

## EXPLORATION - OVERVIEW

*By Dr Charles Moon*

**E**xploration spending continued at low levels during 2000 due to the low gold price and the rival attractions of investing in e-commerce. These factors resulted in a lack of funding for junior companies, in particular, and a reluctance to invest by gold-oriented companies. Two commodities bucked the trend: platinum group elements (particularly palladium) and diamonds. The rise in the palladium price to nearly US\$1,000/oz resulted in a frenzied re-examination of many old projects, particularly in the Bushveld Complex of South Africa and in eastern Canada, as well as the generation of new targets. Diamond exploration worldwide was very active and successful, notably in Canada and southern Africa.

The annual survey of mineral exploration spending by the Metals Economics Group reported recently that total expenditure

(extrapolated from a sample of 656 companies) was some US\$2.6 billion in 2000, down from US\$2.8 billion in 1999. Latin America remained geographically the top destination with US\$662 million, down from US\$719 million in 1999 whereas Australia was sharply down at US\$405 million from US\$495 million. Spending in Canada bucked the trend with an increase of US\$38 million to US\$348 million and US spending was only marginally lower at US\$235 million. Africa's allocation was just US\$293 million, down 25%, and that of the Pacific/ SE Asia area was little changed at US\$199 million. Spending in the rest of the world was slightly down at US\$197 million.

### Canada

Figures from Natural Resources Canada show that North West Territories and Ontario remained the prime areas of exploration

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spending in Canada. Moreover, an upturn in Canadian spending can be expected in 2001, with the re-introduction of flow through funding for the period to 2004.

Diamond exploration continued on a high throughout Canada, particularly in the North West Territories. Exploration was encouraged by the go ahead for the Diavik project and the purchase of the Snap Lake prospect by De Beers Canada. The bankable feasibility study at Diavik (60% Rio Tinto, 40% Aber Resources) highlighted the very high grades of the A154S pipe. This contains proven and probable reserves of 11.7 Mt at 5.2 ct/t for a total of 61 Mct with an average revenue of US\$412/t. The other pipes, A154N, A418 and A21 contain a further 45 Mct. The average value of the stones is estimated at US\$74/ct and project cost is US\$0.87 billion. The Snap Lake prospect is based around a kimberlitic dyke with pre-feasibility resources of 21.3 Mt at 1.97 ct/t and an average value of US\$118/ct. During the year, De Beers Canada took over Winspear Resources (68%) for C\$301 million and bought the remaining 32% from Aber Resources for C\$173 million.

At Kennady Lake, results from the joint venture between De Beers Canada and Mountain Province Diamonds indicate that the two major pipes, Hearne and 5034, are marginal. However, De Beers will proceed with a C\$10 million large-diameter drilling programme to recover 2,000 ct for better assessment of the prospect. Exploration also continued around the Ekati mine and one novel development was the deployment of BHP's proprietary airborne gravity gradiometer, 'Falcon'. Two out of an initial five targets tested in the Ekati core zone were confirmed as kimberlites. Exploration sampling at the Lynx pipe within the Ekati buffer zone gave an average grade of 0.83 ct/t with a value of US\$139/ct.

In Quebec, Ashton Mining and Soquem have narrowed down their search for the sources of kimberlite indicator trains to a number of discrete areas in two project areas. There

were also base metal discoveries in the year, notably by Inco in Ontario, and Noranda in Quebec. Inco announced a new discovery at the Totten copper-nickel deposit and updated resources at its Kelly Lake copper-nickel project. These exploration successes encouraged Inco to spend US\$7.7 million on surface and underground exploration, its highest spend in Ontario since the late 1970s. In Quebec, Noranda drilled 56,000 m at the Perserverance area, 6 km northwest of its Mattagami concentrator. Initial resource estimates are 5 Mt of 16.8% Zn, 1.3% Cu, 34 g/t Ag and 0.4 g/t Au.

### USA

Consolidation was a feature of 2000 with, for example, the takeover of Battle Mountain Gold by Newmont Mining Corp. Meanwhile, drilling in close proximity to existing deposits continued to be successful. The Cortez joint venture of Placer Dome and Rio Tinto discovered a new zone of mineralisation, Crossroads, about 500 m from the Pipeline open pit. Resources are put at 500,000 oz contained in 12 Mt at 1.4 g/t Au.

Cominco reported further mineralisation at its giant Red Dog property in Alaska, and announced plans to re-open the Pend Oreille mine in Washington. The ore reserve at Pend Oreille is 6 Mt at 7.2% Zn and 1.2% Pb, and the deposit is only 50 km from Cominco's Trail smelter. Delineation drilling at Red Dog started at the Annarraaq discovery. Initial results included 73 m of 20% Zn and 5% Pb from 650 m. A preliminary estimate suggests a resource of 12 Mt of 18% Zn, 5% Pb and 90 g/t Ag. The massive sulphide lies about 90 m below a 60-100 m thick barite horizon that has a strong gravity expression.

### South America

Most expenditure remained focussed on the Andean countries, particularly Chile and Peru, although the political situation in both was less settled. Development of major mines in Peru, such as Antamina, encouraged further exploration, although there were some major 'busts', notably that of

Pacific Rim Mining at Luicho. Initial results at this prospect gave high grades from surface and cliff samples, such as 8 g/t Au over 28 m, prompting speculation of a major discovery. However, subsequent drilling demonstrated that the mineralisation was restricted to the upper sandstone unit and only weak mineralisation was present at depth. Late in the year, Barrick Gold announced the suspension of development at its major Pascua-Lama project.

Manhattan Minerals continued drilling in northern Peru on its Tambo Grande prospect. Latest holes include a high-grade copper zone on the B-5 deposit, including a section of 15 m of 10.6% Cu from 604 m. The company is currently conducting metallurgical tests to improve the initial poor recovery from chalcocite and sphalerite-rich zones. Also in Peru, Inca Pacific announced success at its Magistral prospect. A scoping study indicated a resource of 190 Mt at 0.83% Cu and 0.062% Mo in a porphyry and skarn system. The property is currently a joint venture with Antofagasta plc.

In Ecuador, a joint venture between Corriente Resources, Lowell Exploration and Billiton delineated further porphyry mineralisation. Drilling at the Mirador deposit included intersections of 263 m at 0.82% Cu and 0.33 g/t Au from 40 m. Results from the Pantanza project included 288 m of 0.92% Cu and 0.05 g/t Au from 52 m. The San Carlos prospect, 4 km from Pantanza, contains similar intersections to Pantanza and could be part of a joint development.

In Brazil, Phelps Dodge and CVRD announced further definition of their Sossego project in the Carajas region. Drilling defined a resource of 219 Mt at 1.14 % Cu and 0.34 g/tAu within a larger mass of 400 Mt.

### **Australia**

Exploration remained at a low ebb and many geologists, particularly in Western Australia, were under-employed. The Australian Bureau of Statistics reported that exploration

expenditure was similar to levels last experienced in 1992 but that the rate of decrease had stabilised by the quarter to end-September 2000. Drilling on production leases was slightly higher but drilling on other areas fell again.

Goldfields reported significant extensions to the Raleigh deposit at its Kaduna mine in Western Australia. Better intersections include 8 m at 16 g/t. WMC announced a further significant discovery at its St Ives gold operation. Drilling on Lake Lefroy intersected significant mineralisation at Belleisle, including 43.1 m at 18.4 g/t from 217 m. The prospect is 12 km north of the WMC processing plant and 7 km from the heap leach facility. Normandy Mining reported further success at its Tanami operations in the Northern Territory, with extensions to the Callie deposit and at Groundrush, 100 km NW of Granites, where delineation upgraded the resource to 3.93 Mt at 5.6 g/t Au, or more than 700,000 oz.

At Golden Grove, Normandy Mining reported a major exploration success with the discovery of two new mineralised zones. The Amity zone is continuous over 500 m beneath Gossan Hill, and returned high grade zinc intersections with elevated gold and silver values. The second discovery, Catalpa, is between Gossan Hill and Scuddles. Both prospects have higher zinc and precious metal grades and lower iron content than the orebodies being currently mined.

Nickel was also in focus with the continued problems of the new nickel laterite producers. Of the sulphide producers, WMC has intersected significant mineralisation at its West Musgrave project in Western Australia. One hole on the Nebo prospect intersected 26.6 m at 2.45% Ni, 1.78% Cu, 0.09% Co and 0.74 g/t PGM. A hole drilled on the Babel prospect, 4 km to the west, intersected disseminated sulphides assaying 0.3% Ni, 0.4% Cu, 0.01% Co and 0.3 g/t PGM over 149 m from a depth of 54.1 m. WMC stated that it was in discussions with the local aboriginal community over further drilling.

Sampling by Ashton Mining suggested the presence of an additional diamondiferous source near its Merlin mine in the Northern Territory. A sampling parcel reported 71 diamonds with the largest being 0.23 ct.

### **Southeast Asia**

Lateritic nickel deposits are a target of significant spending by major companies. For example, Inco continued to investigate the Goro laterite project in New Caledonia using its proprietary leach technology. The deposit has a resource of 200 Mt at 1.6% Ni and 0.17% Co.

In the Philippines, Anglo American (in a joint venture with Philex Gold) has intersected a buried porphyry system at Boyongan in north Mindinao. Hole 6 included a 365 m intersection averaging 0.81% Cu and 1.9 g/t Au.

China and India remain of long-term interest for exploration as both countries are major metal consumers. A number of joint ventures

have been formed in China, and further areas, such as parts of Xinjiang, have been opened up to foreign exploration.

Iran has re-opened to exploration and a number of both major and junior companies are active. Exploration of areas can be conducted on a sole basis to target testing stage but, if an exploitation licence is required, a joint venture with an Iranian company is needed.

### **Africa**

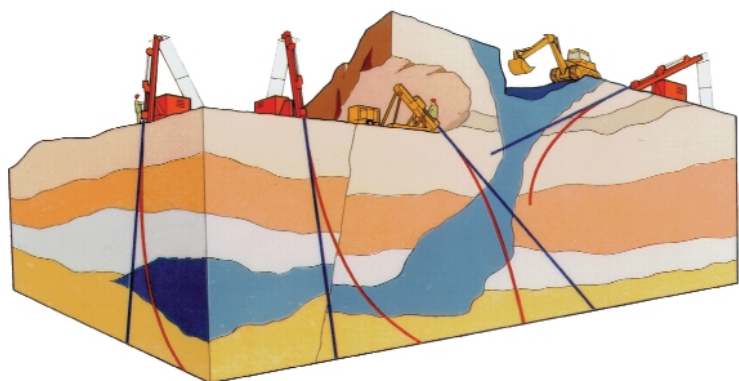
The lower gold price has led to substantially reduced exploration in Africa. One of the major explorers, Ashanti Goldfields, ran into problems with its gold hedging policy and was forced to sell half of its Geita development in Tanzania to AngloGold. Tanzania remained a major location for African exploration spending and Barrick Gold announced an increase of gold reserves at Buyanhulu from 7.5 Moz to 10.5 Moz. Development is likely to be in four phases; on the main zone, which is currently being developed, the east and west zones, and

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a deep zone. Drilling by Barrick Gold on the adjoining Golden Horseshoe Reef (in a joint venture with Tan Range) continued to intersect mineralisation at depth, including 30.4 of 3.6 g/t Au from 335 m.

In Botswana, Gallery Gold continued to advance its Mupane prospect in the Francistown area. Highlights of drilling included 49 m of 4.3 g/t Au. Although formal resource estimates have not been completed, estimates are around 500,000 oz of gold. Zambia saw an increase in exploration activity with final completion of the agreement on the major investment by Anglo American plc. A number of older prospects, such as the Mwinilunga and Lumata prospects in the northwest of the country are being re-examined, in this case by Billiton and First Quantum Minerals Ltd. Drilling is yet to start in this area, which is remote from the main Copper Belt, but trench intersections included 5 m of 2.6 % Cu and 0.39% Co.

In South Africa, a draft minerals law was unveiled that would abolish private ownership of mineral rights and vest them in the state. The aim was to redress past discrimination although security of tenure would be guaranteed for existing mining and exploration. One of the main objectives is to free up areas of inactive mineral rights by giving existing owners two years to convert to a 25-year mining lease. The major activity was in the platinum industry with the start of development of many long-mooted projects, particularly in the eastern limb of the Bushveld Complex.

Diamond exploration was at a high both in southern and west Africa. In Zimbabwe, Rio Tinto and Rio Tinto Zimbabwe announced the discovery of three pipes near Zishivane in the south of the country. Resources are put at 16.5 Mt at 0.95 ct/t and the deposits are currently at the feasibility stage but thought capable of supporting a 500,000 t/y operation. The border area between Botswana and South Africa was a target for exploration, for example by Southern Era at its Mooikloof project, which adjoins De Beers' small Oaks pipe.

Activity in west Africa was reduced although a number of companies extended resources around producing mines. Glencar Mining intersected high-grade mineralisation at Balleybo, 2 km southwest of its Wassa mine. The initial intersection was 5 m at 17.3 g/t from 42 m. In Mauritania, Ashton Mining (in a joint venture with Dia Met Minerals) reported the first drill intersection of diamondiferous kimberlite in the country, at its Maqetir licence in the north. Processing of selected drill samples recovered 78 micro diamonds weighing a total of 2.86 ct. The source is interpreted as a 8 ha pipe. In Guinea, Rio Tinto has agreed to a joint venture over the Ardeor kmiberlite with Trivalence Mining Corp. The company also continued to evaluate its Simandou iron ore project.

### Europe and CIS

Europe and CIS remained relative exploration backwaters although there were a few hot spots of activity in Scandinavia and the eastern Mediterranean.

Zinc exploration continued in Ireland at a high rate during 2000, with reports of a number of mineralised intersections, although teething problems at the Lisheen mine (Anglo American and Ivernia West), and labour problems at Tara, provided some disincentive. Along the Rathdowney Trend that contains the Lisheen and Galmoy mines, Arcon reported intersections of up to 4.6 m of 5.5 % Zn-equivalent at its Rapla prospect, 10 km from Galmoy. Noranda, in a joint venture with Minco (formerly Irish Marine Oil) has three intersections of massive sulphide at around 160 m depth at its Pallas Green prospect in Limerick. The best intersection was 3 m of 21% Zn and 4% Pb.

Gold exploration in the eastern Mediterranean was active during 2000, with ongoing development in northern Greece by TVX, Greenwich Resources and Normandy Mining. Sampling by Navan Resources in southern Bulgaria outlined a high-priority drill target on its Krumvograd licences. Surface sampling returned up to 30 m at 17.6 g/t Au close to the border with Greece and on trend with

Normandy's Perama Hill project. Eldorado Gold continued to refine estimates at its Kisladag porphyry prospect in west Turkey. An updated measured and indicated resource estimate was announced of 125 Mt at 1.2g /t Au (a total of 4.8 Moz gold) with a further 55 Mt of inferred resources. A pre-feasibility study is scheduled for completion in early 2001.

One major exploration programme in Europe was the Arctic Partnership of Outokumpu Mining and Gold Fields over 39,000 ha in northern Finland. The initial resource estimate of the whole project is 49 Mt at 0.34 g/t Pt, 1.4 g/t Pd and 0.12 g/t Au, and include three 'reefs' conformable with the bedding as well as disseminated mineralisation in the footwall of the intrusion. In Greenland, Crew Development (in partnership with state-owned Nunaminerals) is evaluating the small high-grade Nalunaq gold deposit in the south of the country. Indicated and inferred resources are 425,000 at 32 g/t Au within a larger geological resource. A 23,000 t

test-mining programme was successfully completed during the year.

Investment in the CIS was at a low level, and only US\$67 million, for example, was budgeted to be spent in Kazakhstan by foreign mining companies. Some companies are, however, going ahead with advanced projects. Glencore, through its zinc company Kazzinc, is investigating the Obruchevsky and Novelinogorsk deposits. The latter contains 1.8 Mt at 4% Zn. Also, some junior companies remain active, including Celtic Resources Holdings, which acquired the Kazakh exploration assets of Goldbelt Resources for US\$250,000. Diamond exploration is still continuing in Russia, albeit at a low key. Ashton Mining has outlined 14 areas in Karelia, in the Baltic Shield, with kimberlitic indicator minerals, and the company had its licence extended until 2004. The Russian diamond group, Alrosa, is earning a 51% stake in the venture.