POTENTIAL WEALTH AND GREAT OPTIMISM:

MINING BAT GUANO IN THE FLINDERS RANGES

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INTRODUCTION

This is the second in a projected series of papers dealing with the mining of bat guano in Australia. The first (in press) briefly reviewed the distribution of such mining in Australia and described the political and administrative battles over the guano at Naracoorte, South Australia. It was virtually entirely located in the 19th. century.

This paper turns to the less controversial, but nonetheless interesting, story of guano mining in the caves of the Flinders Ranges. Although there were probably various incidents of unrecorded mining over a long period, the period of greatest activity was in the 1920s and early 1930s.

The numbers identifying specific caves are from the Karst Index of the Australian Speleological Federation. Sites discussed or noted in this paper are listed in Tables 1 & 2 below.

Cave	Mining Tenure	Operator
Burr Well (F26)	Mineral Claims 11169 & 11376	??
Wooltana (F9)	?	Wooltana Fertilisers P/L
Mairs Cave (F3) Clara St. Dora Cave (F4) Lizard Cave (F27)	Mineral Claims 11512, 11513, 11594 (little mining)	Nitrogen Ltd.
Arcoota Creek Cave (F5) Fearby Cave (F43) Hardy Cave (F44)	Mineral Sections 1252, 1253, 1267, 1268	Nitrogen Ltd.
Mt. Sims (F7)	?	Nitrogen Ltd. ?
Blinman (F89)	?	Nitrogen Ltd.
Oraparinna (F8)	Mineral Claim 13975	?
Good Friday (F6)	Mineral Claim 13645	?
Walpunda Creek Blowhole (F53)	?	?
Bucket Cave (F56)	?	?

Table 1 : The Mined and Partly Developed Caves of the Flinders Ranges.

Bunyeroo Gorge Cave (F13)	Used by small groups of bats ; no significant guano deposits
Wilcowie Cave (F14)	Some guano but no evidence of mining
Eyrie Cave (F15)	Some guano but no evidence of mining
Clarke Cave (F17)	Some guano but no evidence of mining
Orroroo Cave (F20)	Some guano but no evidence of mining
Brachina Cave (F49)	Used by small groups of bats ; no significant guano deposits
Oratan Rock Cave (F72)	Some guano but no evidence of mining

Table 2 : Other Bat Caves of the Flinders Ranges.

A PLACE OF MINERAL WEALTH

The Flinders Ranges has long been recognised as a place of quite remarkable geological and mineralogical interest. The Adnyamathanha people mined ochre from a number of sites, including immense operations at both Lyndhurst and Bookartoo. That from the latter site was widely considered the finest in Australia, partly because of its admixture of mica and the resulting sheen, and all Flinders Ranges ochre was traded widely across much of the continent (Flood 1990 : 185-186). The Aboriginal people were also aware of other minerals of interest, often because of their striking appearance, and led early prospectors to lodes of copper and radioactive ores.

They also demonstrated a good understanding of the geology ; one excellent example is the story of the Thumping Kangaroo (Tunbridge 1988 : 54-56) which shows that they understood a great deal about the integration of the karst system over some 300 km. of the length of the ranges - something not generally appreciated or understood today, even by cavers.

Then white man arrived, and commenced the long battle for wealth from the Flinders Ranges. The first of many disastrous attempts at copper mining commenced in 1846. By 1865, in spite of enormous efforts, over a hundred different leases for copper mining had proved unprofitable. Over the next 40 years, large-scale mining developed at Blinman, Yudnamutana, Beltana and associated localities but again, in spite of great investment and some fascinating innovations (including Australia's first road-train), none were profitable. Various other minerals were also extracted and mines came and went, many of them being very short-lived. Looking back, the only significant mining operations which have both survived over long periods and made a profit are those of coal at Leigh Creek, barytes at Oraparinna and talc at Mt. Fitton (Mincham 1983). Some very small operations, e.g., the gathering of Chiastolites, may also have made a modest profit for lone operators.

But in spite of constant failures, prospectors always believe the next one will be the lucky one. So at the end of World War I, the search resumed, and set the context for the discovery and exploitation of bat guano from the caves.

THE NORTHERN CAVES

Brown (1904) appears to have been the first to describe a guano cave in the Flinders Ranges region. He dealt briefly with a cave in the quartzite of Oratan Rock, and described it as containing a guano deposit which was remarkably rich in nitrogen and which also contained many bone fragments. It was a small deposit and does not appear to have been mined (McBriar et al., 1981).

The mining thus appears to have started in the North. An immense cave (F9) on Wooltana station proved to have considerable deposits of guano, and a company, Wooltana Fertilisers Pty. Ltd., was established to operate the mining, processing and sale of the guano. Those interested in bats have long known of Wood Jones (1925) report of the mummified specimens of the ghost bat, *Macroderma gigas,* which were found there. What is not so well known is that these were so numerous that they adversely affected the quality of the guano, and so had to be sieved from the guano and bagged separately (*Register*, 23 Jan 1920). Even four years later, when the mining was well advanced, Winton (1924) referred to 'numerous dried bodies'.

Some of the guano had been transformed into ammonium salts, at least principally sulphate and choride, although there were also the familiar dark brown material, some of which was apparently of relatively (?) recent origin. Winton also refers to the black pitch-like substance which is seen in many locations throughout the Flinders Ranges and is generally known today as 'dung bitumen' (or Amberat, particularly in the U.S.). This is more likely to be derived from rodent dung rather than that of other species. He argues, following advice from L.K. Ward, that the salts were probably produced through interaction with ground water rising up through the guano from below.

Winton's report is somewhat superficial and he was only able to estimate the extent of the deposit (some 900 tons) and recommend further investigation. Clearly he had inadequate time or equipment for a proper study to be carried out. His analysis showed considerable variation from one sample to another, but in the deeper material, an average content of 62.5% Tri-calcic Phosphate equivalent, 1.9% nitrogen and 3.9% potash. Much of the paper is taken up with general discussion of other guano deposits, and a lot of speculation.

The mining method was to bag the guano in the cave ; haul it to the surface using a timber slide and a small diesel motor, then allow gravity to take the bags down a further timber slide to the foot of the slope where they would be stored until taken by truck to Copley and railed to Port Augusta. It was planned that a processing plant would be established there.

In spite of the high costs of this operation, the company continued for many years, apparently profitably, but eventually turning to other sources of phosphate. The miners, at least a number of whom were Adnyamathanha, camped on site. The last survivor appears to have been Rufus Wilton (Tunbridge, 1989 : 73).

The other site in the North, Burr Well Cave (F26), which is a cluster of small caves and fissures, was also worked from at least 1920. This was a small deposit, and Winton (1920) reported an analysis which shows relatively poor quality material with a great deal of insoluble material. It is likely that work on the deposit did not continue for long. However, a retired mission worker told the author that the Adnyamathanha at Nepabunna (established c. 1930) took guano from a nearly cave - almost certainly Burr Well, unless another exists in the area - for their own gardens. The caves and associated fissures contain deposits of bone breccia which may be worthy of investigation. Some empty bags and mining gear remain on site.

POTENTIAL WEALTH

Under this heading, the *Advertiser* (21 March 1922 and later articles) enthusiastically announced the development of further mining ventures at Buckalowie and Arcoota Creeks in the Southern Flinders. Their 'special representative' reported that :

> *. . . a great proportion of the most expensive manures needed had to be shipped thousands of miles and extra costs borne by the farmer.*
> *Now in a flash the whole situation has changed. A lonely prospector, who, for the past 40 years, has been chasing the golden fleece, and meeting with no success, was working a guano cave hundreds of miles from civilisation. One day there came to him a man from another district and told him of better caves. The prospector packed up his things and went to look for himself. He was so satisfied with what he saw that he dismantled his workings and had them brought here to Buckalowie . . . It only need a little while for him to be convinced that he had stumbled on a discovery that was not merely a matter of district or state importance, but was something that would bring about a reorganization of the whole artificial manure market.*

Of course, this sounds very like the opening of any one of the many unsuccessful mining ventures of the previous 70 years ! Regrettably, we know nothing more of the prospector - not even which previous site he had worked, although it may have been at Burr Well. A later press report (*Advertiser*, 21 June, 1922) names one Captain F.W. Montague as 'discoverer of the Carrieton guano caves' and then reports his later discovery of the Blinman Caves (see below). However, it is not clear whether he is the lonely prospector, the man who drew that prospector's attention to Buckalowie, or even another.

The 'special representative' reported immense cave systems - an excellent example of journalistic licence. He describes both Clara St. Dora (F4) and Mairs (F5) Caves, but gives them a majesty and scale which is just not true (*Advertiser*, 22 March 1922). Crossing a smallish pond is described as 'swimming across the Styx' with sufficient drama to warrant those words. All dimensions are at least doubled and often increased far more.

A company, called Nitrogen Ltd. was established to work these caves, with A.R.G. Fearby as managing director and J.W. Hardy of nearby Pamatta Station as one of the directors. Later references to the company also list Alan Sinclair as chairman of directors and a Mr. Giles as site manager (*Advertiser*, 5 August 1922). Two others, probably directors, who held mineral sections at Arcoota were A. Clarke and G. Anesbury.

The correspondent also referred to the presence of Frederic Wood Jones, who was searching for other mammalian fossils, and he was apparently successful in locating *Thylacoleo,* Tasmanian Tiger, Ghost Bats, and Stick-nest Rats. *Antechinus flavipes* is also listed, but this record does not appear at all in the zoological literature, so must be treated as questionable. However, significant deposits of bone material remain, both above and below layers of flowstone on the floor.

The other caves, Clara St. Dora and four at Arcoota Creek (*Advertiser*, 24th. March, 1922), are described simply as being extensive ramifying systems filled, sometimes to the roof, with guano. One of those at Arcoota (F5) again had considerable deposits of bone material. The accounts conclude :

, , , the discovery of the enormous deposits in the two series of caves will mean a big asset to the state and the solving of the problem of manuring for the more or less intense cultivation areas throughout the Commonwealth (*Advertiser*, 13 May 1922).

Winton (1922) again provides a somewhat superficial report on the caves, but probably judged correctly that they did not deserve the attention which might have been suggested by the press stories. He clearly did not 'swim the Styx', and his only samples from Mairs Cave consisted mainly of bones from the entry area. He points out that only the surficial part of each deposit had a significant level of nitrogen, as leaching by both inflow and groundwater had removed this from the lower levels. He states 'there is undoubtedly a huge quantity of guano to be obtained here', and later, 'Without, therefore, being able to make an actual estimate, it is certain that there is a considerable amount of guano to be had.'

Certainly, considerable work was done. A platform, obviously to accommodate winding gear, was constructed at the entrance to Mairs Cave, but there is no evidence that any guano was removed, and indeed, no evidence that there was ever any significant deposits in the cave. Some material near the entrance was taken, but appears to have consisted largely of bone fragments. Adits were driven into Clara St. Dora and Arcoota No. 1 and several shafts, both natural and excavated, were shored with timber to provide for access or extraction. Shored shafts or drives also exist at Lizard Cave (Buckalowie), Fearby Cave and Hardy Cave (Arcoota Creek).

The *Advertiser* (5 August 1922) reported that a conveyor belt and other facilities were being developed at Clara St. Dora, capable of conveying 18 tons per hour ! Similarly, a rail system was being installed at Arcoota to carry small trucks laden with guano to the entrance from which they would be conveyed by gravity to storage below. Although considerable guano was removed from both these caves, it does not appear to have been adequate to utilise these arrangements for very long. An adit was constructed to facilitate extraction from a further cave at Mt. Sims (F7), which does not appear to have been documented in any way until visited by cavers in the 1950s. Both empty bags and sieves obviously used for preliminary processing of the guano can still be seen here.

Nitrogen Ltd. also developed another cave (F89) near Blinman (*Advertiser,* 21 June 1922), but other than the initial press announcement, no details are available. Finally, a brief report appeared (Segnit, 1933b) on Good Friday Cave (F6), also in the southern area near Arcoota. A shaft had been sunk into the cave, and it was clearly planned that guano would be taken out , but the evidence is that little or none has been removed. There was clearly some investigation of other caves, especially the Walpunda Creek Blowhole. This has a high enough level of carbon dioxide to prevent entry without special equipment, but has a wooden ladder, and evidence that a windlass has been used. Similarly Bucket Cave has a mining bucket on site and evidence of some mining.

The last site is the cave (F8) at Oraparinna (Segnit 1933a). Segnit makes reference to 8 tons of guano being removed prior to the opening of the operation which commenced in 1932 and he inspected in 1933, but gives not details. The holders of the 1932 lease are also not identified, but up to the time of Segnit's visit, they had taken some 131 tons which had been sent on to Wooltana Fertilisers Ltd. for processing. Two shafts had been sunk, only one of which appeared to be of use in extracting the guano. The guano was bagged on site, dragged to the foot of the shaft and hauled to the surface with a windlass, then trucked to Pt. Augusta.

Segnit's analyses indicated that other the top twelve inches of the deposit, the material was so leached by water that it was of little value. He estimated that no more than 160 tons of useful material was available.

The map included in Segnit's report shows that the cave comprises a grid of joint-controlled passages on two levels. Many passages and features are named, many after streets and other features of the City of Adelaide. The upper level was called the Pompa Cave and one can only assume this is a mis-spelling of Pumpa. Eddie Pumpa had built, and lived at, the Aroona out station of Oraparinna. Amongst other things, he became well-known as the man who first introduced Han Heysen to the Flinders Ranges and who assisted him on his visits to the Ranges (Mincham, 1983 : 178).

A small number of other caves (see Table 2), like that at Oratan Rock, had limited deposits of guano, but were never developed or mined. It is almost certain others remain to be discovered.

AND WHAT OF THE BATS ?

Bones and desiccated remains of *Macroderma gigas* have been recovered from Wooltana, Arcoota, Buckalowie and Mt. Sims Caves. Wood Jones had collected, or was familiar with, specimens from the first three of these. He assumed that it was M. gigas which was responsible for the immense accumulations of guano. He also referred to his finding that ' . . . intestinal content of cave mummies . . . consists entirely of masses of the hairs of small insectivorous bats' (1925 : 444) and thus established the myth of the Ghost bat as a bat-eating bat.
It is extremely unlikely that *M. gigas* was solely responsible for the guano and almost certain that it shared the caves with the 'small insectivorous bats.' However, there appear to no sub-fossil remains which would allow identification of the species concerned.

At least two species are possible candidates. *Vespadelus finlaysoni* has a significant population in Wooltana Cave to this day and *Chalinolobus morio* has been reported from abandoned mines in the region. Various observers have reported seeing a few 'small bats' in virtually all of the Flinders Ranges caves but these have not been identified and could be either species.

CONCLUSIONS

It is not clear when mining ceased but as already noted, the amounts extracted were relatively limited, and much of the deposits remain in place. On one hand, guano mining suffered all the problems which had dogged the pursuit of copper : the need for labour-intensive techniques, the difficult terrain and the long distances from mine to market. This was compounded by the leaching and hence low quality of much of the material - probably a worse problem than Winton had realised with his relatively superficial work.

It seems likely that, other than at Wooltana, the guano-mining operations were so small that the capital cost of sulphuric acid processing was not invested ; further, Winton had suggested (wrongly) that this was probably un-necessary. In any case, the guano miners had to compete with the much more abundant and cheaper phosphates from the Pacific Islands The Federal Government subsidy schemes introduced in the early 1930s to lower the cost of super-phosphate would have dealt the final blow. So, despite the early optimism, the guano industry added one more economic failure to the history of the Ranges.

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