DEPARTMENT OF MINES
SOUTH AUSTRALIA

IRON MONARCH -

A CENTRE OF RADIAL STRUCTURES

by

A. R. Crawford
Asst. Senior Geologist

REGIONAL SURVEYS SECTION

Rept. Bk. No. 56/20
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ABSTRACT

Analysis of the Corunna and Roopena one-mile sheets and plotting of structures subsequently recognised shows that the Iron Monarch area is a centre of radial structures. The structures and their arrangement are probably caused by upward vertical point pressure. This is tentatively regarded as associated with intrusion of iron-bearing gases, waters or magma effused along a 'deep fissure' at a point where that crosses a major meridional weakness.

INTRODUCTION

The location of the largest of Australia's known high-grade iron orebodies at Iron Monarch, one of the largest in the world, has never been explained. The origin of this and the other high grade bodies in the Middleback Ranges has been attributed on the one hand by Lockhart Jack (1922) and Ward (1939, 1949) todeep-seated sources and on the other by Rudd and Miles (1953) to a superficial leaching of the low-grade banded iron ores of which the Middleback Ranges are largely formed. Rudd and Miles realised that this necessitated not only removal of silica but introduction of more iron, and stated that this process was 'not understood'. In admitting that present-day leaching appears to have the reverse effect they considered that solutions might have been of hydrothermal origin. In his detailed study, Miles(1955) postulated the lateral leaching by meteoric waters of an area heated by granitisation. To explain the granitization Miles postulated a complicated relationship between the Middleback Group of metasediments and the surrounding Gneiss Complex, a relationship so unusual that one feels that it would never have been considered had it not been necessary to invent it.

None of these workers paid much attention to the regional location of the rich ore bodies. In the valuable 1:63,360 scale mapping by Miles, Eley, Solomon & Johns (1952) there is a conspicuous absence of regional structural interpretation. The tectonic sketches attached to their four one-mile sheets Corunna, Roopena, Middleback and McGregor merely summarise the mapped structures, suggesting no others. Imaginative speculation on regional structural patterns is not a feature of Miles's Bulletin.

ANALYSIS

Analysis of the mapped structures on these sheets (particularly the Corunna and Roopena sheets) together with additional mapping and re-interpretation shows one remarkable feature: the Iron Monarch - Iron Knob area is the centre of a system of radial structures.

Only three such structures are mapped as such on the Corunna sheet. Two are faults. One is that aligned at 035°, extending from about ½ mile south of Iron Knob township for nine miles. Another, not actually mapped southward to the immediate vicinity of Iron Knob, and less certainly shown, extends in a northerly direction, passing ½ ml. east of Corunna H.S. The third structure is the synclinal axis of the Corunna Range, aligned at 350°.

The outcrop of that Range is not shown as bounded by faults, though the western limb is shown as crossed by the northern, north-curving end of a NE'ly trending fault. The Range was presumably regarded as an erosional feature. Its V-shaped form makes this suspicious when its <u>isolation</u> is recognized. It is significant that though the usual dips within the massive conglomerate forming the Range are from 5° to 25° (and mostly 10°-20°), several readings of 70°, 75° and even 80° are shown near the eastern and western scarps, with some abnormal strikes also. At the exit of Tassie Creek from the west scarp the writer noted vertical grits and shales unlike typical Corunna

Conglomerate. In his opinion each scarp is a fault scarp, or strictly a series of fault scarps en echelon. These faults are closely radial to a centre at Iron Monarch.

Another significant feature is the 'promontory' of Gawler Range Porphyry extending south-eastward from the main outcrop near Bernes Dam. When the limits of this dyke-like body are drawn they, too, radiate from Iron Monarch - where, it is important to note, a rock of similar type is known at depth.

On the Roopena and Middleback sheets the Ash Reef Fault is a prominent structure nearly 15 miles long. When projected along its NNW'ly alignment this too meets Iron Monarch. Three miles east of the northern part of the fault there are traces of another possibly radial fault. Miles also shows an anticline aligned approximately N-S extending from S.E. of Iron Monarch to west of Iron Prince. Even as it is, it is crudely radial, but on the evidence mapped it could be drawn southwards from Iron Monarch.

Two less certain structures exist. On the Corunna sheet the outcrop of the Roopena lavas is mapped with a linear southern boundary. When projected west this meets Iron Monarch. As the flow is probably of fissure-type (no central vents are known) this could be the alignment of the fissure at 080°. Disturbed strikes in nearby sediments give some support to this suggestion. A structure aligned at 090° also may exist, as nearby to the south is a small body of Gawler Range-type porphyry, far removed from the main outcrop, which intrudes older sediments on which the lava lies. It may be significant that such a structure would cross the meridional Roopena Fault exactly where that fault has a branch at 090° half a mile long.

A third lineament is at 110°, and at 290°. This cannot be detected on the one-mile maps. It was noticed on the 1:500,000 scale map of the Gawler Ranges Volcanic Complex. The centres of the Paney, Gilles and other arcs are so aligned, the lineament passing not only through Iron Monarch but - significantly

- through the centre of the Burkett Hill Granite outcrop and the only other - but distant - outcrop of similar rock, mapped by Miles et al three miles N.W. of Mt. Whyalla. This lineament is parallel to the 80-mile long Moonaree Fault separating the Gawler Ranges proper from their northern extensions. It also extends east to Spencer Gulf, the laccolithic Cultana Granite lying on it at a point where a major meridional fault zone is crossed. The Cultana Granite in part closely resembles the most common type of Gawler Range Porphyry and in part the Burkett Hill Granite.

INTERPRETATION

The existence of a pattern of faults and lineaments radial to the Iron Monarch area is established, even if some of the structures are uncertain.

Such a pattern would arise if approximately vertical point pressure were applied at Iron Monarch, either downward or upward. Downward pressure of this kind is of course conceivable from extra-terrestrial action. However upward pressure is almost certainly the explanation. Such pressure could be caused by localized upward movement of magma or associated waters or gases.

The Middleback Ranges form a major lineament along which are several large concentrations of high-grade iron ore, and Iron Monarch is by far the largest of these. It is tempting to suggest that the localization of the high grade ore in such quantity at Iron Monarch is associated with upward magmatic movement, at a point where the Middleback lineament is crossed by the lineament at 110° which is thought to extend for many miles across northern Eyre Peninsula, as a 'deep fissure'.

The presence of other, smaller, concentrations of high-grade ore in the Middleback Ranges does not conflict with this hypothesis. There is some evidence of radial structures around Iron Baron orebody. Moreover the complementary circumferential structures which might be expected to exist

are already observed in part, in the faults mapped by Miles east of the Ranges, together with other faults and arcuate lineaments observed by the writer on air photographs. Some of the faulting in the Davenport - Cultana area may be part of the circumferential suite centred on Iron Monarch, while some of the faults on the Middleback and McGregor sheets can be regarded as centred on the southern Middleback Ranges orebodies.

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