successfully, there was a substantial degree of difficulty in reaching agreement, especially as the view of the industry at that time was that petroleum and mineral potential was not high. Although relations between the Pitjantjatjara people and the Department could also become tense on occasions, the Department became more attuned to negotiating and assisting Aboriginal groups, and the mid-1980s saw remote Aboriginal communities provided with better electricity supplies and water wells being drilled by the Department on Aboriginal land. By then the higher world oil prices of the early 1980s had again spurred petroleum exploration in the Officer Basin.

The first PEL granted within Pitjantjatjara lands was issued in November 1985 to Amoco Australia Petroleum Co. (50%; the operator), AP Oil Pty Ltd (20%), Crusader Resources NL (15%) and Quadrant Energy Development Ltd (15%). PEL 29 covered 20 749 km² of the Officer Basin in the southeast of the Pitjantjatjara Lands. The Amoco group reached an agreement with a company owned by the traditional owners to become involved in a joint PEL. After the Haematite episode, the Pitjantjatjara Council had applied for a PEL in October 1984. The Department advised the Minister to refuse the request because the application failed to demonstrate that the Council had the financial resources and technical expertise to fulfil the licence conditions. The Council acted on suggestions from the Department's Oil, Gas and Coal Division and pursued expressions of interest from recognised petroleum companies. The Pitjantjatjara Council formed AP Oil Pty Ltd and then negotiated to share in a licence with the Amoco consortium and an amended application was resubmitted.

The agreement with the Amoco consortium involved the group funding the Council's 'administration expenses' and included the novel provision for AP Oil to hold a 10% vote in the management of the operation. In return, the Council exercised its statutory right not to claim compensation for disturbances to the local community during exploration and production. The agreement also provided that AP Oil would hold a 20% carried interest share in the licence during the exploration phase. This did not include any contribution to exploration costs. On the discovery of an economic petroleum deposit, AP Oil had the right to convert this carried interest to a 20% working interest on the payment of 40% of the cost to date. Alternatively, they could choose to retain a 10% net profit interest in the discoveries.

This agreement was an interesting development in Australian petroleum exploration as it predicted a way forward for mining and exploration on Aboriginal land. However, the project stalled in October 1987 when the licence was cancelled due to the effects of the oil crash; one of the joint venturers collapsed following the fall in world oil prices in 1986. Anangu Pitjantjatjara remained prepared to enter joint ventures with companies which combined technical expertise with a respect for the Pitjantjatjara interests and concerns.

The Department continued to signal its desire to have Aboriginal land opened up for mineral searches. For example, in 1989 it re-assessed the mineral potential of the Maralinga lands (Flint *et al.*, 1989) and late in 1991 a data package titled *Geology and mineral potential of the Pitjantjatjara lands* was released. These areas were the least examined mineral frontiers in the State. Departmental officers had continued talking with Anangu Pitjantjatjara, who seemed to favour oil exploration over mineral exploration, since petroleum companies were considered to have substantial financial resources. Furthermore, the focus for the proposed petroleum searches is well away from the area of rock outcrops in the Musgrave Ranges where Aboriginal communities and sites of significance are concentrated. More recent exploration initiatives involving Pitjantjatjara land are described below under 'Revitalisation'.

PETROLEUM INDUSTRY EXPLORATION

OEL 8

The first Oil Exploration Licence (OEL) for the Officer Basin was granted to the Australian Mining and Smelting Co. Ltd (operating through Frome–Broken Hill with funding from Consolidated Zinc Corporation Pty Ltd) for two years from January 1954. This followed the discovery of oil elsewhere in Australia, notably at Rough Range in Western Australia in 1953 which stimulated exploration in South Australia (including the formation of Santos and Geosurveys in March 1954) and brought a revised approach to exploration thinking. OEL 8 covered 125 486 km² of the southwestern corner of the State (Fig. 2.1). The company's work was confined to the southern portion of the licence and extended into Western Australia. In December 1953, Frome–Broken Hill requested BMR to survey part of the area, and Quilty and Goodeve (1958) first reported on the basin after BMR had flown six flights in May 1954, including from Oodnadatta to Ceduna, Kalgoorlie to Oodnadatta, and Forrest to Mount Harriet, Cook and Ceduna. In March 1955, the company proposed sending a field party to study rocky outcrops south of the Musgrave Ranges but the company's director, Maurie Mawby, held little hope for the area. He wrote to the Director of Mines prior to surrendering the licence in May 1955 that: 'It would ... appear that the only area of thick sedimentary section in the Eucla Basin lies immediately south of the Warburton–Musgrave Ranges and there the sediments hold little prospect of oil generation' (MESA file 354/1955).

OEL 12

After the withdrawal of Australian Mining and Smelting, Clarence River Basin Oil Exploration Co. NL lodged two applications for OEL in February 1956. The first was granted in May 1956 as OEL 12 over an area between Coober Pedy and Pimba. The second application over an area of the Eucla Basin lapsed because the company was unable to complete the geological studies necessary to formulate a proper application for the area (MESA file 244/1956). At this time, the Department suggested to the Minister of Mines that a further investigation with air and ground field work of the Nullarbor Plain over about six months was warranted to determine if test drilling was necessary. Tom Barnes wrote in March 1956 (MESA file 244/1956):

It is my personal belief that the Nullarbor Plain is an area where the Government might well undertake a comprehensive geological survey on its own accord — the area is very poorly understood geologically, and has considerable hydrological interest, both for W.R.E. in relation to Maralinga, and also the few landowners; in addition to the unknown oil prospects.

In such an isolated area it would be impossible to exercise effective control over an exploratory company, and a licence should only be granted to a company of unquestioned integrity.

OEL 19 and 28

OEL 19 was granted over 222 160 km² in the Officer and Eucla Basins to Oil Drilling and Exploration Pty Ltd in October 1958. The company drilled Eyre 1 and Gambanga 1 in the Eucla–Madura portion of the Eucla Basin. OEL 19 was

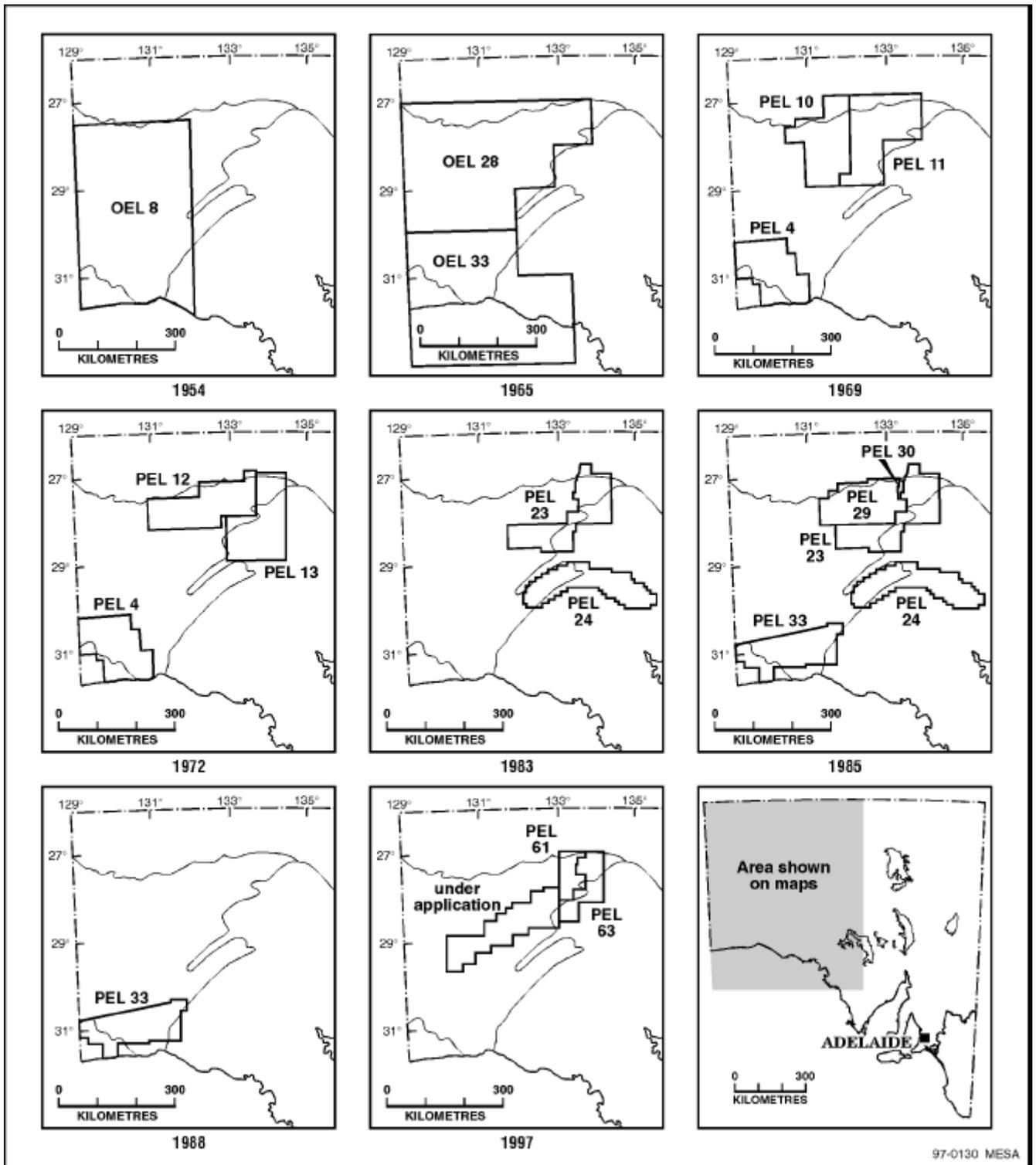


Fig. 2.1 History of Officer Basin petroleum tenements, 1954-97.

transferred to its subsidiary Exoil Pty Ltd in July 1959 and was surrendered in September 1962, but a consortium led by Exoil (Oilmin NL from July 1973) held it until 1976; by then the area had been reduced progressively to 24 605 km² through subsequent renewals (being reissued as OEL 28 in October 1962 over 160 000 km² and as PEL 10, 11 and 12).

The exploration boom that permeated the Australian mining scene from the mid-1960s introduced several new players to the northwest oil and gas search. Transoil Pty Ltd,

Continental Oil Co. of Australia Ltd (Conoco) and Australian Sun Oil Co. Ltd were farm-in companies to Exoil's licence between December 1964 and September 1969. The method of a licensee 'farming-out' areas to others prepared to 'farm-in' to a joint arrangement was legislated for by the State Government's amendment to the *Mining (Petroleum) Act 1940* in 1958, which also allowed a company to checkerboard its permit area and work the new blocks over five years instead of one. The introduction of these companies, particularly Conoco, strengthened exploration prospects in the area.



Using a Mayhew to drill a shothole with compressed air at Giles Junction, west of Emu, for Namco International Geophysics Ltd in 1962. (Photo T6491)

Exoil's Mabel Creek seismic survey from April to August 1962 did not provide good quality data but it did reveal the first definite proof of a thick, subhorizontally bedded sedimentary sequence (MESA confidential file SR 11/5/29). The Namco traverse of 470 km went west across the basin along 'Giles Road' north of Lake Dey Dey to Serpentine Lakes on the border and into Western Australia. Exoil's initial seismic and gravity surveys were followed up by the drilling of Emu 1, the first petroleum wildcat well in the basin, which the Department drilled as a shallow stratigraphic test well near the Emu Field for Exoil. It was spudded in August 1963 and abandoned two months later at 417 m after reaching unmetamorphosed shale and sandstone (Grasso, 1963).

Conoco participated in an aeromagnetic survey over the eastern Officer Basin after farming into the area. The survey, which covered ~155 400 km² between latitudes 27° and 30°S, and longitudes 129° to 134°E, was conducted from October 1964 to April 1965 except for three weeks when the Maralinga aerodrome was closed. The aircrew was based at Maralinga, Forrest and Oodnadatta. The survey identified the western half of the permit as having more petroleum potential because of the average thicker sections (~ 2440 m) on the southwest shelf and trough with 'more foothills type of structures' developed within it (Steenland, 1965).



Looking south past the leading vibrator truck along a longitudinal line east of Serpentine Lakes in the Officer Basin on 1 March 1966. (Courtesy H. Wopfner; Photo 44362)



Personnel and no. 2 core at Continental's bore in the Officer Basin, December 1966. (Photo T7157)

In 1965-66, Seismograph Services Ltd carried out a Vibroseis reflection survey for Conoco near Serpentine Lakes in the northwest of OEL 28. This was followed by a helicopter-supported stratigraphic survey beginning in March 1966 over outcrops to the north of the licence and on its margins. The Munyarai structure was discovered by the Department's 1966 seismic line (the EO line). Conoco subsequently detailed the structure by an additional seismic grid and drilled stratigraphic well Officer 1 (TD 183 m; Krieg, 1967) in November 1966 at the northern end of the EO line.

Two deep wildcat wells, Birksgate 1 and Munyarai 1, were then drilled. Birksgate 1, spudded in January 1967, was positioned on a minor anticline as defined from the seismic work and reached 1878 m (Henderson and Tauer, 1967). The drilling required access clearance from Commonwealth Department of Supply and the South Australian Department of Aboriginal Affairs. Constructing a road to the site was expensive and so heavy loads were carried by large trucks fitted with desert tyres; earth moving equipment was used and an airstrip was laid down at the drill site. Access was difficult because of the high sand dunes and there was a lack of water. A stratigraphic well also at Birksgate, spudded in November 1966, was drilled to 644 m, plugged back to 392 m and completed as a standby water well. Birksgate 1 passed through probable Precambrian sediments to its total depth. In February 1967, Conoco proposed leaving this and another water well at Birksgate to the Mines and/or Aboriginal Affairs Departments because the effort to find potable water was expensive and it would have been a waste not to retain them. Aboriginal Affairs was very interested and arranged with the Mines Department for one well to be capped and the other to be fitted with a windmill and tank.

In the following year Namco, on behalf of Conoco, followed up the structural lead with more detailed seismic work using the 'thumper' method. As a result, a large anticlinal structure was delineated and a site for Conoco to drill Munyarai 1 was chosen. But heavy rain prevented the well from being spudded until July 1968. Munyarai 1 terminated at 2899 m without hydrocarbon shows being recorded (Conoco, 1969).

OEL 33

In 1964, licensee Al Jergins (Outback Oil Co. NL) and Departmental officials made a two-day aerial reconnaissance of the Eucla Basin from Ceduna to Forrest (Western Australia) and back to Ceduna via the coastline. Some 'geomorphological' anomalies and joint or fault controls were noted. The company had taken up OEL 33 (126 910 km² of the Eucla Basin and offshore) in January 1964. The focus was still the Eucla Basin to the south, where in November 1964 Outback Oil drilled Cook 1C (A and B were unsatisfactory sites but the third attempt became Cook 1) near Cook in the northern Eucla Basin. It was abandoned as a dry well after bottoming in probable Neoproterozoic sediments at 279 m.

Outback Oil undertook a helicopter gravity survey over much of its licence area west of 130°45'E followed by an aeromagnetic survey of its offshore area. Between February and May 1966, four shallow wells (Hughes 1, 2, 3 and Denman 1) were drilled near Hughes on the Trans Australian Railway; Tertiary and Cretaceous sediments were noted to a depth of ~229 m, and possible early Palaeozoic sediments were noted below that unconformity but no significant hydrocarbon shows were reported (AR, 1965–66). This section is now considered to be Neoproterozoic (Ch. 5).

In the South Australia portion of the Eucla Basin the company undertook several photogeological studies which revealed some 'geomorphological anomalies'. These were inspected by a ground survey team. Farmines to the licence between June 1966 and June 1968 included Union Texas (Aust.) Co., Rock Island Oil and Refining Co. Inc., Tenneco Australia Inc. and Coastal Petroleum NL. The licence expired in January 1969 and the onshore area was then issued to Outback Oil as PEL 4. From June 1969, Outback Oil drilled Mallabie 1, which proved a thicker sedimentary section than previously thought, thus improving the exploration potential though the dry well was plugged and abandoned (TD 1672 m). PEL 4 expired in January 1974.

DOWNTURN TO DISCOVERY

Oil and gas discoveries elsewhere in Australia had sustained hopes for the Officer Basin search (O'Neil, 1995, 1996a; Wilkinson, 1988). For example, in the Cooper Basin, Innamincka 1 in 1959 revealed a Permian basin below the Great Artesian Basin and hydrocarbon shows in the Permian sediments suggested its oil prospectivity. The Gidgealpa–Merrimelia Trend was first identified on seismic lines shot by the Mines Department in August 1962 and Gidgealpa 2 was drilled on this structure; the well produced gas and condensate. This testing of commercial quantities of gas from the Permian was the first petroleum discovery in the Cooper Basin and set South Australia's petroleum industry on the way. The discovery of gas at Gidgealpa on 31 December 1963 and Moomba in March 1965, and oil at Tirrawarra in 1970, in the Cooper Basin indicated that the local efforts were not in vain. Gas production from Permian Cooper Basin reservoirs in the Gidgealpa and Moomba fields to Adelaide commenced in 1969. Follow-up drilling in 1970 and 1971 through farmout arrangements with several new companies resulted in significant Cooper Basin oil and gas discoveries.

As petroleum developments in the Cooper Basin began to unfold under their own momentum, the Department began to concentrate on collecting basic data in the areas of low or marginal prospectivity to encourage companies to explore areas such as the Arckaringa and Officer Basins. By the late 1960s, the Permian sequences east of the Officer Basin were considered as possible petroleum sources and some attention was given to them. When no hydrocarbon discoveries were made, the exploration focus shifted to the central and western Arckaringa Basin–eastern Officer Basin area where a pre-Permian carbonate–redbed evaporite sequence (Observatory Hill Formation) was considered to have economic hydrocarbon potential (Hibburt, 1984). The evaporites in Cootanoorina 1 in the Boorthanna Trough of the Arckaringa Basin and in the area to the southwest were identified as being of Devonian age. The evaporite beds below the Permian north of Coober Pedy were equivalent to the Observatory Hill Formation. Observatory Hill near Maralinga was named by Len Beadell in 1955 as the hill was similar in shape to an astronomical dome. The Arckaringa Basin was another little-known basin in a high exploration risk category but information from the west and northwest of that basin was 'of direct importance to the understanding of the Officer Basin ... which contains at least 16 000 feet of Palaeozoic sediment-fill [and] is one of the real challenges and its investigation is a natural follow-on from the work carried out in the Arckaringa Basin' (AR, 1970–71, p.8).

A downturn in the petroleum industry occurred from 1973 under the imposts of a Federal Government which terminated the Petroleum Search Subsidy Scheme, abolished tax concessions, banned the export of LPG and moved against the involvement of foreign companies such as Aquitaine and Delhi. It also moved to create a Petroleum and Minerals Authority. In South Australia, the inability to secure a petrochemical plant despite strenuous efforts throughout the 1970s was also a disincentive to explorers discovering liquids-rich gas. Exploration and development drilling was all but abandoned; only one well was drilled in 1973, and none in 1974 and 1975. Few seismic surveys were conducted. Although there was little exploration by either companies or the Department in the Officer Basin from 1969 to 1974, thereafter the Department drilled seven wells to 1979 to establish how widely spread the pre-Permian sequence was. Of these wells, Byilkaora 1 and Wilkinson 1 intersected oil-mature Cambrian source rocks (Hibburt, 1984).

Between July and December 1976, the Department drilled four shallow stratigraphic wells in the southern Officer Basin — Murnaroo 1 (7 km south of Observatory Hill; TD 628 m), Ooldea 1 and Reid 1 and 1A — which were all dry and abandoned though Murnaroo 1 revealed a potential reservoir sandstone. Then Wilkinson 1 was spudded in June 1978 and completed as a dry and abandoned well in August 1978 (TD 710 m). This hole, with its excellent oil-source potential, encouraged more exploration and led the Department to form an Officer Basin Study Group (there being an Eromanga Basin Group also), which began to draw together previous work on the basin and to reassess its petroleum potential.

As a result, Byilkaora 1 was drilled on the northeastern margin of the basin in the Mount Johns Range. This well, ~300 km north-northeast of Wilkinson 1, was spudded in



Drilling Byilkaora 1 in 1979. (Photo T14751)

May 1979 and completed in July 1979 to 497 m. Oil-source rock correlations in Byilkaora 1 indicated an alkaline playa-lacustrine origin for the immature crude (McKirby and Kantsler, 1980). Carbonates equivalent to the hydrocarbon shows found in Byilkaora 1 were detected in Marla 1A and 1B.

This drilling suggested that the Cambrian carbonate sequences in the basin correlated to the Observatory Hill Formation, which by 1980 was 'considered to be the major potential source of petroleum in the eastern Officer Basin' (Pitt *et al.*, 1980, p.209). Although the signs at Wilkinson 1 gave a good reason for companies to want to resume exploration in the basin, it was the oil bleeding from Byilkaora 1 cores which provided the first really significant oil shows, confirmed the prospects revealed by Wilkinson 1, and raised expectations even higher.

Complementing the work in the northeastern Officer Basin, in 1979–80 the Department undertook a helicopter-based geological survey over 48 000 km² of South Australia's western portion of the basin in order to better understand this little studied region. The exercise had three main objectives: 'to delineate further the rock units (particularly the Observatory Hill Formation) mapped or intersected in drillholes to the east; to recognise Officer Basin rock units mapped in eastern Western Australia; and to assess the degree of deformation in the area with a view to identifying structural leads for petroleum exploration' (Pitt *et al.*, 1980, p.215).

PEL 10, 11 and 12

There was little company exploration in the basin for almost 15 years after OEL 28 became PEL 10 and 11 in August 1969. PEL 10 was held by Exoil over 24 864 km² and PEL 11 was held by Conoco, Transoil NL and Australian Sun Oil Co. Ltd over 24 346 km². When PEL 10 and 11 were relinquished in January 1971, PEL 12 was granted to Exoil and Transoil over a portion (24 605 km²) of the old areas. The area bordered the Everard Ranges and included the southern reaches of Officer Creek. No active work followed in the short term and efforts to farm out were unsuccessful until June 1974 when Shell Development (Aust.) Pty Ltd joined for nine months. Shell recommenced the exploration phase and ran 154 line km of seismic (the Everard seismic survey) in October and November 1974. The results of this were later shown not to be as expected. PEL 12 was surrendered in June 1976.

PEL 13

PEL 13 was issued in September 1972 to Planet Exploration Co. Pty Ltd over 24 518 km² in the Arckaringa Basin, the far west of the Great Artesian Basin. The northern perimeter of the licence, which extended west of Coober Pedy and north of Lake Phillipson, was on the northeastern margin of the Officer Basin but PEL 13 was surrendered in December 1973 without being explored.

PEL 23 and 30

Active company petroleum exploration returned to the Officer Basin with Comalco Aluminium Ltd holding PEL 23 and 30 from January 1983 and February 1985, respectively, until early 1989. Comalco became interested in the petroleum prospects of the Officer Basin after the Byilkaora 1 discovery; its mineral exploration in the period from 1979 included 20 fully cored drillholes in its mineral tenements in the region. Comalco's search was essentially for evaporite minerals, base metals and coal. Although its extensive exploration program failed to find alkali evaporites, indications of enhanced prospectivity for the basin were noticed; oil bleeds were detected wherever Comalco drilled the Observatory Hill Formation and the underlying Rodda beds.

Commencing in March 1984 with a 1200 line kilometre seismic survey, Comalco's petroleum exploration included 2613 km of reconnaissance and semi-detailed seismic, and the drilling of five cored wells (at an average depth of 2000 m). This work improved the understanding of the geology and petroleum prospectivity of the eastern Officer Basin. The company partially completed its own review of the basin stratigraphy prior to drilling the first exploration well (Giles 1) during September–October 1985 (TD 1327 m; Stainton *et al.*, 1988). Of Comalco's plugged and abandoned dry wells, Ungoolya 1 (November 1985) revealed encouraging oil shows over several hundred metres in low porosity, early Palaeozoic and Neoproterozoic clastics; Karlaya 1 (April 1987), Lairu 1 (July 1987) and Munta 1 (September 1987) also showed traces of oil in these sediments.

PEL 23 had been applied for in 1980 but a delay in granting was caused through stalled negotiations with



Company oil exploration in the Officer Basin in 1987. (Photo 36174)

another company for adjoining acreage. PEL 23, from Emu to the Marla area, was renewed for five years in January 1988 and the area reduced from 23 222 km² to 15 505 km² by relinquishing in the southeast and north of the licence. PEL 30 was granted over 434 km² adjoining the northwestern perimeter of PEL 23. Both PEL were surrendered early in 1989.

PEL 24

In November 1983, CRA Exploration Pty Ltd was granted PEL 24 over 21 778 km² on the southern margins of the Officer and Arckaringa Basins. A \$6.4 million exploration program was proposed, including the drilling of at least four wells over the five-year licence term. However, only 435 line kilometres of seismic were recorded in 1985 and 1986, and Arkeeta 1, the only well, was drilled in December 1986. In July 1987, Pacific Oil and Gas Pty Ltd became the operator but the licence was surrendered four months later.

PEL 29

Exploration by Amoco, the operator, recorded 235 km of seismic including a section between Ungoolya 1 and Munyarai 1, but no wells were drilled. This, and the work by Comalco, delineated a number of large structures capable of trapping hydrocarbons. Amoco obtained good quality seismic data in the Munyarai Trough in 1987.

PEL 33

PEL 33 was issued to a consortium of small companies — Median Oil NL (operator), Geometals Oil Exploration Ltd, Heron Petroleum Pty Ltd, Malita Exploration Pty Ltd, Gulf Resources NL, Southern Cross Exploration NL, Forsyth Oil and Gas NL, Antarctic Petroleum Pty Ltd, Spectrum Gold NL — in June 1985 over 23 793 km² in the Eucla Basin where an experimental seismic survey of 40 km was recorded before the licence was cancelled in April 1989.

REVITALISATION

The Department continued its regional geological studies and assisted Comalco in refining the stratigraphy of the Officer Basin (Brewer *et al.*, 1987). From the mid-1980s, the hydrocarbon potential of the basin was promoted by the Department in data packages prepared with seismic, drilling, mapping and reports. Companies were encouraged to take

up new permits in the Pitjantjatjara and Maralinga lands of the Officer Basin. Petroleum exploration was planned onshore in the Officer Basin in 1990 and discussions were held with the Pitjantjatjara Council about access for proposed licence holders. Three potential reservoirs — Murnaroo Formation, Relief Sandstone and Observatory Hill Formation — had been determined by the time a data package was released on 44 300 km² in and adjoining Aboriginal land in four areas of the basin in late 1990. Although there had not yet been any commercial hydrocarbon discoveries, the basin's potential reservoirs were then estimated to contain more than 523 bcf of sales gas or more than 451 mmbbl of recoverable oil (Morton, 1992).

An Officer Basin team of professional and technical staff was formed within the Department in August 1992 to liaise with the Pitjantjatjara and Maralinga people, to carry out water well drilling and to survey for a seismic transect. This survey had been proposed in 1989 by the Department for the Australian Geological Survey Organisation (AGSO, formerly the BMR) to undertake. AGSO was to interpret existing geological and geophysical data, and to acquire new seismic, source rock, stratigraphic and petrophysical information. This was intended to form part of a major study by the Department on the structure, stratigraphy, petroleum source and reservoir potential of the Officer Basin in South Australia. The important potential of the basin would thus be highlighted. In the new regime applying to exploration, anthropological work and work corridor clearance demonstrated the modern approach to Aboriginal liaison and environmental management. The results included establishing a better correlation with the Amadeus Basin in the Northern Territory where oil and gas was already being produced at the Palm Valley and Mereenie fields, an improved knowledge of the sandstone reservoirs, hydrogeological and structural features of the basin, and better seismic interpretation from the reprocessing of existing data. Aerial surveys were flown by AGSO and the Department as part of its South Australian Exploration Initiative (SAEI).

Under the National Geoscience Mapping Accord (NGMA) and the SAEI, the Department funded petroleum exploration to acquire seismic data in areas that had been ignored by the private sector but where the Department



Anthropologist Scott Cane, at right, with southern Pitjantjatjara tribal elders during line scouting for the seismic survey on Maralinga Lands in November 1993. (Courtesy S. Cane)



Geosystems Pty Ltd Vibroseis trucks operating on the Officer Basin seismic survey in August 1993. (Photo 41474)

considered there was petroleum potential. A frontier geological province such as the Officer Basin required earlier information to be revised. This work was now subject to agreements with the Aboriginal landholders for access for water well drilling, seismic line surveying and seismic surveys. The planned NGMA transect of 600 km from the Musgrave Block in the north to the Nullarbor Plain was modified when access to the unnamed conservation park was denied, and seismic test work on the Nullarbor Plain could not penetrate the surficial cavernous limestone (Gravestock and Lindsay, 1994). Reflecting the modern regime, the AGSO–MESA transect in 1993 included environmental audits of seismic practices.

In conjunction with AGSO, the Department conducted seismic surveys in unexplored Pitjantjatjara and Maralinga Lands in the eastern Officer Basin late in 1993 (Gravestock and Lindsay, 1994). AGSO undertook a 550 km regional transect to tie a northern line, including reprocessed 1966 seismic data, to a series of lines in the south. This formed part of the NGMA with Federal Government funds and South Australian logistical support on Aboriginal liaison, line surveying and water wells. (See Ch. 3 for more detail on the land access arrangements.)

As well as investigations to establish water supplies for mineral and petroleum companies during 1993, especially in the desert areas outside the Great Artesian Basin, the Department examined water supply options in the Officer Basin and at Oak Valley where the Maralinga people had formed an outstation since 1984. An earlier camp had been at Dey Dey. These projects identified water of stock quality in the eastern Eucla Basin through to potable supplies in the Musgrave Ranges.

The Department reviewed seismic data for the Marla area and contracted 378 km of seismic survey work along nine regional lines west of Marla. The NGMA transect was the first in the barely explored central and southern Officer Basin, while the SAEI grid linked seismic acquired in the mid-1980s by Comalco and Amoco in the eastern Officer Basin. Some 140 km of Comalco seismic data were reprocessed to the same standard. The new seismic acquired in the basin followed a reinterpretation of Comalco's 1983–85 data (Mackie and Gravestock, 1993).

The \$5 million of surveys and associated geological studies indicated that considerable undiscovered hydrocarbon potential exists in the Officer Basin but that further studies would be needed to assess its potential. The investigation confirmed 'thrust faulting (Alice Springs Orogeny) along the structural northern basin margin, the thrusts propagating south within as well as beneath the sedimentary cover' indicated '6 km or more of Neoproterozoic sediment in the Birksgate sub-basin [but that] the southern Murnaroo Platform is unlikely to contain large structures', strengthened 'biostratigraphic correlation with the Amadeus Basin and confirm[ed] the utility of acritarchs for Neoproterozoic zonation' and indicated 'a potential sabkha-associated source rock near the base of the succession' (Gravestock and Lindsay, 1994, p.65). The prospects for major investigations were enhanced by the discovery of sufficient ground water in the south-central Officer Basin to support shothole drilling.

The new seismic investigated the southwestern extension of the Manya Trough and Marla Overthrust Zone, which have revealed most of the oil shows. As well, biostratigraphic and petrophysical studies of wells throughout the basin correlated the Neoproterozoic more effectively and improved the known reservoir characterisation. New structural data adjacent to known oil-bearing rocks in the Marla Overthrust Zone were obtained in the adjacent troughs and ridges but they are poorly delineated by seismic and are relatively undrilled. Furthermore, the Mesoproterozoic Ammaroodinna Inlier poses questions as to its origin and structural position southwest of the Marla Overthrust Zone. The correlation between strata in the Munyarai and Manya Troughs, both potentially oil-generating kitchens, requires further investigation to reveal their significance for petroleum exploration (Gravestock and Lindsay, 1994).

PEL 61 and 63

In May 1996, PEL 61 and 63 were granted over 6258 and 19 930 km², respectively, in the Marla area of the Officer Basin, after Hemley Exploration Pty Ltd successfully concluded access negotiations with the Aboriginal landowners. Drilling is scheduled to commence in 1997.

CONCLUSION

The search to date of the Officer Basin has been sparse and <7200 km of seismic data have been recorded and only 30 wells deeper than 500 m drilled. Only 12 of the ~70 drillholes are petroleum exploration wells of sufficient depth to enable the stratigraphy to be pieced together. Core and wireline logs from mineral, groundwater and stratigraphic drillholes, especially in the eastern part of the basin, provide useful data. There has been limited wildcat exploration but the promising potential of the region is such that it deserves more attention, especially given that the logistical problems and land access issues can be overcome. The current interest demonstrates that the Officer Basin is now regarded, at least by some parts of the industry, as having significant petroleum potential.