HAT CREEK BOCANNE–BUCHITE

(92I/2E, 13E)

By B. N. Church

The term bocanne-buchite has been aptly applied to high temperature metamorphic rocks and pseudo-volcanic rocks above No. 1 Coal Reserve at Hat Creek. According to Crickmay (1967) bocanne is the process of autogenous combustion of carbonaceous shale or coal-bearing strata, and buchite, by glossary definition, is a partly fused shale or clay resulting from intense thermal metamorphism.

It was noted by Church (1975, p. G110) that some of the coal at Hat Creek appeared to be burnt, evidence of this being yellow and reddish altered rocks and soil overlying the Hat Creek Coal Formation. This observation was subsequently confirmed by British Columbia Hydro and Power Authority during excavation of a large trench for bulk sampling purposes.

At the beginning of excavations hard clinker-like material was encountered. The layered structure of this material, although somewhat rumpled and deformed, proved to be continuous with bedd ng planes in the adjacent coal. A sharp line visible on the walls of the trench cuts sinuously across the strata marking the boundary of the burnt zone.

The extent of the burnt zone has been established by drilling. The thickest section, about 75 metres deep, underlies the Dry Lake gulch near the base of the coal measures. Other profiles of the burnt zone give an average thickness of about 25 metres, although thinning and some discontinuity is apparent. The present area of the burnt zone amounting to about 3.5 square kilometres is evidently only an erosional remnant of a once much broader area of altered rocks. Similar reddish rocks and soils can also be seen 8.5 kilometres to the south near the No. 2 Coal Reserve.

A rock described as a volcanic dyke by MacKay (1925, plate opposite p. A320) on the south slope of Dry Lake gulch was re-examined and found to be metamorphic in origin, reconstituted by fusion and recrystallization. In thin section a typical sample resembles volcanic agglomerate consisting of welded scoriaceous clasts composed of numerous microlites of calcic plagioclase, mostly 0.2 to 0.6 millimetres in length, and interstitial opaque oxides and glass. However, chemical analysis shows this to be unlike normal volcanic rock displaying unusual alumina and iron oxide enrichment with overall composition more like the ash residue obtained from burn tests on Hat Creek coal (*see* Table 1, Church, *et al.*, 1979, p. 1886). Norm calculations indicating an abundance of anorthite, cordierite, hematite, and quartz agree with X-ray diffraction results.

Exposed locally on the walls of the bulk sample trench are peculiar lenses of vesicular hematite and magnetite interlayered with baked shales resembling accumulations characteristic of volcanic spatter. In particular, the rootless lava lenses of hematite and magnetite, which were probably derived from fused siderite-rich stumps and logs in the bocanne, bear striking similarity to the iron ore lavas of the Laco Volcano, Chile. Among the numerous exotic minerals identified in the baked shales are tridymite, cristobalite, cordierite, corundum, mullite, clinopyroxene, anorthite, pseudobrookite, siderite, barite, ferroan dolomite, hoegbomite or spinel, and woodhouseitte-hinsdalite±goyozite or gorceixite.

The thermal effect is also manifest in the physical characteristics of the coal. For example, fresh samples taken from the bulk sample trench near the burnt zone have a peculiar appearance, displaying a hard clean

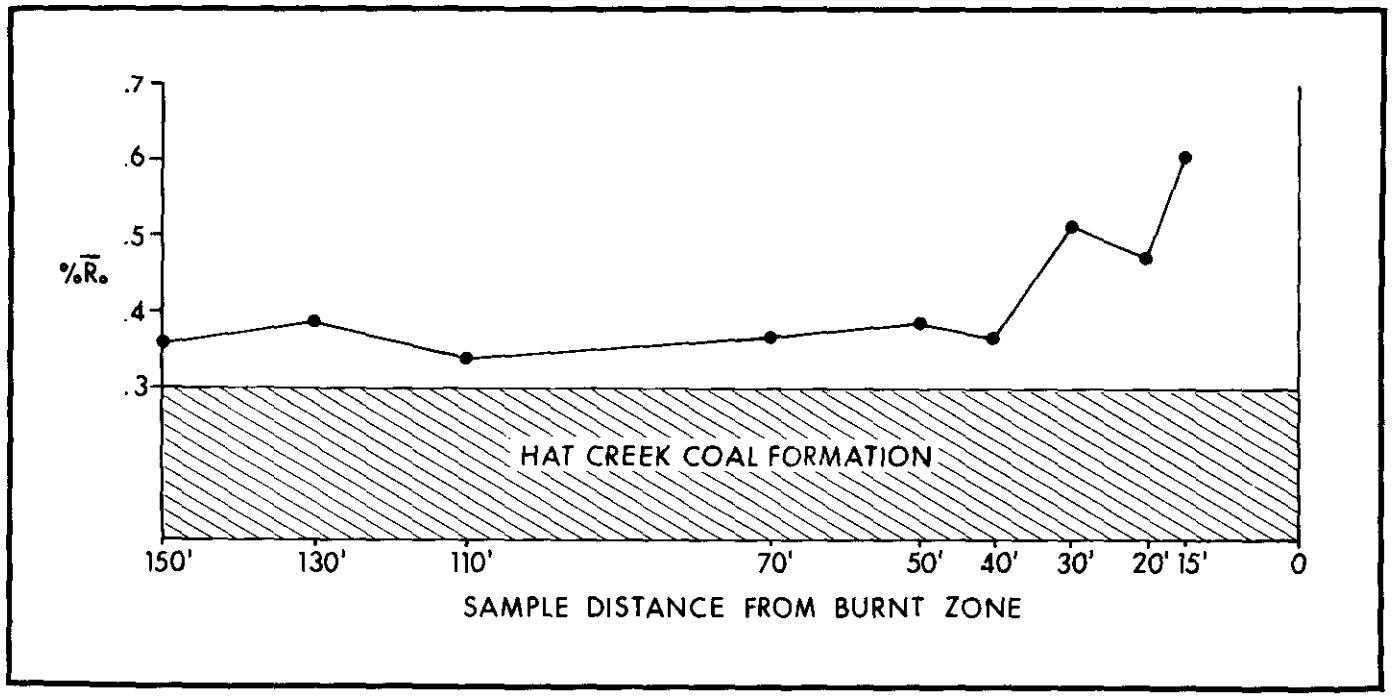

Figure 30. Plot showing increase in vitrinite reflectance in Hat Creek Coal Formation approaching burnt zone contact.

surface with a waxy lustre and conchoidal fracture not typical of low rank coal from this area. Determination of the coalification level of this material gives an $\bar{R}_o$ value of 0.42 per cent. A more representative collection of coal samples, taken at intervals across gently dipping strata up to the burnt zone, shows significant increase in $\bar{R}_o$ values from an average level of approximately 0.36 per cent to 0.61 per cent (Fig. 30).

The temperature of the bocanne estimated from combustion tests was probably in the range 1 330 to 1 400 degrees celcius and possibly higher (*see* Table 1, Church, *et al.*, 1979, p. 1886). Owing to the insulating properties of coal and the anticipated short duration of the combustion episode, temperature in adjacent unburnt coal beds probably did not exceed a few hundred degrees. Indeed it appears that the thermal effect did not penetrate the coal measures laterally more than about 12 metres (40 feet) from the combustion interface as viewed in the bulk sample trench.

The age of the bocanne appears to be interglacial. The burnt zone is covered by till and glacial alluvium, proving a minimum age of at least 10 000 years, the time of retreat of last glaciation. Maximum age, shown by a polarity test of magnetite-rich lenses in the burnt zone, is evidently less than 700 000 years, the time of the last major magnetic reversal.

The phenomena of spontaneous combustion of low rank coal is widely known and it is suspected to be the ultimate cause of the Hat Creek bocanne. Tests have demonstrated that loose stacking of the coal promotes oxidation. Within several days temperatures can rise sharply causing ignition. It seems most likely that the original fire at Hat Creek may have begun in this manner in talus accumulations adjacent the coal measures.

ACKNOWLEDGMENTS

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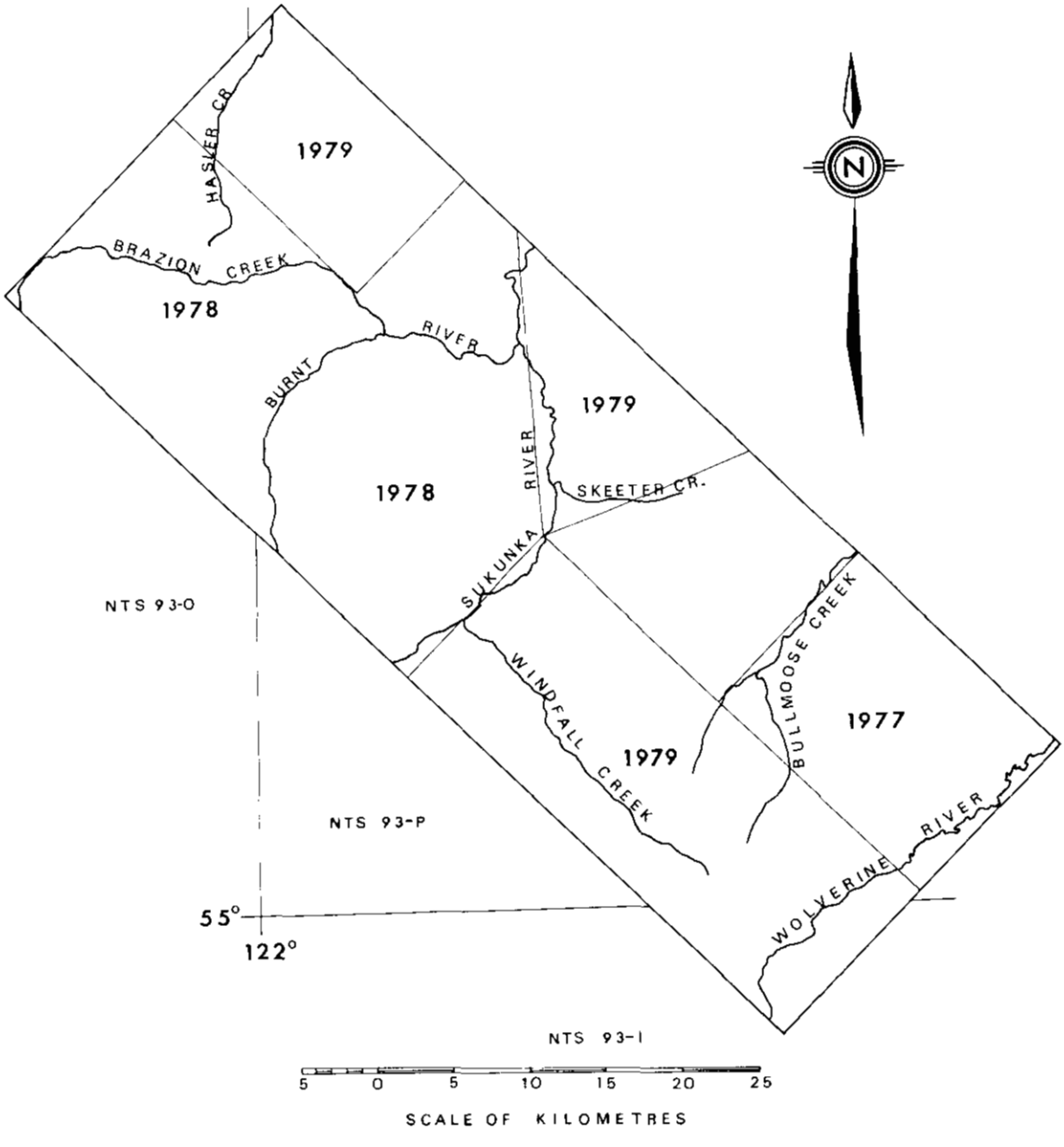

Figure 31. Wolverine—Hasler map-area, showing areas by year mapped.