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DISCUSSION

AN ANALYSIS OF METAL DISTRIBUTION AND ZONING IN THE HERBERTON TINFIELD, NORTH QUEENSLAND, AUSTRALIA[1]

A recently published paper on the Herberton Tinfield, north Queensland, by R.G. Taylor and B.G. Steveson (Economic Geology, vol. 67, pp. 1234-1240) makes inadequate acknowledgement to previous workers in the area, several errors and omissions, and questionable conclusions. Some of these are set out below.

Most of the paper appears to be based on information obtained by geologists of the Bureau of Mineral Resources and the Geological Survey of Queensland during a combined survey carried out between 1962 and 1968. The results of the survey were first presented in the unpublished report (Blake, 1968) quoted by the authors, and were later summarized in a published article (Blake, 1970). The report, now published (Blake, 1972), gives a much more detailed picture of the mineralization than that given by Taylor and Steveson, and includes tabulated descriptions of the mines and prospects, whose positions are shown on accompanying geological maps at scales of 1:63 360 and 1:50 000. These maps clearly form the basis of Figures 1-3 in Taylor and Steveson (1972), although this is not stated. The reader is left to assume, quite incorrectly, that the maps are based on the work of the authors.

The survey of 1962-1968 involved seven geologists and a total of ten man years' work. Although of a reconnaissance nature, it was certainly more than "the preliminary studies" stated by Taylor and Steveson (p. 1239). It followed on from over 250 published and unpublished reports on aspects of the geology of the Herberton Tinfield, the first of which was by R.L. Jack in 1881.

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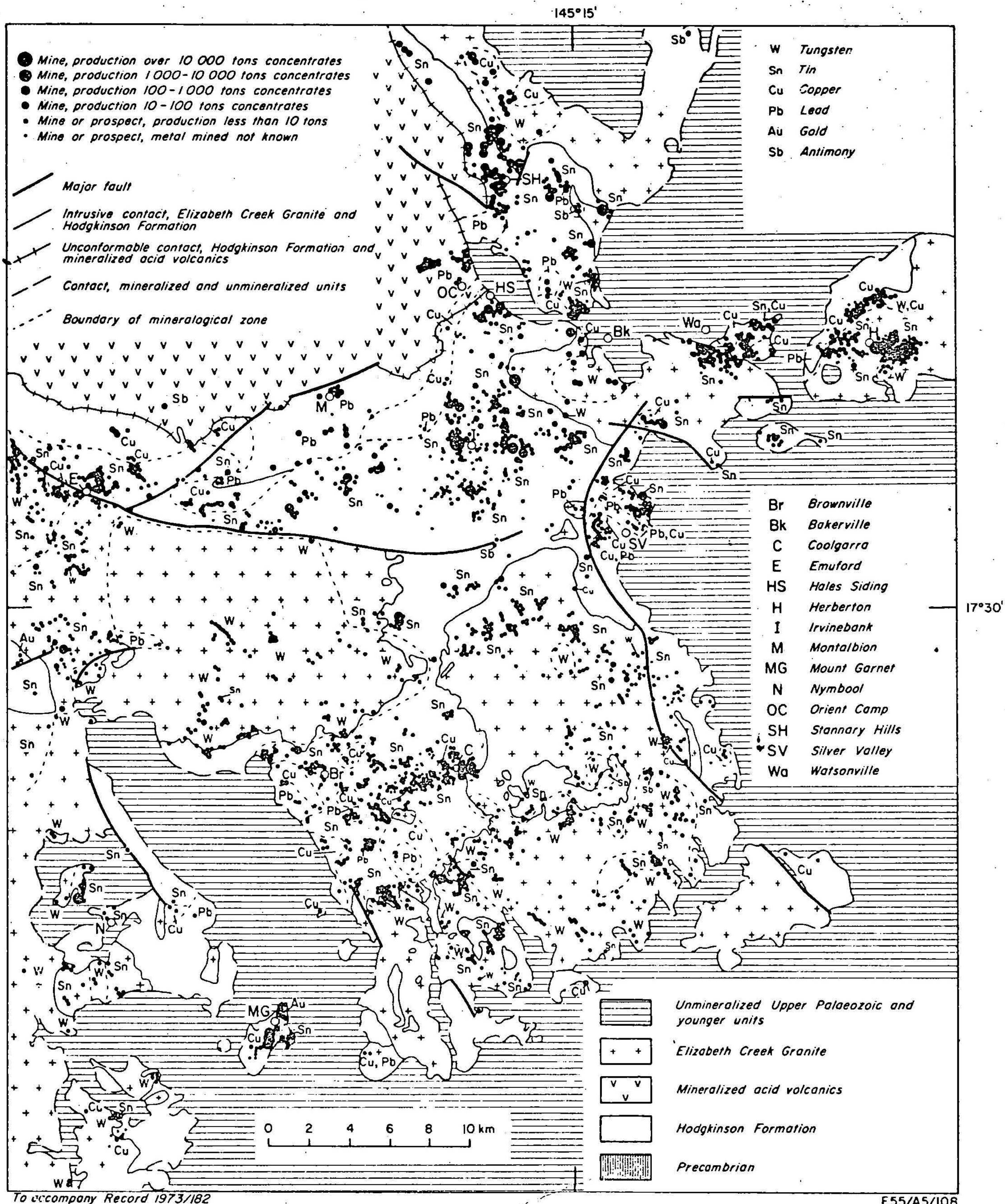

Fig.1-Geological map of the Herberton Tinfield showing distribution of mineralization

The "intimate link" between granite and mineralization in the Herberton Tinfield, suggested by the authors (p. 1234), has been common knowledge since the beginning of this century (Cameron, 1904; Stirling, 1905). The granite responsible is considered to be the Elizabeth Creek Granite (Blake, 1968, 1970, 1972; Blake and Smith, 1970, 1971), one of several Upper Palaeozoic granites in the area. This granite has intruded and thermally metamorphosed sedimentary rocks of the Silurian to Devonian Hodgkinson Formation and also some Upper Palaeozoic acid volcanics. It is almost certainly made up of several separate but closely related intrusions of slightly different ages, as is indicated by petrographic differences between and within outcrops, by sharp contacts between the different petrographic types, and by recent isotopic dating of the granite carried out by Dr L.P. Black (pers. comm.).

In the Herberton Tinfield, the tungsten mineralization is largely confined to the Elizabeth Creek Granite, the tin mineralization is restricted to the outermost parts of the granite intrusions and the immediately adjacent country rocks, and most of the copper, silver, and lead has been obtained from mines in country rocks well away from the granite, as at Mount Garnet, Montalbion, Orient Camp, and Silver Valley. As a result, the tin mineralization centres are close to exposed granite/sediment contacts, as at Watsonville, to concealed contacts, as at Irvinebank, or to contacts that have been removed by erosion, as at Herberton Hill. However, as the tin occurs in fissure lodes and veins which are generally strongly oblique to the granite/sediment contacts, the mineralization trends at each centre tend to cut across, rather than closely parallel, as stated by Taylor and Stevenson (p. 1234), such contacts.

Figure 1 in Taylor and Steveson (1972) fails to show either the type of mineralization (i.e., Sn, W, Cu, Pb) or the amount (i.e., production), nor does it show which rock units other than the Elizabeth Creek Granite are mineralized. Hence it can hardly be said to give an adequate picture of the mineralization. A more objective way of showing the mineralization (= metal distribution) is presented as Figure 1 of this discussion. In this figure the mineralized rock units and the position and relative importance of each mine and prospect are shown, together with the metal or main metal mined, indicated by the district mineralogical zone within which the mine or prospect is situated. From this figure it can be seen that no major mineralization trends are apparent in the northern part of the area, where most of the main mines are located. The statement "Two predominant mineralization trends are apparent with axes trending approximately E.N.E. and N.N.W." (p. 1234) is an assessment that cannot be applied to most of the area.

There are other features of Figure 1 in Taylor and Steveson that need comment. In several parts it is not apparent to which major mineralization centre the subcentres "east", "west", "north", and "south" refer. The only reference in the text to subcentres is the statement (p. 1234) that "several major subcentres contain distinct subcentres which often have different salient features". What these are, is not explained. The authors fail to state that most of the place names shown refer to mining areas that were arbitrarily defined and named by Blake (1968, 1972), mostly after mining settlements, as a means of grouping the mines and prospects into readily describable areas. Thus, in the figure, "Emuford" in main lettering refers to a mining area, but not to the largely abandoned mining settlement of the same name. However, the following mining areas, whose names are shown in the figure, were not named after mining settlements: "South Coolgarra"; "Geebung", which is the name of a hill and an abandoned mine; and "Five Mile Creek", "Adventure Creek", "Mowbray Creek", and "Dry River", which are the names of local watercourses. In addition "Brownville" and "Mowbray Creek" are spelt incorrectly, and the positions of Brownville and Coolgarra should be reversed. Also, Mount Garnet, the main copper mining centre, and Montalbion, spelt incorrectly in the text as Mt Albion, are not labelled on the figure. "Siberia", shown as a major mineralization centre, is a copper lode of relatively minor importance.

Taylor and Steveson make much of hypothetical troughs and ridges on the original granite surface. In doing so they fail to take into account the effect the present topography has in determining the shapes of the granite outcrops. The Herberton Tinfield consists mainly of steep hilly terrain with a relief commonly over 300 m, and the irregular granite/sediment contacts shown on the geological maps are largely due to the intersection of the terrain and flat to gently dipping roof contacts of the granite intrusions. Most roof pendants are on the tops of hills or along ridge crests, and represent remnant cappings on the granite. Hence, there is little evidence for the assumption (p. 1236) "that elongated roof pendants and granite-metasediment embayments mark original trough zones on an underlying intrusion surface".

The northern margins of the granite intrusions between Brownville, Irvinebank, and Bakerville trend NE and WNW, and consequently it is difficult to see how (p. 1236) "the shape of the northern end of the Brownsville-Coolgarra granite intrusion", whichever intrusion this is (it is not stated in the paper), can suggest that the mineralization around Irvinebank, Bakerville, and Stannary Hills is related to a NNW-trending ridge system.

In the vicinity of Irvinebank, one of the main tin mining centres, the mineralization occurs in sedimentary rocks of the Hodgkinson Formation. The relatively wide aureole here is due to the Hodgkinson Formation's being underlain by the mineralizing Elizabeth Creek Granite at shallow depth (Blake, 1968, 1972). The intrusive contact between the granite and the sedimentary rocks which may be close to flat-lying under Irvinebank, rises to the surface to the SW, S, and NE, where there are extensive granite outcrops. Hence, the Irvinebank centre would appear to be in a depression on the intrusion surface of the granite rather than being associated with a ridge system. Alternatively, it may be located between two separate granite intrusions.

The writer considers that the trough and ridge system postulated by Taylor and Steveson does not exist. It is more likely that the granite has an uneven surface because it consists of a number of separate intrusions. These have a cross-cutting relationship to the adjacent country rocks except at Stannary Hills, where the northwest trending granite contact is parallel to bedding trends of the Hodgkinson Formation to the southwest. Most of the individual granite intrusions were accompanied by W-Sn-Cu-Pb-Ag mineralization, the emanative centres of which were concentrated around their margins. The location of the centres appears to be otherwise random, and not controlled by any known detailed structure of the granite surface.

Much of the complexity of the district zoning in the Herberton Tinfield can be attributed to the mineralizing Elizabeth Creek Granite being made up of several separate intrusions, and to the type of mineralization present - localized small high-grade lodes rather than large low-grade deposits. The zoning, when mapped, appears more complex as the scale of the map increases, owing to the greater detail that can be shown. The maps of the zoning given by Blake and Smith (1970) and Fig. 1 of this discussion are at a scale of about 1:300 000, and hence, are generalized in that they cannot show the detailed zoning depicted at a scale of 1:50 000 (Blake, 1972). Zones which might be considered discontinuous at a scale of 1:50 000, because of gaps in mineralization of a mile or more, appear essentially continuous at 1:300 000 scale.

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