

ESKAY CREEK An Epithermal Massive Sulphide?

By Art Ettlinger
Mineral Deposit Research Unit, UBC

Origin of the Eskay Creek deposit, which contains an estimated geologic reserve in excess of 3.25 million ounces gold and 125 million ounces silver, has yet to be established. Early descriptions of this new discovery located in northwestern British Columbia, contain characteristics common to volcanogenic massive sulphide deposits formed at oceanic spreading centres and Great Basin-type epithermal deposits, often thought to occur at or near the surface in extensional continental environments. These apparently incompatible deposit characteristics have led to the suggestion that Eskay Creek mineralization may represent the superposition of a classic epithermal gold system onto an earlier volcanogenic massive sulphide deposit.

Epithermal and volcanogenic characteristics can be roughly attributed to two main zones forming the Eskay Creek deposit, namely the 21A and 21B zones, respectively. The 21A zone, which lies approximately 0.5 kilometres to the south of the 21B, is characterized by a rhyolite-hosted, stockwork and disseminated sulphide suite enriched in Au-Ag-As-Sb-Hg-An-Pb. An ore-bearing assemblage of stibnite \pm realgar \pm orpiment

\pm tetrahedrite \pm cinnabar is characteristic of this zone. Vertical geochemical and mineralogical zonation patterns within the 21A zone are suggestive of increasing temperatures and base metal content with depth.

The bulk of estimated ore reserves, and the focus of current surface and underground exploration, are stratabound massive sulphides hosted by graphitic argillite overlying rhyolite within the 21B zone. Gold mineralization is associated with a sulphide suite enriched in Ag-Zn-Pb-Cu-As-Sb. Sphalerite, galena, tetrahedrite and Pb-sulphosalts are most common. These sulphide minerals display fabrics suggestive of emplacement by turbiditic gravity slides, such as repetitive, normally graded beds and detrital grains. Angular clasts of argillite are abundant in sulphide layers.

Both ore zones are underlain by an intensely silicified and phyllosilicate altered, volcanic sequence displaying limited remnant textures suggestive of an original rhyolitic or dacitic composition. Abundant pseudo-breccias, believed to have formed through the process of replacement veining, are present

within the rhyolite. A distinct style of brecciation and silicification is observed in the vicinity of drill hole CA89-109, in the 21B zone. Within the "109 zone", both footwall and hangingwall rocks are fragmented, with individual fragments showing displacement or rotation. Rhyolitic and sulphide fragments within the footwall are often coated with white sparry quartz which grows into open vugs now filled with black silica. This open-space filled texture appears to be unique to this portion of the 21 zone.

The following features need to be considered for any genetic model of Eskay Creek:

- The close spatial and temporal association of contrasting mineralization styles present in the 21A and 21B zones.
- The 21A zone is dominated by epigenetic mineralization, whereas the 21B zone consists primarily of syngenetic, bedded sulphides.
- The similar intensity and style of footwall alteration underlying both ore zones.
- There is Sb-As enrichment common to both ore zones.
- The epithermal-style, open-space breccia textures, concentrated in the vicinity of drill hole CA89-109 in the 21B zone; and, the epithermal-style geochemical signature of the 21A zone.

An epithermal massive sulphide model is proposed as one possible explanation for the relationships observed above. Sulphide-gold mineralization in both ore zones is the product of a single, epithermal-like hydrothermal system, possibly developed above a synvolcanic intrusion. In the case of the 21B zone, gold and base metal-bearing fluids accessed the rock-sea water interface prior to deposition of the bulk of the metals. Sulphides and gold were deposited at the interface as a result of either rapid cooling or mixing of the hydrothermal fluid with sea water, or both. Turbiditic gravity flows reworked these sulphides and deposited them down slope in local low energy environments resulting in a graded, stratabound deposit.

Mineralization in the 21A zone resulted from development of the epithermal system into a stockwork at depth. Au-Sb-As-Hg mineralization was deposited as classical epithermal stockwork veinlets and disseminations prior to reaching the sea floor. This mineralization can be considered distal to the primary fluid/metal source relative to the 21B zone.

WERE YOU UNABLE TO ATTEND THE GAC/MAC ANNUAL MEETING IN TORONTO?

DO YOU WANT TO HEAR ABOUT RECENT DEVELOPMENTS IN MINERAL DEPOSIT RESEARCH AND RELEVANCE TO EXPLORATION?

Consider purchasing 1 or more video tapes, recorded at TORONTO'91, and review parts of selected technical sessions in the leisure of your office or home. The Mineral Deposits Division, Geological Association of Canada, provided seed money to undertake the video recording of parts of technical sessions at TORONTO'91. When you purchase a tape, MDD receives a royalty. This royalty will assist MDD to support future initiatives and continue to provide other benefits to our members.

Papers that were recorded are listed in *THE GANGUE*, Issue 36, July 1991. For additional information, contact Andy Fyon, c/o Ontario Geological Survey, Sudbury Advance Office, Tel (705) 675-4441; Fax (705) 675-6473.

The video tapes are available from RE:SOURCE MEDIA, 100 University Avenue, 6th floor, Toronto, Ontario M5J 1V6, telephone and fax (416) 971-5084. Visa, Mastercard, American Express, cash and cheque accepted. All tapes feature a lifetime guarantee. Video Cassettes are \$24.99 Canadian plus Ontario provincial sales tax and general sales tax & shipping and handling- total cost per tape is \$32.50 (Canadian). Contact RE:SOURCE MEDIA for discount information.

Inserted by the MDD Executive

MDD Photo Archive
*or, are you sufficiently
 ancient to own photos of
 historical interest?*

Brian Grant
 Editor, *The Gangue*

MDD Executive have realized a need to establish an official home for photos relating to MDD members and activities. As a result the Editor of *The Gangue*, currently myself, will collect and maintain those photos which may be of interest or use to the organization in the years to come.

If you have original prints, negatives or slides of subjects you believe should be preserved for posterity please submit them. Each photo should be accompanied by a caption identifying: the year/month taken; persons shown therein; the locality; the occasion of the photo; and, the person who contributed the material.

PACMANUS Deposit
Active Hydrothermal
Field Southeast Pacific

Steven D. Scott
 Scotiabank Marine Geology Research Lab
 University of Toronto

Editor's note: the following excerpt from Steve Scott's letter and descriptive material were submitted in response to our previous article on the Middle Valley success of the Ocean Drilling Program. Such research results, although obviously not of immediate economic concern, add significant detail to our understanding of mineral deposit settings and genesis. We appreciate and encourage like submissions.

"Dear Brian:

The article on Middle Valley in the October issue of *The Gangue* has prompted me to send you the summary of our recent oceanographic expedition in the southwest Pacific. We found a very large, actively forming massive sulphide in dacite (perhaps rhyolite! We are awaiting analyses). The PACMANUS deposit, as we are calling it, has many similarities

in its local geology (although perhaps not tectonic setting) to the Millenbach deposit at Noranda. The PACMANUS deposit and others of its type are sitting on top and on the flank of one of two large lava domes that we have recognized in the area. Further work is anticipated. ..."

Cruise Summary -

PAELARKV - Western Woodlark Basin and PACMANUS I - Eastern Manus Basin. September 24 October 14, 1991, aboard the RV Franklin.

Cruise FR8/91 of RV Franklin was an outstanding success and achieved all major objectives, significantly expanding geological knowledge of two key areas of sea floor comparable with the environments of ancient "volcanogenic massive sulphide" (VMS) orebodies. Highlights were the discovery of a new active hydrothermal field (PACMANUS) forming sulphide deposits associated with dacite in the eastern Manus Basin, and the acquisition of cored sections through low temperature Fe-Mn-Si oxide deposits on Franklin Seamount, a basaltic andesite volcano in the western Woodlark Basin.

Initial operations in the Woodlark Basin were suspended when inclement weather was encountered. Franklin moved to the more protected Manus Basin for 8 days on station, then returned to the Woodlark Basin where alto-

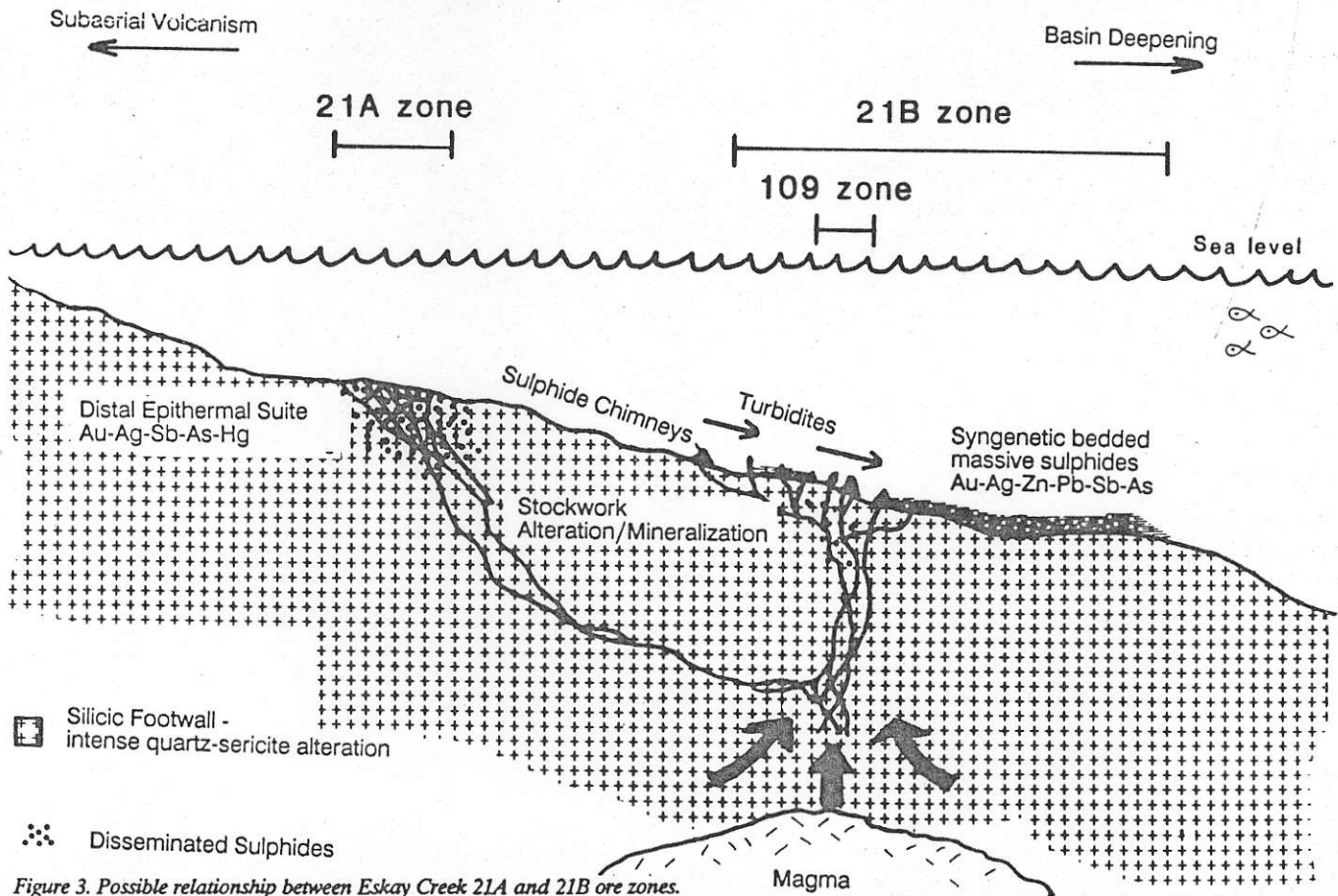


Figure 3. Possible relationship between Eskay Creek 21A and 21B ore zones.

gether 4.5 days were spent on station. A total of 30 rock dredges, 18 gravity cores, 13 camera-video tows, and 14 CTD-hydrocasts was conducted in the two areas in addition to 12 kHz echo-sounding. Transit legs took 7.5 days. The capabilities of RV Franklin for marine geoscientific research of this type were clearly demonstrated and fully utilized. New activities relative to previous cruises in the PACLARK program included very successful on-board analysis of methane in water samples as a real-time plume pathfinder, and a less successful attempt at on-board analysis for manganese.

Five sub-areas of the eastern Manus Basin were examined. Three were established as essentially basaltic in character, while two were found to be dominated by more siliceous volcanic rocks. Most attention was devoted to a previously unexplored ridge near 151°41'E (for which the name 'Pual Ridge' is proposed), where very young submarine dacite extrusives and lesser andesites are the main rock types. The ridge may be part of the complex extensional subsurface intrusive activity in former island arc crust rather than a form of back-arc sea-floor spreading.

The PACMANUS hydrothermal deposit occurs near 1650 to 1700 metres depth on a bathymetric high composed of dacite flows, in the central sector of Pual Ridge. First discovered using the towed camera-video system, it comprises a number of discrete fields of chimneys and mounds in a zone extending some 2500 metres along the ridge crest and about 500 metres wide. It includes both lightly-sedimented fossil deposits and active deposits associated with conspicuous concentrations of galatheid crabs, molluscs, gastropods and rarer tubeworms. Individual chimneys range up to 4 metres in height. Some are mushroom-shaped and many have collapsed or have shed red-brown to yellow material. A plume characterized by elevated particulate and methane contents was detected in the seawater column up to 12 kilometres from the deposit, occurring at depths between 1550 and 1700 metres towards the top of a 2.9°C well-mixed water body below the sill level of the Manus Basin. Seven attempts were made to dredge the deposit with high-precision navigation, yielding large quantities of fresh dacite, some altered dacite, and fragments of frothy dacite glass encrusted with Mn and Fe oxides. Several small pieces of massive, finely crystalline pyrite with some anhydrite, denoting high-temperature formation, were collected by the camera system after collisions with chimneys.

Elsewhere on Pual Ridge, an isolated chimney was observed at a second site, and deposits of Mn crusts on dacite and ooze at a third also indicate hydrothermal activity in the vicinity. Pual Ridge is highly prospective for further hydrothermal deposits and a considerable part of the eastern Manus Basin remains to be explored. By virtue of their association with dacitic volcanics these are closer ana-

logues to ancient VMS ores than all but one previous sea-floor discovery of a modern exhalative sulphide deposit.

Other operations in the eastern Manus Basin included gravity cores in sedimented basins to establish bottom characteristics associated with differing acoustic responses. Four enclosed deeps within grabens adjacent to volcanic ridges were tested as potential traps for dense metalliferous brines but showed no CTD anomalies or unusual bottom sediments. One dredge and a CTD-hydrocast were conducted at the DESMOS hydrothermal site (discovered in 1990 by the Aquarius expedition from Japan) 23 kilometres east of the PACMANUS deposit. The dredge recovered tubeworm-encrusted altered basalt. The CTD survey intersected a pronounced plume 1100 metres west of DESMOS.

In the western Woodlark Basin, two out of nine deployments of the gravity corer on a knoll near Franklin Seamount recovered complete sections through low-temperature hydrothermal oxide deposits from a 100 by 200 metre target at 2650 metres depth defined by previous cruises in this series. No plume anomaly was found in a CTD-hydrocast over the crest of Franklin Seamount where active low-temperature venting was discovered during manned submersible dives last year. Other dredges in this area established the presence of older basaltic (oceanic) crust rather than continental crust as the walls of the neovolcanic zone near Franklin Seamount. One dredge, two camera tows, and a CTD-hydrocast investigated a Mn-anomalous zone of seawater detected during the 1990 SUPACLARK cruise. No plume anomaly indicative of active black smokers was found and the presence of an offset segment of the neovoicanic zone southeast of Franklin Seamount was discounted. A previously unexplored ridge north of East Basin was dredged and photographed, proving to be an edifice of young ferrobaltic pillow lavas and tube flows responsible for a pronounced east-west magnetic dipole extending to Cheshire Seamount.

At the far western end of the Woodlark Basin, near Dawson Strait, previously echo-sounding traverses were extended to define the walls and western extremity of the South Valley rift system. A dredge attempting to characterize the southern wall of this structure recovered only ooze. The ship's boat was used to confirm the presence of a submerged caldera under Numanuma Bay, to collect a bottom ooze sample at 160 metres depth and to survey a safe passage into this structure from the east for future use by large vessels.

Cruise FR8/91 returned with a wealth of material for forthcoming laboratory analysis and interpretation in Australia and Canada. A new target for future manned submersible dives has been defined in the eastern Manus Basin, but proposed surveys with Franklin in 1993 are desirable to further document the

PACMANUS site beforehand and to explore for other potential dive targets.

Scientific Participants

Ray Binns*, Chris Taylor, Don Rigby and Graeme Wheller - CSIRO Division of Exploration Geoscience
 Steve Scott*, Ian Clark and Alex Ortega-Osorio - Dept. of Geology, Univ. of Toronto
 Garry Davidson and Bruce Gemmel - Centre for Ore Deposit and Exploration Studies, Univ. of Tasmania
 Dave Edwards - CSIRO Division of Oceanography
 Melissa Fellows - Dept. of Geology, Australian National Univ.
 Kaul Gena - Dept. of Geology, Univ. of Papua New Guinea
 * co-Chief Scientists

ISKUT RIVER, B.C. METALLOGENY

A.J. Macdonald, A.D. Entlinger
& J.F.H. Thompson
MDRU, Univ. of B.C.

Abstract from GSA, San Diego, Oct. 1991

The Iskut River area, on the northeastern side of the border between the Alaskan Panhandle and British Columbia is a relatively small (approx. 80x50 km) but economically significant portion of the coastal Cordillera. A Late Triassic (Carnian and Norian, 235-209 Ma) to Middle Jurassic (Bathonian, 161-166 Ma) volcano-sedimentary and coeval plutonic suite comprise a portion of the Stikinia suspect terrane, a proposed island-arc and back-arc complex. Principal lithologies range from submarine sediments, submarine mafic to felsic volcanic and volcanoclastic rocks, to subaerial intermediate to felsic volcanic rocks; these are intruded by: Toarcian to Pleinsbachian (185-195 Ma) Texas Creek suite of granodioritic to alkali feldspar granitic composition, and locally potassium feldspar megacrystic; and rare, small, olivine gabbros of unknown age.

These lithologies are host to a wide spectrum of mineral deposit types, in many cases displaying a marked spatial relationship with intrusive rocks and elsewhere exhibiting stratiform and stratabound associations with volcano-sedimentary assemblages:

- Steeply dipping pipe and lens-shaped bodies of magmatic sulphides (Ni-Cu-PGE-Au), hosted by gabbro stocks (e.g., the E&L deposit);
- Oxidized gold skarns (e.g., McLymont Creek);
- Large tonnage, low grade, porphyry-style CuAu, Mo, spatially associated with

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Walter Gibbins
Geology Division - DIAND, Yellowknife

The 1991 Yellowknife Geoscience Forum opened with an outside temperature 10 degrees Celsius higher than at the 1991 Grey Cup game. Later, while outside temperatures approached the freezing point of *Old Sam*, inside activities, including Yellowknife-style hostility suites, were as warm as *Sam McGee's crematorium*.

Several "key economic indicators" suggest that the recession in NWT mineral exploration is over; Forum attendance was up, as were the number of out-of-town registrants. Another factor, the number of reported diamonds, has risen from 12 to about 100, with an additional 81 from the Lac de Gras area. More recently the number of claim tags sold, stories of staking "rushes", and the stock value of certain exploration companies have all shot up to impressive levels. The largest and most attentive crowd at the technical sessions was drawn by the excellent presentations by Herb Helmstaedt and Bruce Kjarsgaard; these, of course, focused on modern techniques for diamond exploration.

During the Forum, Minnova Inc. announced that they had purchased

Falconbridge's interests in the Izok, Hood River and Gondor VMS deposits and plan an ambitious two-year drilling program. Athabasca Gold recently resumed work at its promising Nicholas Lake gold occurrence with the financial support of Royal Oak Resources, a major shareholder.

Continued success at BHP-Utah's gold discovery on the ULU claims in the High Lake volcanic belt, and Lucky Eagle's Meadowbank project were outlined at the Forum. Along with the George Lake and Meliadine River gold projects, these have been the backbone of 1990-91 NWT mineral exploration activities.

Further good news includes a new 5-year federal-territorial EDA/MDA Mineral Initiatives Program with a strong geoscience component, and a federal-territorial-industry agreement to fund a transportation survey by Canarctic Shipping to investigate the feasibility of a deep water port in Coronation Gulf. Considerable progress was made in 1991 towards the resolution of several land claims.

With so much good news, it was impossible to find any unhappy campers at the 1991 Forum. The up-beat tempo lasted from the welcoming messages of the Hon. Nellie Gournuceya, the newly elected Leader/Premier

of the GNWT, who has retained responsibility for Energy, Mines and Petroleum Resources, and recently re-elected alderman Mike Byrne of the City of Yellowknife, to the closing session which consisted of a NWT Mineral Showings Database Workshop. Along the way delegates from all sectors of the resource industry participated in technical sessions on exploration and mapping research. In addition a Great Slave Lake Lithoprobe Transect workshop discussed a proposed seismic profile across several unique features in the Southern Slave Province.

Well attended social events included anthropologist Tom Andrews' presentation about the Camsell River Trail at the Charles Camsell Geological Societies' beer night, while the NWT Chamber of Mines annual banquet featured lofty local entertainment, including President Mike Magrum and Managing Director Tom Hoefler.

Copies of the forum abstracts and the 1991 NWT Mineral Exploration Overview are available from the NWT Geology Division - DIAND, Box 1500, Yellowknife, NWT, X1A 2R3. Tel(403) 920-8215.

See you next year - it should be an even better event!

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feldspar megacrystic intrusions (e.g., Red Bluff, Kerr);

- Mesothermal gold veins, also spatially associated with the Texas Creek intrusive suite (e.g., Snip)
- Possible epithermal (quartz, sericite, alunite, native sulphur) mineralization (e.g., Treaty Creek)
- Stockwork/veinlet base metal, gold, Sb, Hg, As deposits (e.g., Eskay Creek 21A, SIB)
- Proposed volcanogenic, base metal massive sulphides (e.g., Black Dog), locally precious metal-rich (e.g., Eskay Creek 21B)

The over-abundance of mineralization in the Iskut River area is a consequence of intrusion of a specialized intermediate to felsic suite and favourable host rocks.

Duncan R. Derry Medal

The Duncan R. Derry Medal is the highest award bestowed by the Mineral Deposits Division (MDD) of the Geological Association of Canada. It is awarded annually to an outstanding economic geologist who has made major contributions to the science of economic geology in Canada. Candidates should be recognized for their skill and stature as professional economic geologists, and also by their public contributions to the science. It is acknowledged that publication is the prime, but not the only method, of disseminating scientific information in any discipline. Candidates should be members of the GAC and preferably, but not necessarily, members of the MDD.

tuMuireraents for Award Nominations

Nominations of individuals for the award are invited from membership of the association. Individual nominations are valid for a period of three years.

Each nomination should be accompanied by nomination papers signed by the appropriate number of sponsors, as indicated. The nomination should include a 200-word citation. Also, the nomination should be supported by a curriculum vitae and bibliography, which describe the candidate's accomplishments in his/her field of geology. Additional documentation and letters of endorsement are encouraged.

Nominations for the Duncan R. Derry Medal are to be made by 3 members of the MDD, jointly or by independent submission. Nominations should be submitted in triplicate to the chairperson of the Selection Committee before 31 January, 1992;

Dr. James Macdonald
Mineral Deposit Research Unit
Department of Geological Sciences
The University of British Columbia
633b Stores Road, Vancouver
B.C. V6T 1Z4
Tel: (604) 822-4563

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