

1 Exploration History and Discovery – Buffalo Head Hills

The Buffalo Head Hills – Peerless Lake area is typical of much of northern Alberta. Exploration has focused predominately on energy resources, while non-energy resources received very little attention. After all, the primary established reserves in the Peerless Lake area are upwards of $47,000 \times 10^3 \text{ m}^3$ oil in twelve conventional fields and $800 \times 10^6 \text{ m}^3$ gas in three fields. However, this changed dramatically in early 1997 when Ashton Mining of Canada Inc. released the drill results from potential kimberlite targets located approximately 350 km north-northwest of Edmonton in north-central Alberta. A summary of the discovery is provided below.

In September 1995, the Alberta Geological Survey recovered 152 possible pyrope garnets from a single 25 kg sample of dark greyish brown, silty clay till; the sample was collected northwest of Red Earth Creek (latitude $56^\circ 50.834' \text{ N}$, longitude $115^\circ 45.237' \text{ W}$; Fenton and Pawlowicz, 1997). Thirty-five garnet grains were analyzed by scanning electron microprobe, and 27 were classified as Group 9 (G9) garnets according to Gurney's (1984) CaO versus Cr_2O_3 plot. The same site was resampled in August 1996 and 176 possible pyrope grains were recovered, thus duplicating the high number of pyrope garnets initially recovered from this site.

Alberta Energy Company Ltd. conducted a fixed-wing aeromagnetic survey over the Buffalo Head Hills in 1995. The survey identified 'dominant features' defined by several shallow, long-wavelength, high frequency anomalies that also corresponded to very strong diffractions in the seismic profiles. An astute geologist with Alberta Energy Company Ltd., Rob Pryde, recognized that the anomalies might be related to diatremes. In October 1996, an option agreement was signed by Ashton Mining of Canada Inc., Alberta Energy Company Ltd., and Pure Gold Minerals Inc. to investigate these anomalies.

Closer inspection of the total field profile from the aeromagnetic survey revealed more than 100 shallow targets, with the highest-priority anomalies evaluated by helicopter high-resolution magnetic surveys (Carlson et al., 1999). In January 1997, Ashton Mining of Canada Inc. announced a drill program to test ten isolated geophysical anomalies in the Buffalo Head Hills area, approximately 35-45 km northwest of the community of Red Earth Creek. The initial two drill holes, located on anomalies identified as K7B and K7C, penetrated "olivine-dominated fragmental and tuffaceous material" underlying glacial overburden at depths of 34.0 m and 36.6 m, respectively. The rock types were interpreted by Ashton to represent pipes (diatremes) that intruded from the basement through a thick column of overlying younger sedimentary rocks to the preglacial surface (Ashton Mining of Canada Inc., 1997a). Petrographic studies of core from K7B and K7C confirmed that the drill holes intersected kimberlite and identified indicator minerals such as chromite, eclogitic garnet, and peridotitic garnet (Ashton Mining of Canada Inc., 1997b).

By March 1997, a total of 11 kimberlites within a 100 km^2 area had been discovered, 10 by drilling and one by bulldozer, including kimberlites K2, K4A, K4B, K4C, K5A, K5B, K6, K7A, K7B, K7C, and K14 (Ashton Mining of Canada Inc., 1997C). The first microdiamond analyses of samples collected from kimberlites K2, K4, and K14 were released in April 1997 and confirmed that the pipes are diamondiferous; more significantly, three samples totalling 152.5 kg from kimberlite K14 yielded significant numbers of diamonds, including 139 microdiamonds and 11 macrodiamonds (Ashton Mining of Canada Inc., 1997d). Geochemical analysis of diamond-indicator minerals from K2, K4, and K14 yielded G10 pyrope garnets and abundant chromites, with chromium and aluminium plotting in the diamond-inclusion field.

These results, and ensuing headlines such as “Ashton Pulls Diamonds From Property in Alberta” (Northern Miner, 1997a), “Ashton, Pure Gold Find More Diamonds in Alberta” (Northern Miner, 1997b), “Forget Oil; Diamonds New Lure” (Calgary Herald, 1998), and “Alberta Has ‘Tremendous Potential’ for Diamonds” (Edmonton Journal, 1998), indicated that a new chapter in the history of the resource potential of Alberta was about to be written.

To March 2000, a total of 32 kimberlite pipes had been reported, of which 18 are diamondiferous, but with generally low diamond grades as pronounced by the results of mini-bulk sampled kimberlites K5, K6, K11, K14 and K91 (Ashton Mining of Canada Inc., 1998a, 1999a, b.). However, the high ratio of diamondiferous to barren pipes, large inferred sizes of the pipes (1 to 45 ha), accessibility of the pipes (from cropping out to overburden thickness of up to 127 m), and advanced road infrastructure in the Buffalo Head Hills area help make the prospect of finding a diamond mine in Alberta possible.

To August 2002, new kimberlite discoveries (K8, K160, K252 and K281) bring the total number of kimberlites in the area to 36, of which, at least 24 are diamondiferous and six of the kimberlites contain estimated grades at >3 carats per hundred tonnes (cpht). The 35th kimberlite discovered, kimberlite K252, provided the most encouraging results to date. A 22.8 tonne mini-bulk sample from the K252 kimberlite returned a total of 12.54 carats of diamonds for an estimated diamond content of 55.0 cpht (Ashton Mining of Canada Inc., 2001). In addition, a 0.94 carat stone indicates the potential for K252 to host commercial-sized stones. The promising K252 results are not the only positive announcement with respect to this pipe. Until now, the Alberta diamond play has focused on identifying targets that have clear airborne electromagnetic signatures. Kimberlite K252 is the first target discovered in the Buffalo Head Hills area that has a very small magnetic signature; rather K252 was discovered using seismic and gravity data (Ashton Mining of Canada Inc., 2000).

As a result of the K252 results, a ground gravity survey was completed in February 2002 and identified a strong gravity signature associated with K6, which is located about 500 m from K252. A mini-bulk 5.7 tonnes sample returned a total of 0.539 carats of diamonds larger than 0.8 mm in two dimensions for an estimated diamond content of 9.4 cpht (Ashton Mining of Canada Inc., 2002).

2 References

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