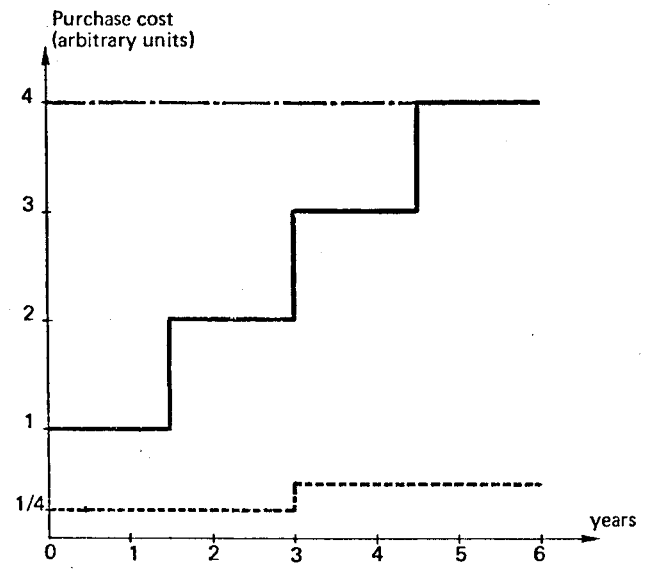
Purchase Cost Considerations

The cost of a conventional seismic data acquisition system is less than that for a telemetry system operating with the same number of channels in that the former has one or two gain ranging amplifiers and digitizers while the latter utilises one set per channel along with transmission electronics in a relatively harsh environment.

The cost of these expensive station modules multiplied by the number of channels is offset by the relatively low telemetry cable cost. This is illustrated in the figure which was prepared on the assumption that the cost of a set of 120 pair cables is approx. 25% of the cost of a 100 channel conventional system with a service life of 6 years and that these cables for a given spread length are fourfold the cost at half the service life cables typically employed with the Sercel model SN 348 telemetry system.

The economics afforded by the telemetry technique together with vastly simpler cable maintenance contributes profitwise but, unfortunately, the capital cost of the instruments is conspicuous.



ACCRUED PURCHASE COST OF CABLES (120 traces)

Operations and Logistics

The weight of each station module is of the order of a single geophone array, however, the difference in weight between 100 m of 120 pair conventional cable is of the order of 20kg. or 5 station modules over that of the same length of telemetry cable. It can be seen that by way of the telemetry technique the total weight of cables, geophones and station modules per geophone station is less than that for conventional techniques.

Less weight carried can perhaps be translated into profits whether this be by way of an increased production rate or low operating cost.

Technical Advantages — Cable Noise

Noise pick-up in multi-pair cables is experienced to a greater or lesser extent depending upon environmental conditions and the condition of the cables and geophone arrays being employed apart from relatively static conditions such as geophone array impedance and cable capacitance, etc. The effects are readily recognised when the spectra of the interfering source is of a different nature to that of the seismic signal spectra, for example, the 50 Hz. pick-up associated with overhead power lines.

A series of tests were run including those utilising a Sercel model SN 348 telemetry system to record the 50 Hz pick-up from a spread crossing under a power line whereby a standard set-up of telemetry cables and station units were modified by the addition of a multipair cable through which the geophone arrays at their original station locations were connected to a ground series of station units interconnected with the same telemetry cables.

A comparison of the records made with the standard telemetry spread and the alternative spread with introduced multi-pair cable, all other things being essentially equal, indicated a considerable advantage in eliminating the multi-pair cable to the extent that in practice a survey can be run with a telemetry system without the need for notch filters. There is no need to stress the advantage of recording without notch filters.

The 50 Hz. contamination of the far traces inthe multi-pair spread cable configuration was particularly noticeable and it can be assumed that seismic signal cross-feed on a production record would be as intense. However, the cross-feed in the telemetry mode is negligible.

Conclusion

Telemetry systems were developed to meet requirements for large numbers of recording channels and the initial high cost would seem to restrict useage to application not readily accommodated by conventional systems, despite other apparent advantages. A closer examination of the overall costs reveals at least a breakeven cost situation occurring within the service life of a conventional systems and that of a telemetry system, cable maintenance and replacement costs taken into account. Consideration should also be given to the less recognised economics afforded by more reliable cables in reducing field down-time. In concluding, the difficulty to access cost advantage of elminating cable pick-up and cross-feed can be significant, and in poor areas this can mean the difference between success and failure.

EXPLORATION FOR UNDERGROUND GAS STORAGE TARGETS IN SOUTH AUSTRALIA

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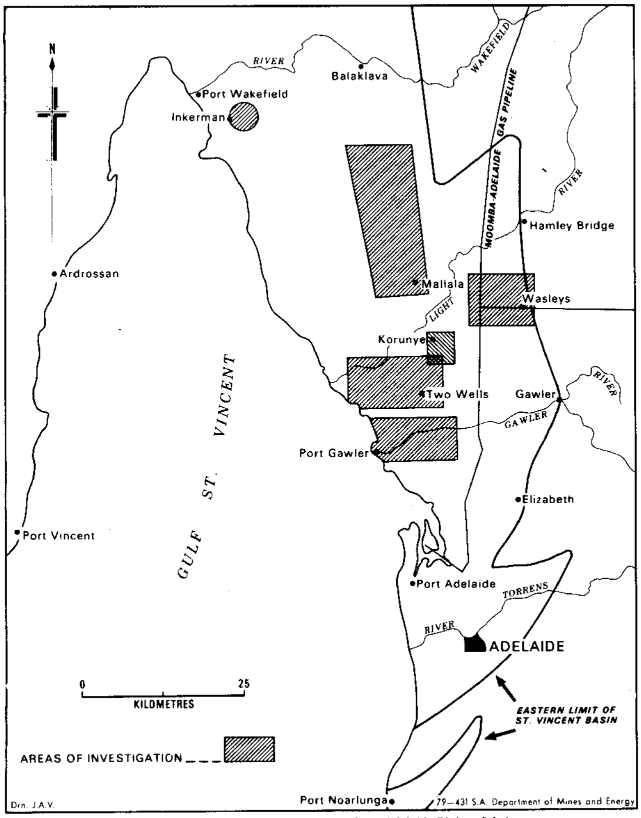
Exploration in South Australia for underground structures suitable for storing natural gas was initiated in 1964, following the proposed utilisation of natural gas from the Moomba-Gidgealpa gasfields via a pipeline to Adelaide.



Underground Gas Storage Exploration, Northern Adelaide Plains, Sth Aust.

It was estimated that the minimum storage capacity required for optimum benefit would be approximately 280 million cu. m (10BCF), which represents a target size of 7 sq. km assuming a reservoir thickness of 10 m.

The main constraints placed on the location of underground gas storage targets are the proximity to the pipeline, the proximity to Adelaide and the occurrence of deep, suitably confined sedimentary aquifers. Considering these constraints, the Cainozoic St. Vincent Basin, and in particular the Northern Adelaide Plains, forms an ideal target search area (see figure).

In 1964 it was initially suggested that a known dome-shaped structure in the Inkerman Coalfield might afford a suitable target. However, this suggestion was quickly rejected due to the small extent and shallow depth of the structure.

In the Two Wells area conventional seismic reflection surveys and a stratigraphic well completed in 1964 indicated a much thicker Tertiary sequence dipping to the south with a possible basal Tertiary aquifer wedging out against bedrock to the north. Further work was recommended to define aquifer configuration but interest in the project apparently flagged at this stage and the project lay dormant till 1975.

Interest was rejuvenated when a gravity high in the Wasleys area indicated a possible dome-shaped structure within the Tertiary succession. However, detailed gravity surveying indicated that the anomaly was caused by an uplifted bedrock block with only thin Cainozoic cover.

On the other hand, the study did indicate that the gravity low immediately west of this gravity high was caused by a basin-like structure filled with Tertiary sediments. The possibility of having deep Tertiary aquifers confined in the central part of the basin was tested during 1976 and 1977. Extensive geophysical investigations including resistivity probes, gravity, seismic refraction, and conventional and high resolution seismic reflection surveys were carried out to determine bedrock configuration, while drilling investigated aquifer configuration and confinement. This work showed the feature to be a fault-bounded trough-like basin filled with up to 200 m of Cainozoic sediments and gently dipping to the south. A thick aquifer was found in the lowermost part of the Tertiary section, but the overlying sandy silt unit being moderately permeable was unsuitable as a caprock.

Exploration was then concentrated in the Korunye area where the unit overlying the lower Tertiary aquifer was expected to be finer grained and therefore less permeable and more suitable as a caprock. High resolution seismic reflection surveys during 1977 and 1978 indicated southerly dipping Tertiary units, the lowermost ones appearing to wedge-out against bedrock highs to the north and east. Subsequent drilling however, indicated a thinner than expected Tertiary section with the lowermost aquifer being absent and their overlying unit still being quite marginal and sandy.

Since 1978, exploration has been confined to the Port Gawler area. Drilling and geophysical surveys, including gravity and high resolution seismic reflection surveys, have located a Tertiary palaeochannel incised within Proterozoic bedrock. This channel is presumed to be filled with sands and gravels and capped by clays and lignites. Subsequent Cainozoic deposition has buried this channel to a depth of approximately 350 m.

Based on seismic evidence, the channel is approximately 1800 m wide and extends northeast from Port Gawler for at least 5 km, and possibly up to 10 km, and has a gentle southwest gradient, estimated to be 1 in 700. The infilling sands and gravels appear to have an average thickness of about 20 m and should have sufficiently high porosity and permeability to constitute a good reservoir.

The overlying caprock of clays and lignites is approximately 20 m thick and forms a sheet-like body which infills the uppermost part of the channel and directly overlies bedrock on either side. The underlying bedrock, tight limestone and dolomite near Port Gawler and weathered clayey siltstone to the east, probably has low permeability, similar to that of the clays and lignites.

Present data therefore indicate favourable reservoir and seal conditions for the storage of natural gas in the channel although the headward extent and configuration is not yet fully defined. At this stage the storage capacity of the reservoir is difficult to estimate but a figure near the minimum requirement is expected.

Awaiting further funding, a three stage proposal for continued exploration has been recommended. The first stage is to drill a stratigraphic hole to confirm the presence of the potential reservoir sands and caprock. The second stage is to drill a test well nearby so that pump testing can be carried out to test caprock integrity and reservoir characteristics. The third stage comprises gravity and high resolution seismic reflection surveying to define the geometry of the northeast part of the channel.