ATLAS Explorations LTD

INTENSIFIED EXPLORATION
on
YUKON'S CENTRAL PLATEAU

by A. E. AHO
Consulting Geological Engineer

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Dr. A. E. Aho

Abstract

The future of Yukon looks bright in spite of some setbacks in current mineral production. Heightened exploration and development is sweeping through the Territory in the wake of: (a) major lead-zinc discoveries made by the Dynasty-Cyprus team in the Anvil district, and (b) other significant developments such as the Clinton Creek asbestos and New Imperial Mines copper operations, which are being readied for early production. In particular, the central plateau region out of Ross River is proving to have very large base-metal deposits and potential, and may become the locus of a metallurgical complex as a result of developments in the Anvil district.

Government assistance of various types has been and will continue to be very important in stimulating and furthering developments, as long as substantial risk capital expenditure is made by industry.

Regionally, mineralization in the central-plateau area appears to be localized in certain structural districts characterized by some or all of the following: anomalous structure; violent tectonics; Upper Cretaceous or Early Tertiary intrusives or porphyry; vertical uplift; NS, NW, and NE faults or fractures; proximity to northwest-trending continental fault structures like the Tintina Rift; and certain favourable host rocks which vary with district and type of mineralization. Structural data is scanty, but with geologic, physiographic and geophysical interpretation and other data, useful guides can be developed for exploration.

A general exploration approach is outlined for the central plateau region.

Exploration Trends in Yukon

A wave of mineral exploration unparalleled since the great Klondike Gold Rush is sweeping through Yukon in the wake of major lead-zinc discoveries made by the Dynasty-Cyprus team in the Anvil district, 40 miles northwest of Ross River. These and other developments represent a great breakthrough after years of exploration devoted to this territory.

For the past 20 years since building of the Alaska Highway, a number of companies have explored Yukon for mineral deposits each season. It was long recognized that regional geology is favourable for major potential, some promising new discovery was made almost every season, and considerable work was concentrated on several properties. However, only the asbestos deposit of Cassiar Asbestos Corporation and the Canada Tungsten deposit attained significant production, and neither of these was actually located in Yukon, although all approach and traffic was necessarily through the Territory. Although base metals were considered to present the largest potential, no such discovery proved to be large enough or rich enough to become economic in this higher-cost region.

A paper presented at the Annual Convention of the Northwest Mining Association in Spokane, Wash., December 3, 1966.

Thus, as regional reconnaissance programmes remained unsuccessful in discovering large immediately-economic deposits, some disillusionment was felt about Yukon, reconnaissance dwindled somewhat, and exploration philosophy in the last few years trended toward doing saturation prospecting or intensive work on known prospects where high unit-value products might be produced.

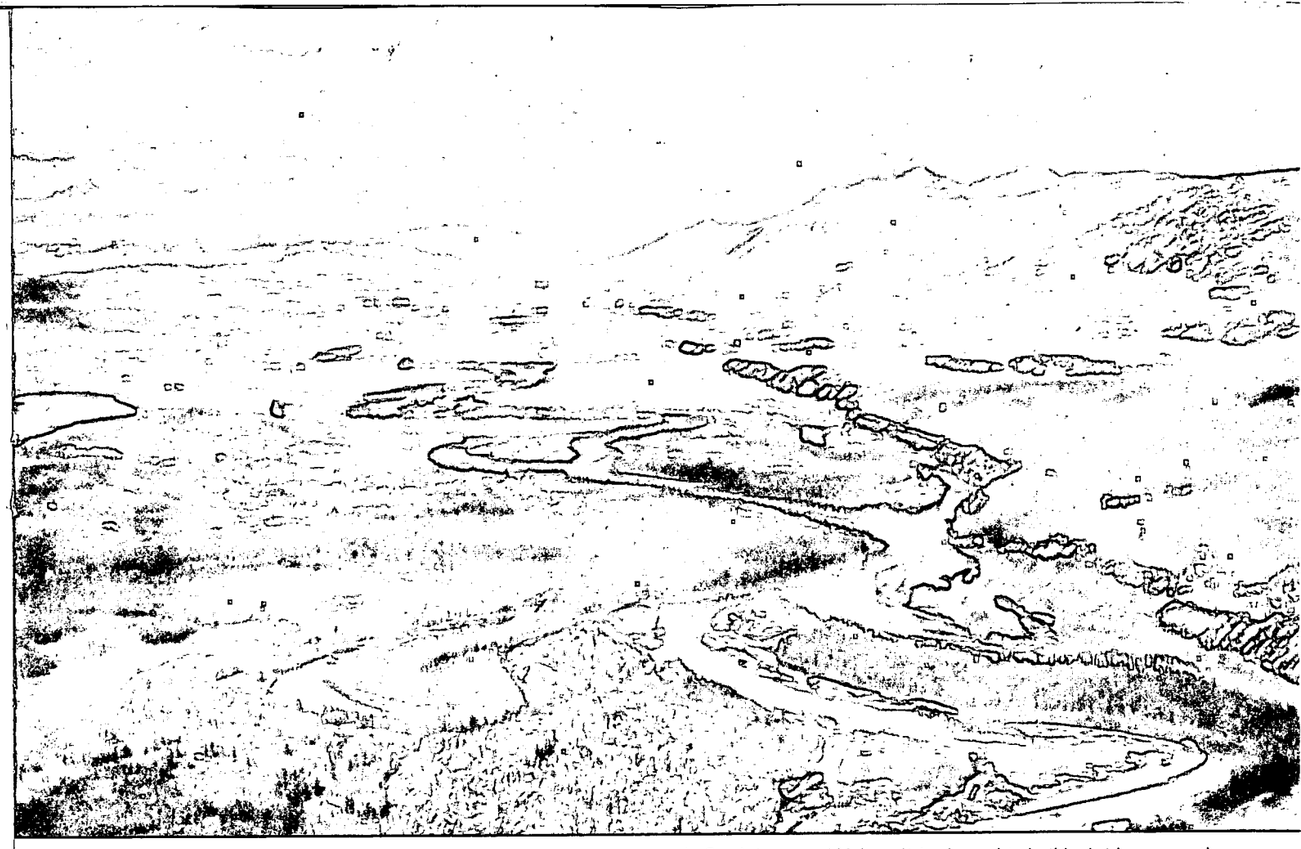
In primary exploration, sizeable virgin mineral outcroppings, float, or gossans are still being found by conventional prospecting; but fully-integrated saturation-prospecting programmes, emphasizing geochemistry and geophysics, were started in the 1960s. The best and most successful example is that of Dynasty Explorations, in which a thorough programme costing several hundred thousand dollars of risk capital was tailored in magnitude and intensity to the expected size and potential of the Anvil lead-zinc district.

In property exploration and development, the generally heightened interest in mining in western Canada provided enough incentive for serious work on a number of deposits, the most notable successes being the Clinton Creek asbestos development proceeding to production northwest of Dawson City, the New Imperial open-pit deposits being readied for production in the Whitehorse copper belt, and Anvil Mining Corporation's open pit lead-zinc deposit being developed northeast of Ross River, the latter being the result of the Dynasty programme mentioned above. The latter discovery may be large enough to become a base for a metallurgical complex, and should thus have the greatest impact on the economy of the territory.

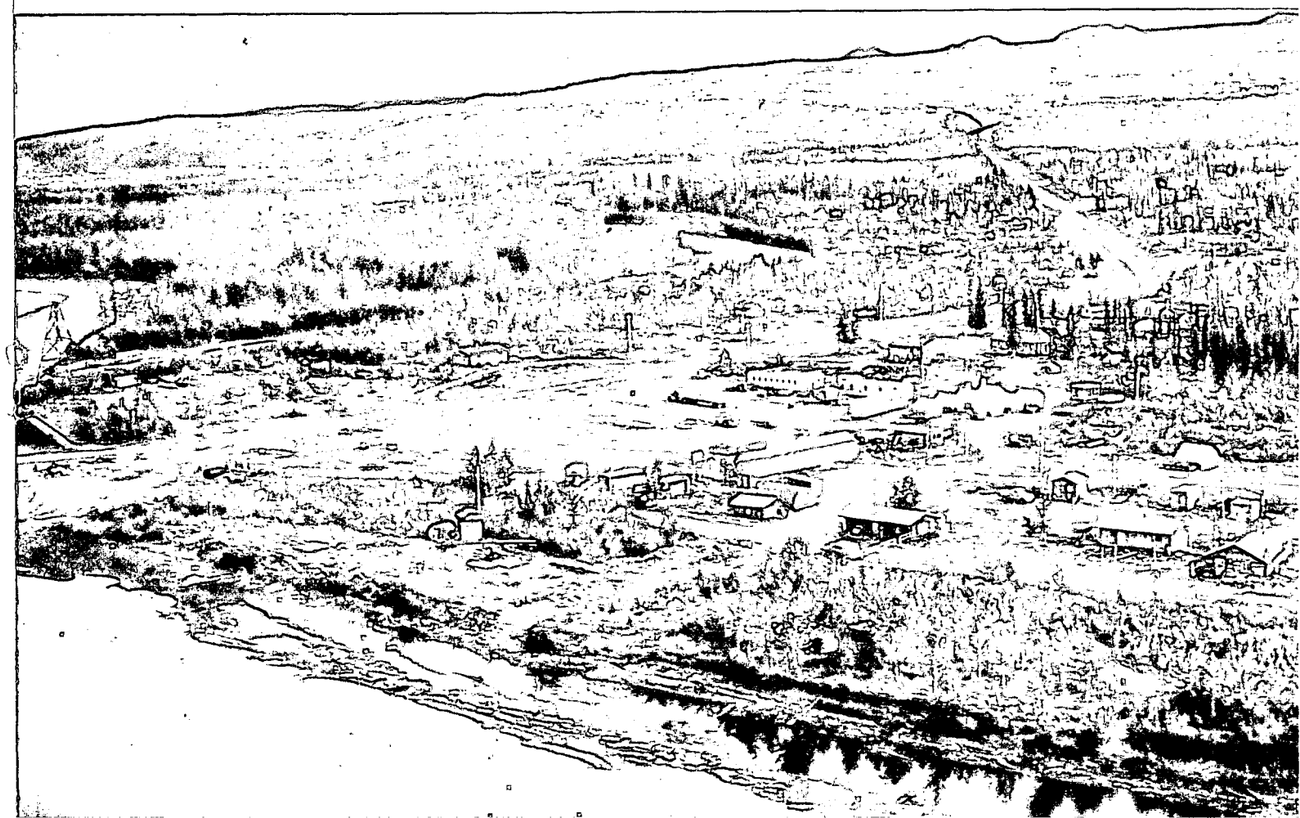
Thus, some of the long-sought mineral potentials of Yukon are being unearthed as vindication of the years of hope, sweat and expenditure. This year some 15,000 claims have been staked, a number equal to all the claims previously held, making an unprecedented 30,000 claims in Yukon.

Major mining companies in Canada and the United States are following developments with renewed interest, and at least 25 have either actively worked in Yukon or have had their representatives on hand. These include Cyprus Mines Corporation, Cominco, Canadian Superior Oil, Imperial Oil, Standard Oil, New Consolidated Gold Fields of South Africa, Hudson Bay Mining & Smelting, Nippon Mining Co., Placer Development, Kerr Addison, Newmont Mining, McIntyre Porcupine Mines, K. J. Springer and Associates, Conwest, Falconbridge, and others. It is estimated that over six million dollars has been expended on exploration in Yukon in 1966. A summary of activity in Yukon is being presented at this meeting by C. J. Brown. (See also mineral map of Yukon).

On the other hand, negative aspects, such as shutdown of Discovery Mines and Yukon Consolidated Gold Corporation, and curtailments at United Keno Hill Mines, cloud the picture in Yukon; but these appear to be lesser setbacks in a growing economy. Although the Mayo district is suffering severely from the United Keno cutback, this company is continuing to explore, Hecla Mining Company is driving an adit under a rich new



Looking northwest up the Tintina Trench at the mouth of Vangorda Creek in central Yukon. It is planned to build a bridge across the Pelly River to the properties of Anvil Mining Corporation. Below: The busy community of Ross River, which has gained recognition as a post-office address.



silver-lead find on Bunker Hill, and Silver Titan Mines (Haldane Silver Mines) is drifting on a silver-lead property at Mt. Haldane this winter.

The general effect of all the exploration and development activity in Yukon has been a great increase in business and a rising tide of optimism in future development. Morevover, if natural gas, petroleum, or cheap coal is found in sufficient quantity in certain areas, other major resources such as the 22-billion-ton Crest Explorations iron deposit may become economic.

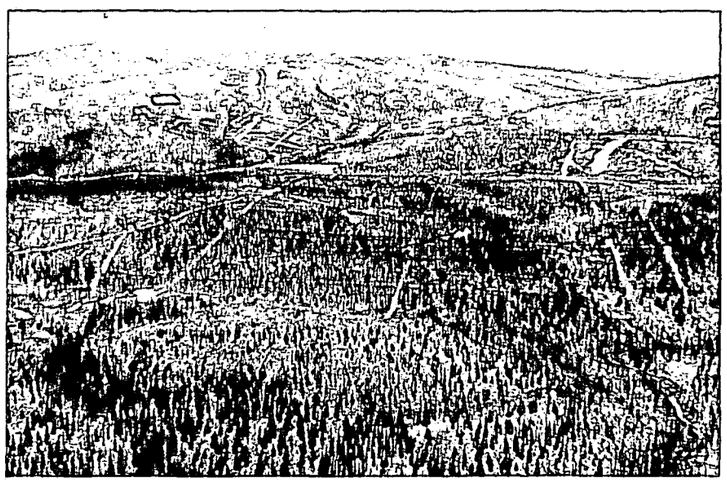
Therefore I am fully confident that major developments will rapidly change the entire economy of Yukon, making it possible for the Territory to become an economically self-sufficient province of Canada. However, in Yukon this is possible only with revenue-producing mineral resources, for which high-risk exploration expenditure must be encouraged. With its large areas of favourable Cordilleran-type geology and major mineral potential, Yukon offers the best possibilities of major success for those who are willing to risk the greater initial exploration expenditures necessary in this region.

Government Assistance

As in any undeveloped region, government assistance in various forms may be very necessary; it can stimulate and guide developments; and it should be sought or used by industry wherever possible. In Yukon, several good forms of assistance are available: tote trail and road assistance, development assistance in various forms, prospector's assistance, and the new Northern Mineral Exploration Assistance.

In particular, the Federal government is to be congratulated for the latter by which new capital, aside from operating companies with producers' tax benefits, is encouraged to explore mineral prospects. Under this legislation, if a property is carried to the drilling stage, up to 40% of the exploration costs may be reimbursed with no repayment obligation if unsuccessful; if successful, the 40% is repaid with interest. Like the Alaska purchase, I am sure the investment will repay itself manyfold.

The Department of Northern Affairs and the Territorial Government are to be commended for their foresight in providing the transportation routes to assist and stimulate development and to retain its impetus. Too long the energy and drive of prospectors and exploration groups has been thwarted, and mining development strangled by lack of cheap, reliable access.



Diamond-drill grids on the Faro No. 2 orebody of Anvil Mining Corporation. In the background, the drill-grid pattern on the Faro No. 1 orebody is disclosed.

Development in Ross River Region

General

The greatest activity is centred in the Ross River region where over 10,000 claims have been staked, some 20 companies and syndicates were active with several helicopters and fixed-wing aircraft, major exploration and development programmes are being carried out by Anvil Mining Corporation and Atlas Explorations, the Federal and Territorial governments are building roads, and significant new discoveries are being made.

The former small community of Ross River has exploded with development. In 1965 it contained only about 30 people, mostly Indians, and a small trading post, with minimal facilities, no schools, no electricity, little or no supplies, no sewer or water; and flying services were chartered from Whitehorse 125 miles away by air. A few short months later, spurred by the heat of the exploration activity, Ross River attained a development area status and boasts a fixed wing and helicopter base, Northwest Expediting and Communications base, Territorial Government base for road crews, Atlas Explorations base with atomic photospectrometer - geochemical laboratory, electricity and water, a school, a modern motel and restaurant, several new permanent houses, two new churches, a large and well-stocked store, fuel and propane depot, and many other facilities of an organized community.

Under the Federal Government's plan of resource roads to active areas, the Watson Lake - Ross River all-weather highway has been constructed a distance of 223 miles from Watson Lake to Ross River, and 40 miles northwesterly to the Anvil project. Contracts have been let this winter for completion of the link to the Mayo-Dawson Highway 100 miles to the west at Carmacks by next fall. It will then be possible to ship concentrates from the Anvil district to seaboard on heavy trucking equipment.

A recent important development and exploration road project announced this fall by the Territorial Government is to open up the first 20 miles beyond Ross River of the old Canol Pipeline road and to install a ferry at Ross River to service it.

From the point of view of prospecting and exploration, the establishment of Ross River as a supply-and-aircraft base and the government road-building projects are indeed major steps forward, since they open up the central plateau region of Yukon northeast of the Tintina trench, considered to have the largest mineral potential of the northwestern Cordillera, but formerly accessible only by high-cost air charters from Whitehorse or Watson Lake, each over 125 miles away.

This is the region in which Atlas Explorations has made significant new base-metal discoveries and Hudson Bay Mining & Smelting had previously developed major reserves of zinc that await favourable transportation for further development. It is easy to predict a new wave of discoveries here, perhaps developments rivaling those in the Anvil district. The geology and mineralization is quite similar, and important new finds are imminent, as prospectors and developers take advantage of access and the Ross River base facilities.

Anvil District

Most of the claim staking and the majority of the exploration activity in central Yukon has been focused on the Anvil lead-zinc district northwest of Ross River, which has been the scene of significant major base metal discoveries by the Dynasty-Cyprus team and by Kerr Addison Mines.

The Vangorda Mines deposit (now owned by Kerr Addison) was discovered in 1953 by Alan Kulan, drilled until 1956 by Prospectors Airways, and proven to contain 9.4 million tons of 8% combined lead and zinc with 1.74 oz. silver per ton with 0.27% copper. Kerr Addison carried out further prospecting starting in the early 1960s and staked a prominent airborne-magnetic anomaly at Swim Lakes eight miles SE of Vangorda. Drilling in 1965 and 1966 proved it to be another sizeable lead-zinc deposit.

In 1964 Dynasty Explorations launched a major district-wide integrated programme of prospecting, geologic and geochemical reconnaissance, airborne surveys, and detailed ground follow-up and rotary drilling to test all favourable targets. One submarginal sulfide deposit was found and drilled near Swim Lakes in 1964. By the time the main Faro orebody was discovered in July 1965, some 20,000 feet had been drilled and about $500,000 had been spent by Dynasty and its major partner, Cyprus Mines Corporation.

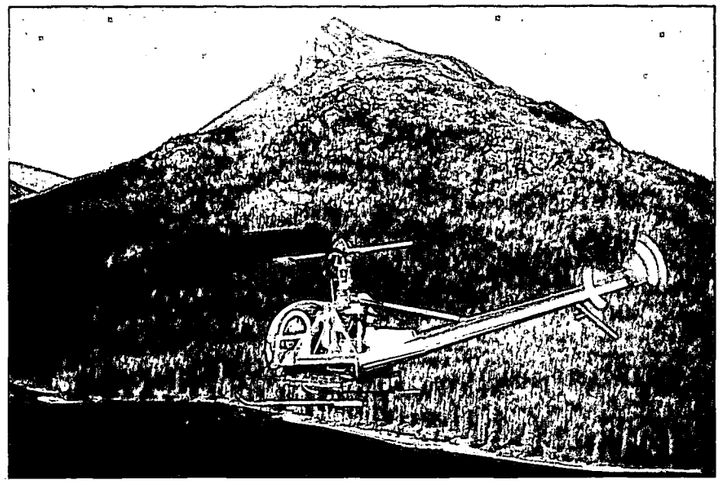
By the time Anvil Mining Corporation was incorporated December 1st, 1965, with Cyprus Mines Corporation owning 60% and Dynasty Explorations 40%, $1,895,000 had been spent. Anvil's subsequent programme of development drilling, feasibility surveys, road construction, and exploration of other targets on its 2,500-claim properties has been the largest and most significant 1966 programme in the Territory, costing another $1,900,000 up to September. The Faro orebody has been fully drilled, proving a reserve of about 40 million tons of open-pit ore averaging over 10% combined lead and zinc with more than one ounce of silver per ton; a bulk-sampling tunnel is being driven; and feasibility studies for a concentrator are now being defined. An intensive study of proposed developments is being made by both the company and by the Federal government.

Kerr Addison Mines Limited carried out diamond drilling with several machines, expanding the sizeable lead-zinc replacement orebody found in 1965 on their Swim Lakes property. Drill holes have outlined ore sections grading 8 to 10% combined lead-zinc with 1½ oz. of silver in a massive to semi-massive sulphide zone similar to the Vangorda Mines deposit.

An extensive airborne magnetic survey was carried out in the general Ross River area and northwest of the Anvil district, and additional groups of claims were staked on airborne anomalies on which further follow-up surveys were done or are planned.

No work was carried out during the year on the Vangorda deposit. Production plans for this deposit await forthcoming road improvements and developments planned for Anvil Mining Corporation's Faro deposit eight miles to the northwest.

A number of other companies and syndicates also carried out examinations; geological, geochemical and geophysical surveys; and drilling in some cases in the Anvil district. These include Jaye Explorations, Kamloops Copper Consolidated, Tay River Mines, Cominco, Giant Yellowknife Mines, Frontier Exploration, Flagstone Mines, Dynacore Explorations, Arlington Silver Mines, Yukon Copper Company, Glenlyon Mines, Ross River Explorations, Silver Arrow Mines, Noradco, T. C. Explorations, Van Metals, Northwest Minerals, P. C. Explorations - U.S. Smelting, Mining and Refining - Canadian Superior Oil, Consolidated Bellekeno, Pontoon Explorations, Earlcrest Resources, Northwest Explorers, Citation Mines, Transcontinental Resources, Northlodge Mines, Slocan Ottawa Mines, Canex, and others. The total activity has been too complex for compilation of accurate data; the number of interests in the district is indicated on a recent property map compiled by Archer and Cathro, consulting geologists, in Whitehorse, and displayed in the August 1966 issue of "Western Miner."



One of two helicopters used by Atlas Explorations on the Sheldon prospect, 80 miles east of Ross River. Traffic Mountain in background. August 1966.

Moving geophysical camp of Atlas Explorations. August 1966.

Although no other significant new discoveries have yet been reported in the district, it is almost certain that continued intensive exploration in the Anvil district will be successful in unearthing other major lead-zinc deposits.

Other Areas

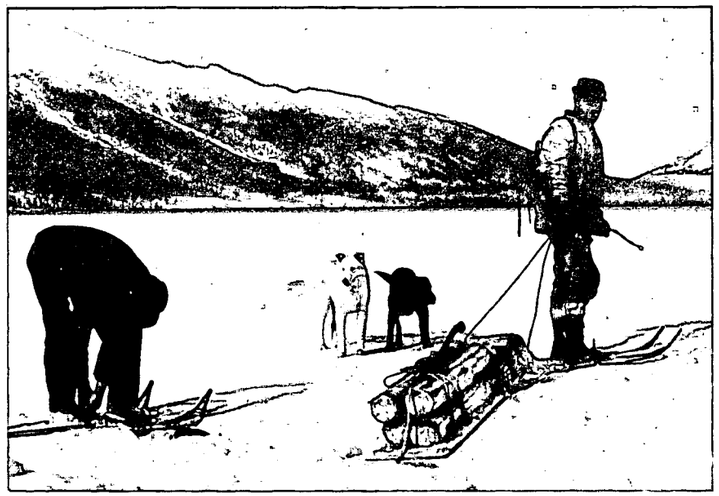
Near Earn Lake, northwest of the Anvil district, Conwest Exploration is reported to have had two diamond drills working on a base-metal area.

In the Ketza River district of Pelly Mountains, 40 miles south of Ross River, Silver Key Mines and Stump Mines trenched a text-book-type lead-geochemical anomaly and exposed a 600-foot length of vein zone averaging 32.6 oz. silver per ton with 27% lead across a 4-ft. mining width.

In the Grass Lakes area southeast of Ross River, Northlake Mines and Riviera Mines flew an airborne survey and located a coincident electromagnetic and copper base-metal geochemical anomaly zone, which was diamond-drilled in October. Kerr Addison Mines and Atlas Explorations were also active in this area with airborne and ground geophysical and geochemical surveys.

At Fyre Lake, 80 miles southeast of Ross River, Atlas Explorations is conducting a diamond-drill programme on two zones of flat-lying replacement copper-mineralization in schist with associated magnetic and geochemical anomalies.

Except for the Anvil Mining Corporation project, the largest exploration programme in Yukon is that of Atlas Explorations Limited, centred out of Ross River and carried out by the same organization which first discovered the Dynasty-Cyprus (Anvil) deposit. Although many other areas of Yukon were examined, the programme was designed mainly to concentrate on the large favourable areas of the Central Plateau region with experienced personnel, adequate finances, and fully-integrated scientific-saturation-prospecting techniques, and with emphasis on fully flexible authority to make decisions in the field. In Ross River the company erected a base consisting of several new buildings, including an atomic-absorption-photospectrometer laboratory which also did some custom geochemistry to aid other companies active in the area near Ross River. Properties at Magundy River, Old Gold Creek, Grass Lakes, Fyre Lake, Traffic Mountain, Mt. Hundere and several other localities were explored in varying detail and several prospecting parties combed the region.



Staking claims, February 1966, for Atlas Explorations at Fyre Lake, 80 miles southeast of Ross River.

Sheldon project. Prospecting crew of Atlas Explorations at the old Pelly Lakes trading post. August 1966.

The work employed some 50 personnel and consisted of three phases: (a) preliminary study of all available data, photogeology, airborne magnetic and electromagnetic surveys and follow-up acquisition of ground before break-up when ground mobility was easy, completed by June; (b) isolation of airborne anomalies by follow-up linecutting and detailed geologic, geochemical and geophysical surveys, and (c) evaluation of all data compiled followed by bulldozer trenching or diamond drilling. To date about $500,000 has been spent on the project; promising areas of copper, lead, zinc, and silver mineralization have been discovered in locations considered to have potentials similar to the Anvil district; over 2,500 claims have been staked; bulldozer trenching, minor drilling, and an aeromagnetic survey were carried out in the Sheldon district 80 miles east of Ross River; and diamond drilling was started in October at Fyre Lake. The discovery of porphyry-copper-type mineralization in the Sheldon area may be particularly significant.

Possible Structural Controls For Mineralization

Anvil District

This district, in which large, massive sulfide deposits of lead and zinc are localized, consists broadly of a 20-by 40-mile uplifted northwest-trending block with the Anvil batholith as a core, and schists, volcanics, chert, and argillite draped over it with gentle to moderate dips away from the anticlinal batholithic core, but complicated by folding, faulting, and irregularities of the intrusive contact. This mineral district is bounded by the regional Tintina fault trench on the southwest, by the Ace fault up lower Tay River on the northwest, its southeast boundary being as yet undefined. Perhaps this district or mineral belt extends SE toward Ross River and also to the northwest.

Parallel to the Tintina trench a zone of low topography extends from Swim Lakes northwest through Vangorda Creek and down Rose and Anvil Creeks. This zone contains all the major deposits known to date and may, therefore, be the most important regional ore control, perhaps a fault or crumple zone reflecting some deep underlying structure buttressed between the Tintina fault and the underlying Anvil batholith.

Another regional ore control that has been suggested is graphitic schist as a source bed or localizing stratigraphic control. Kerr Addison's Vangorda and Swim Lakes deposits and Anvil's Faro No. 2 deposit are localized in or next to graphitic schist, and graphitic argillite horizons in the chert sequence appear to cause high zinc geochemical background. On the other hand, Anvil's Sea deposit and the largest orebody, Faro No. 1, have no associated graphitic material, thus a plutonized source bed concept or some local stratigraphic preference is probable. This may apply to the other districts also.

More localized controls appear to be N-S faults or crumples, E-W faults, porphyry, and folds or crumples, perhaps related to nearby intrusives as on the footwall side of the Faro No. 1 orebody. Northeast faults or fracture patterns visible in many localities as prominent northeast linears may also be important ore controls, but they could be large post-ore since they are part of a typical Late Tertiary physiographic pattern throughout much of the Tintina and Rocky Mountain trenches. As such they may not be a regional control but when superimposed on a mineral district, they may be important, and may have existed as structural controls during mineralization.

Fyre Lake - Grass Lakes District

Several deposits of replacement-type copper-zinc mineralization occur in the general Fyre Lake-North Lake-Grass Lakes area of the SE Pelly Mountains in schists intruded by granitic rocks, ultrabasics, and porphyry.

These known deposits all lie on the same (NE) side of the Tintina trench, occur in similar Precambrian schists, and appear to be related to a similar pattern of N-S and NE faults cutting a NW-trending zone of low topography parallel to the Tintina trench. This geologic environment in the southeast Pelly Mountains is very similar in many respects to that of the Anvil district and may well have similar potential. The occurrence of copper in chloritic schist is similar to minor occurrences in the Anvil district.

Sheldon District

Mineralization in the general Sheldon area 80 miles east of Ross River appears to be controlled by a WNW-trending fault and porphyry zones parallel to regional Tintina-type structures, by N-S fault zones, and by NE tear faults. Part of this general pattern consists of the McEvoy system of NE faults and linears which may be tear faults on the north side of the Logan Mountains regional bulge, or a transverse basement trend along the projection of a schist dome near Mink Creek. In the McEvoy-Pelly Lakes area part of the vertical uplift appears to be related to granitic and porphyry intrusives.

Conclusions

Structural geological information on the Central Plateau area of Yukon is still too sketchy to lead to any firm conclusions, but the following are suggested as working hypotheses (most of the mineralized districts appear to have some or all of the following characteristics in some combination):

1. Transverse basement trends or otherwise anomalous structure in some cases.
2. Intense earlier deformation and violent tectonics related to the mineralization.
3. Upper Cretaceous or Early Tertiary porphyry or intrusives, often closely related to mineralization.
4. Vertical uplift, perhaps related to the above.
5. N-S faults in most cases, as well as NW and NE fractures, some of which may be superimposed regional patterns.

The general impression is that due to regional tectonics, perhaps sliding of the continent against the Pacific Ocean basin, active northwest fault zones of continental scale such as the Tintina and Ekakwak faults exerted an overall fracturing tendency which was superimposed on, or intensified in, certain nearby areas of structural complexity where magmatism and mineralization resulted, or were already in process.

The intrusives and schists in some districts dip toward the Tintina Rift, tending to converge somewhat at depth. The Tintina itself appears to have great lateral displacements as well as much lesser but substantial vertical displacements which vary along its length.

The N-S fractures may be most important as tensional ore-forming channelways, perhaps resulting from right lateral movements along the main rift zones. Examples as such N-S faults are the Haldane fault in the Mayo district, Eldorado fault in the Klondike, faults through the Anvil district (e.g. Faro), Seagull fault in Pelly Mountains, faults closely related to known copper prospects in the Fyre-Grass Lakes district, and faults in the Mt. Hundere, Canada Tungsten, and Traffic Mountain districts.

Although largely theoretical, the above observations are useful in defining generally interesting areas for more extensive exploration.

Exploration Approach

For the central plateau region out of Ross River, the best general exploration-approach appears to be as follows:

1. Outline a broad area of interest based on regional geology, known mineral occurrences, and any other considerations such as published aeromagnetics, etc.
2. Carry out reconnaissance, geochemistry, conventional prospecting, and geologic reconnaissance supported by fixed-wing or helicopter craft to determine specific areas of interest.
3. Determine applicability of airborne-geophysical methods and carry out airborne work if applicable to type of mineralization, terrain, and geology.
4. Follow up with intensive conventional prospecting, closer geochemical surveys, ground geophysics, geologic mapping, and preliminary trenching if applicable.
5. Decide on type and extent of drill programme or whatever exploration is applicable to test all favourable targets conclusively, and carry it out.

Special problems of seasonal conditions, access, permafrost, overburden cover, and methods and their limitations have been outlined in detail in a previous paper by the writer entitled "Exploration in Yukon with special reference to the Anvil-Vangorda district," to which the reader is referred (see Western Miner, April 1966).