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PROBABLE SAND VOLCANOES IN THE LOWER PROTEROZOIC AT TENNANT CREEK. N.T.

by

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SUMMARY

Some small ovoid domes, each with a small apical depression, were found on the top surfaces of two or three thin beds of graded greywacke in the Warramunga Group at Tennant Creek. Examination of thin-sections cut across the domes reveals the presence of a central pipe of coarse-grained detritus surrounded by curved laminae parallel to the pipe and to the upper surfaces of the domes.

DESCRIPTION OF THE DOME

The domes are small and ovoid from $\frac{1}{4}$ inch to 4 inches long and about one fourth as high. They all have a small apical depression (see fig.1). The domes are slightly elongated parallel to the strike of the beds upon which they occur; this elongation increases with the dip of the strata and is probably a tectonic elongation parallel to the structural "b" axis.

Thin sections cut vertically across the domes so as to include the apical depression show that a narrow pipe of coarse-grained rounded and sub-rounded fragments of quartz, siltstone, and hematite leads to the apical depression. The surrounding matrix consists of smaller fragments of quartz, siltstone, and hematite, arranged in laminae parallel to the pipe and to the convex surface of the dome (see fig.2). The grainsize in the laminae decreases upwards and outwards away from the pipe and the laminae pass laterally into the upper layers of the bed of greywacke upon which the domes occur. One polished section across a dome (see fig.3) shows well developed laminae which are parallel to the upper surface of the dome and pass laterally outwards into the upper part of the greywacke. The microscope evidence shows that the domes are an integral part of the beds and do not merely rest upon them as appears from the hand-specimen.

MODE OF OCCURRENCE AND DISTRIBUTION

The domes occur on the top, silty layers of graded greywacke beds, 18 to 24 inches thick, just under the overlying shaly siltstones. One unusual feature is that they have been found on the tops of only two, or perhaps three, of the innumerable, seemingly identical, thin-bedded graded greywackes forming the Lower Proterozoic Warramunga Group. They are commonly so close together as to touch their neighbours (see fig.1). It is usual for two beds to occur 2 to 4 feet apart and the domes on the upper bed to be larger than the domes on the lower bed.

The domes occur at several localities near Tennant Creek (see Plate 1). They have been found just to the west of Mt. Samuel ($3\frac{1}{2}$ miles south-south-west of Tennant Creek) and at a point 300 yards south of the Red Ned Mine. They can also be traced on the eastern side of the Stuart Highway from a point 100 yards south-west of the Enterprise Mine along the strike past the Eldorado Mine to near the Cats Whiskers Mine 3 miles east of Mt. Samuel. The domes were also found near the Nobles Nob and Red Terr Mines 10 miles farther east and near the Gibbet Mine 2 miles west of Tennant Creek.

The beds carrying domes always occur 20 to 40 feet stratigraphically below a local marker horizon of hematite shale. This bed, up to 20 feet thick, consists of alternating minutely crinkled bands, up to $\frac{1}{8}$ inch thick, of hematite and chert or silicified shale.

DISCUSSION

The more important features of the domes are the constant shape and proportions, the laminae, and the pipe leading to the apical depression. The restricted occurrence of the domes and the fact that they are part of the top surface of the greywacke beds are also significent.

Before the thin sections were cut it was thought that the domes were fossils - some form of primitive soft-bodied animal. Thin sections, however, revealed a definite inorganic internal structure. The domes may be mounds at the tops of burrows or pipes dug by some burrowing organism. But, since the mound forms an integral part of the bed, the organism must have been burrowing into the bed before deposition was completed: this is unlikely, as graded greywackes are regarded as being formed by rapid deposition from turbidity currents (Kuenen & Migliorini 1950) The greywackes, however, do contain worm tubes, so some life was present in the Warramunga sea.

The domes and their mode of occurrence are somewhat similar to the sand volcanoes described by Gill & Kuenen (1957) as having formed on the tops of slumps or turbidity current deposits. In these turbidity deposits, Gill & Kuenen suggest that the weight of the top of the bed of greywacke causes water to be squeezed out of the lower part. The water is squeezed out upwards and emerges from the top of the bed in a jet like a fountain. It carries up particles of the greywacke and deposits them around the orifice in the form of a cone or sand-volcano.

However, the sand volcanoes described by Gill & Kuenen differ considerably from the domes found in the Warramunga beds in being much larger - 1 to 20 feet across - and having concave slopes like an ash volcano. Often the sand volcanoes are so large as to have collapsed into the underlying bed just as igneous volcanoes often collapse into

the postulated underlying magma chamber. The sand volcanoes were found on a whole succession of slumps whereas the domes on the Warramunga Group are restricted to a few beds. One possibility is that the domes may be sand volcanoes formed of particles carried up by streams of gas derived from the decomposition of organic matter within the bed. There is abundant evidence in the form of worm tubes, limestones and graphite beds of life in the Lower Proterozoic.

Similar forms have been found previously in Tennant Creek by J. Elliston (Peko Mines N.L.) and at Adelaide River, Northern Territory by field parties from the Bureau of Mineral Resources (E.J. Malone 1958).

The observations on which this paper is based were made during the course of a regional geological survey by a party from the Bureau of Mineral Resources in 1958. The author wishes to thank P.W. Crohn, the party leader, for his help in the field work and in the preparation of this paper.

References

Gill, W.D. & Kuenen, P.H., 1957 - "Sand Volcanoes on Slumps in the Carboniferous of County Clare, Ireland". Q.J.G.S., CXIII, p.441-464.

Kuenen, P.H. & Migliorini, C.I., 1950 - "Turbidity currents as a cause of graded bedding". J. Geol. 59, p.91.

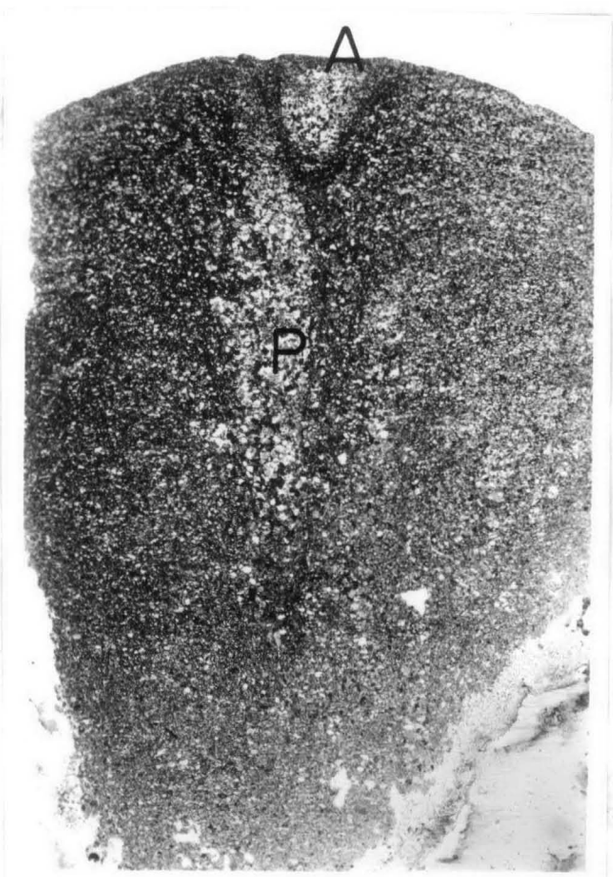
Malone, E.J., 1958 - "The geology of the Darwin-Adelaide River Area". Bureau of Mineral Resources, Record, 1958/96.

Fig. I.

G.R. Ryan

Domes on the bedding plane of one of the greywackes in the Warramunga group 300 yards south of the Red Ned Mine. Note elongation parallel to the strike.

Fig. 2.



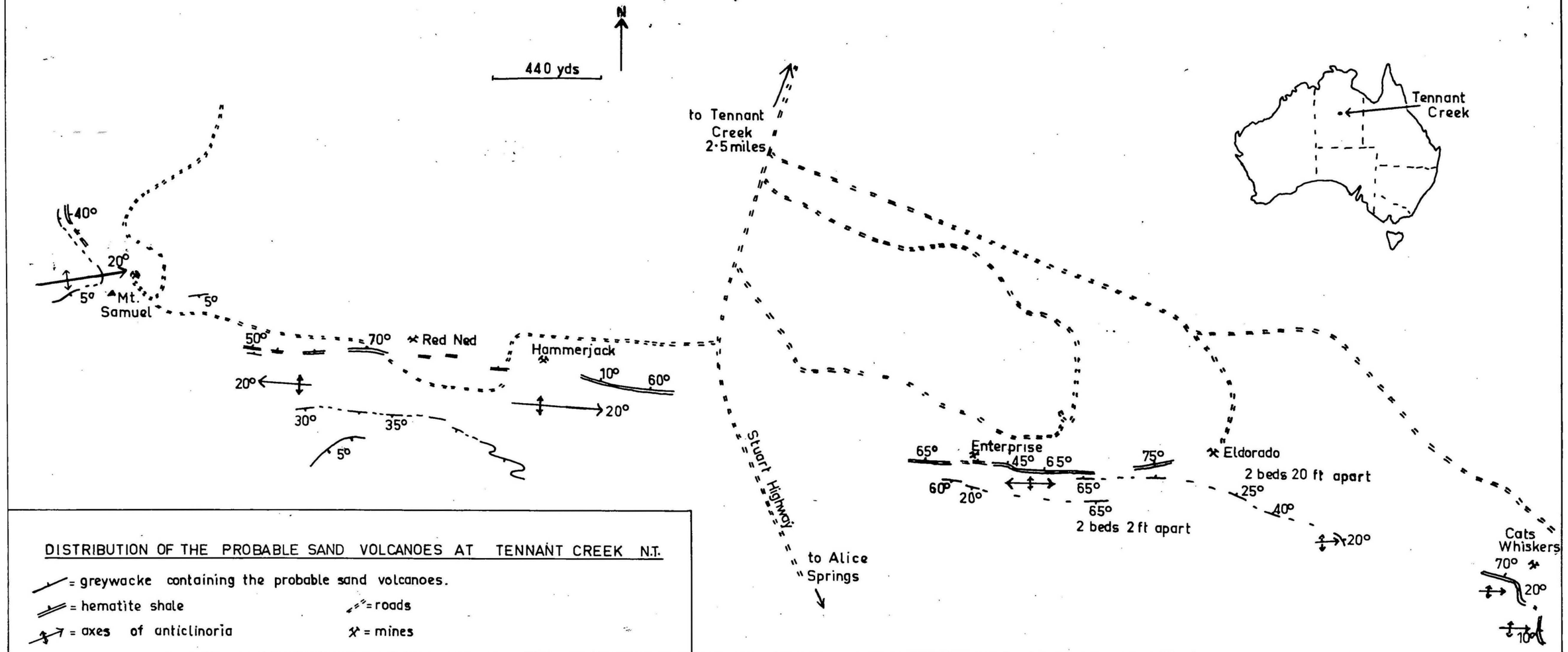
J. Zawartko

Thin-section cut vertically across a dome so as to include the apical depression (A) and the pipe (P) filled with coarse detritus. Ordinary light x5.

Fig. 3.

J. Zawartko

A dome showing unusually well developed laminae parallel to the surface of the dome and forming an integral part of the sediment. Twice actual size.


N
440 yds
to Tennant Creek 2·5 miles
Tennant Creek
40°
20°
5°
Mt. Samuel
5°
50°
70°
Red Ned
Hammerjack
10°
60°
20°
20°
30°
35°
5°
Stuart Highway
to Alice Springs
65°
Enterprise
45°
65°
75°
60°
20°
65°
65°
2 beds 2 ft apart
Eldorado
2 beds 20 ft apart
25°
40°
20°
Cats Whiskers
70°
20°
10°
DISTRIBUTION OF THE PROBABLE SAND VOLCANOES AT TENNANT CREEK N.T.
= greywacke containing the probable sand volcanoes.
= hematite shale
= roads
= axes of anticlinoria
= mines