Frontier Technical

EAR 26.5.93

INTERPRETATION OF SEQUENCE OF EVENTS

CENTRAL FLINDERS ZONE

Callanna sediments known only in diapirs, (except perhaps in the Arkaba Anticline).

Burra sediments not recorded in the diapirs or outcrop except to the south and north. The closest best documented area is the Worumba Anticline in the Nakara Arc area where after Burra time there was some folding and diapirism with erosion and an unconformity below the Umberatana Sediments.

The situation at the base of the Umberatana in the Central Flinders Zone is virtually unknown.

It is suggested that there was a thick salt horizon below most of the Callanna Section and above bedrock. The reasons for this suggestion is the nature of the structures within the Adelaide Geosyncline generally and the Central and North Flinders Zones in particular when compared to salt provinces elsewhere.

Bedrock rafts are known in at least four diapirs in the region and appear to have come from bedrock several kilometres deep as recorded in salt provinces elsewhere. The reason for suggesting a massive salt horizon **below** the Callanna Strata rather than the salt content of the sediments, is to explain the transport of the massive blocks as recorded in the Blinman Diapir.

From the base of the Umberatana to after Cambrian time, the strata were essentially flat and undisturbed with minor unconformity or disconformity. There is no sign of igneous intrusion, little if any metamorphism and the sediments appear to have only experienced compaction and diagenesis.

After Cambrian sedimentation in Dalmerian time, a major structure developed in the Central Flinders Zone. The cause of this development is not apparent, but once started it is suggested that the movement of mobile material, (fluids and salt) from the synclinal to the anticlinal axes accompanied and aided the folding.

Later or perhaps at a late stage, this structure was modified by the major cross influence which resulted in the Nakara Arc to the south and the North Flinders zone to the north. This produced a series of en echelon structures with axes trending NW-SE across the N-S axis of the major structure. These structures include Arkaba Anticline, Wilpena Pound, Upalinna, Oraparinna and Blinman Domes. The major structure was also modified by NE-SW faulting which also affected the domes.

The relationship between the faulted domes and the diapirs is obvious and considered significant.

From the above information, the following sequence of events is suggested.

As the major structure developed, the mobile material moved into

the higher parts of the structure with the development of an "hydraulic head" resulting from the stratigraphic loading differential between the synclinal and anticlinal structural positions. This situation could only have developed in Dalmerian time.

In the early stages of structural development, the mobile material would have formed "pillow" type masses between strata and exerting pressure on the overlying layers. It is conceivable that some of the mobile material could be injected between the layers of up arching strata as well as along faults or joints as dykes.

This interpretation infers that the potential for cross cutting diapirs could not have developed until Dalmerian time as for example the Blinman, Oraparinna and Upalinna would not have had those sites determined before that event.

It is considered that the structural gravity and seismic evidence of a "pillow" structure at Martin's Well Dome supports this concept. At that locality the "hydraulic head" was insufficient for a diapiric breakthrough.

The above concept suggests that in the area being discussed, the development of some of the major diapirs was an explosive event on the geologic time scale. It would also suggest that once the "hydraulic head" developed in the mobile material is relieved by breaching, that there should be some evidence of collapse of the strata around major diapirs.

It is realised that the above interpretation is in conflict with what is regarded as the evidence of the exposure of diapirs during Umberatana time with the deposition of diapiric material adjacent to exposed diapirs. Also the diapiric material cored in Blinman No.2 is interpreted as interbedded with Umberatana sediments, and therefore evidence of exposure of the Blinman Diapir at that time.

It would be of value to re-examine the diapiric material in the Blinman No.2 drillhole and also revisit the diapiric material around diapirs thought to be interbedded. If all the material is found to be of size relatively small compared with the size of the material within the diapir core, then the possibility of the diapirs "mushrooming" during formation with injecting along the bedding of adjacent strata is still a possible interpretation. The recent mapping of the Upalinna Diapir has some bearing on this problem.

Another aspect of evidence against exposure of the diapir is the upturning to nearly vertical of well lithified wall rock. The significance of the present interpretation is as follows.

The nonmetallic minerals

There is good evidence of the existence of salts which are of economic value associated with the diapiric structures. Barium salt with associated strontium is closely linked with the diapirs in barite deposits.

The presence of potassium salts has been shown by chemical analysis and the strong potassium signature registered by radiometric surveys over diapirs is significant. If there was a massive salt bed at the base of the Upper Proterozoic, it's composition would be of interest.

With diapiric activity the various salts would be both mixed and disturbed, and the chances of finding an economic deposit of useful salts would be unlikely, especially as there has probably been deep leaching. The cap of a salt plug can be of interest as a locus for sulphur and base metals.

Once the diapirs have breached the strata and the saline solutions escaped, the chances are greatly reduced unless the elements are fixed in an insoluble form, e.g. Ba as $BaSo_4$ or Zn as $Zn_2\ ScO_4$.

The same reasoning can be applied to base metals. It is generally accepted that the Callanna Group sediments have adequate signs of base metals.

If the suggestions of sequence of events referred to above are accepted, then the Callanna Sediments had a long period when the saline solutions could take various salts and base metals into solution before any transfer took place.

As the structures and potential diapirs developed, the richer saline solution could have occupied the higher structural positions, but there would have been dispersed with the diapiric breakthrough.

The best target areas are thought to be the tops of unbreached domes where the Callanna strata are within reach or where pillow structures exist and there is the possibility of saline influence above these.

The potential for hydrocarbons, principally methane is a separate subject, but the strata of the Upper Proterozoic have the potential to have generated hydrocarbons.

In rocks of any age less than Upper Proterozoic, domal structures similar to Martin's Well Dome with it's geologic history and setting would rate highly as a prospect. The deliverability of gas from such strata would be dependent on fracture porosity and permeability for the most part, but in the Callanna Group dolomites cavities may be more effective.