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MINNOVA INC.

DATE: June 1, 1990

TO: Ian Pirie.

COPIES TO: Alex Davidson, Property File.

FROM: John Bradford.

SUBJECT: **REPORT ON THE SAMATOSUM REGIONAL MAPPING.**

Mapping of the Samatosum Joint Venture property at 1:2500 scale began on April 19 and is complete except for a small area on the north slope of Samatosum Mountain. Mapping has been extended beyond the property from Adams Lake to New Volcano, using an air photo base and compilation at 1:15,000. This was done in an effort to resolve larger scale structural and stratigraphic problems which affect the interpretation of the Sam - Rea Gold sequence. A central problem for interpretation of this succession is the apparent absence of major stratigraphic or structural breaks between Devonian rocks hosting syngenetic mineralization at Rea and the Tshinikin marble, of supposed Cambrian age. A summary of results of the mapping program follow.

1. <u>The Rea volcanic - sedimentary succession is in probable thrust contact with the Homestake sequence.</u> A sequence of quartz and feldspar - phyric (dacitic?) flows, tuffs and intrusives structurally underlies the "Rea sediments" (basinal turbidites). The contact is well constrained in outcrop and is a sharp break with no stratigraphic continuity. The felsic package has no correlatives in the overlying succession and is assumed to form part of the Homestake metavolcanic arc, of Devonian age (EBA-EBF of Schiarrizza and Preto, 1987). The contact with overlying basinal turbidites of the Rea succession (EBP correlatives of Devono-Mississippian age) could represent a thrust - telescoped marginal basin - outboard arc transition.

2. <u>Rea is a VMS within an overturned succession at a stratigraphic</u>

volcanic - sedimentary transition. Present mapping supports earlier facing interpretations at Rea, based on bedding - cleavage relations and primary sedimentary structures in the Rea turbidites, and on typical VMS stratigraphy in the deposit area. Although the "Rea horizon" - turbidite contact is sharp and continuous as seen in outcrop and commonly faulted in core, it is not interpreted as a profound structural break. It probably represents a stratigraphic transition due to an influx of turbiditic sediments into a basinal environment. The presence of heterolithic sulphide-rich breccias in the Rea horizon (core), and rapid lateral facies changes (in, e.g., siliceous exhalite thickness) suggests an active fault model for the Rea succession. Sericite-pyrite schists apparently interfinger with stratigraphically overlying silica-sulphide exhalite and are texturally similar to chlorite-carbonate altered feldspathic crystal - lithic tuffs farther away from the mineralized horizon. This is compatible with a stratigraphic transition from volcanism to exhalative activity for Rea.

3. The Rea succession includes mafic volcanics which are correlatable with those structurally overlying the Samatosum deposit. Feldspathic, carbonate - altered crystal-lithic tuffs stratigraphically underlying the Rea footwall alteration zone are typical of unit EBF (Devono-Mississippian) regionally (P. Schiarrizza, personal communication). The only outcrop of the Rea mafic package outside the Rea concession on the Sam property (at DDH 62) contains typical feldspathic EBF with overlying fragmental EBG metabasalts. This corroborates recent core mapping, which suggests that EBF-like and typical EBG rocks are found in the Rea mafic package, with EBG porphyritic and amygdaloidal flows overlying volcaniclastic rocks with intercalated sediments (K. Glover). Structural interleaving of EBG and EBF metavolcanics within the Rea package is possible, but is unsubstantiated by detailed core mapping. Down-dip intersection of a thick package of EBG calcareous metabasalts (DDH 254), would have to be accommodated by a thrust ramp between 254 and the lowest projection of the Rea horizon.

Samples from the Sam hangingwall and sub-Tshinikin mafics are being analyzed for major oxides and trace immobiles, for comparison with published data on the Rea mafics (Trygve Hoy, BCMEMPR).

4. Turbidites in the footwall of the Sam mafics are structurally overturned in part; the sub-Tshinikin mafics are upright. Bedding - cleavage relations were observed in only one exposure of distal turbidites (variously described as the "argillaceous remnant", "argillite wedge", etc.) within the sedimentary package hosting Sam. These indicate an overturned succession. Drilling has shown that this overturned succession is on the upper limb of a tight syncline. Unaltered sediments within this structure are stratigraphically analogous to the Rea turbidites with respect to the depositional mineralized horizon (upper and lower Sam horizons); correlation of both Rea and Sam turbidites and mineralized horizons is permissive with present data.

Recent drilling through a stratigraphic "Sam mafic" - sediment contact also strongly suggests that it is overturned; in all surface exposures shearing along the Sam hangingwall has obliterated this evidence. Tops in pillow basalts in the Sam mafics are unclear because of the high degree of flattening. Higher in the EBG package (by the tailings pond) relatively unflattened pillows in epidotized metabasalts indicate an upright sucoession. It is possible that the entire Sam hangingwall mafic package is upright, and in thrust contact with an overturned fold limb of a thinner mafic metavolcanic unit within the "Sam sediment" package (stratigaphically underlying the argillite wedge). This thrust could locally cut upsection through the overturned limb, putting EBG mafics on upright Sam sediments.

5. A distinct sedimentary unit structurally overlying the Sam mafics represents the only recognizable stratigraphic break between the Sam hangingwall and the Tshinikin limestone. This unit has been traced from the north slopes of Samatosum Mountain to the

north end of the Victory grid, with a correlative, structurally thickened unit occurring above Adams Lake. It is characterized by a basal ribbon chert - argillite sequence, and includes grey and green phyllite, laminated grey to black marble, laminated argillite and fine tuff (?), and minor chert pebble conglomerate, sandstone and siltstone. Intense flattening of conglomerate pebbles and a locally well developed second phase cleavage suggest that this unit represents a structurally deeper level than the Sam and Rea sediments.

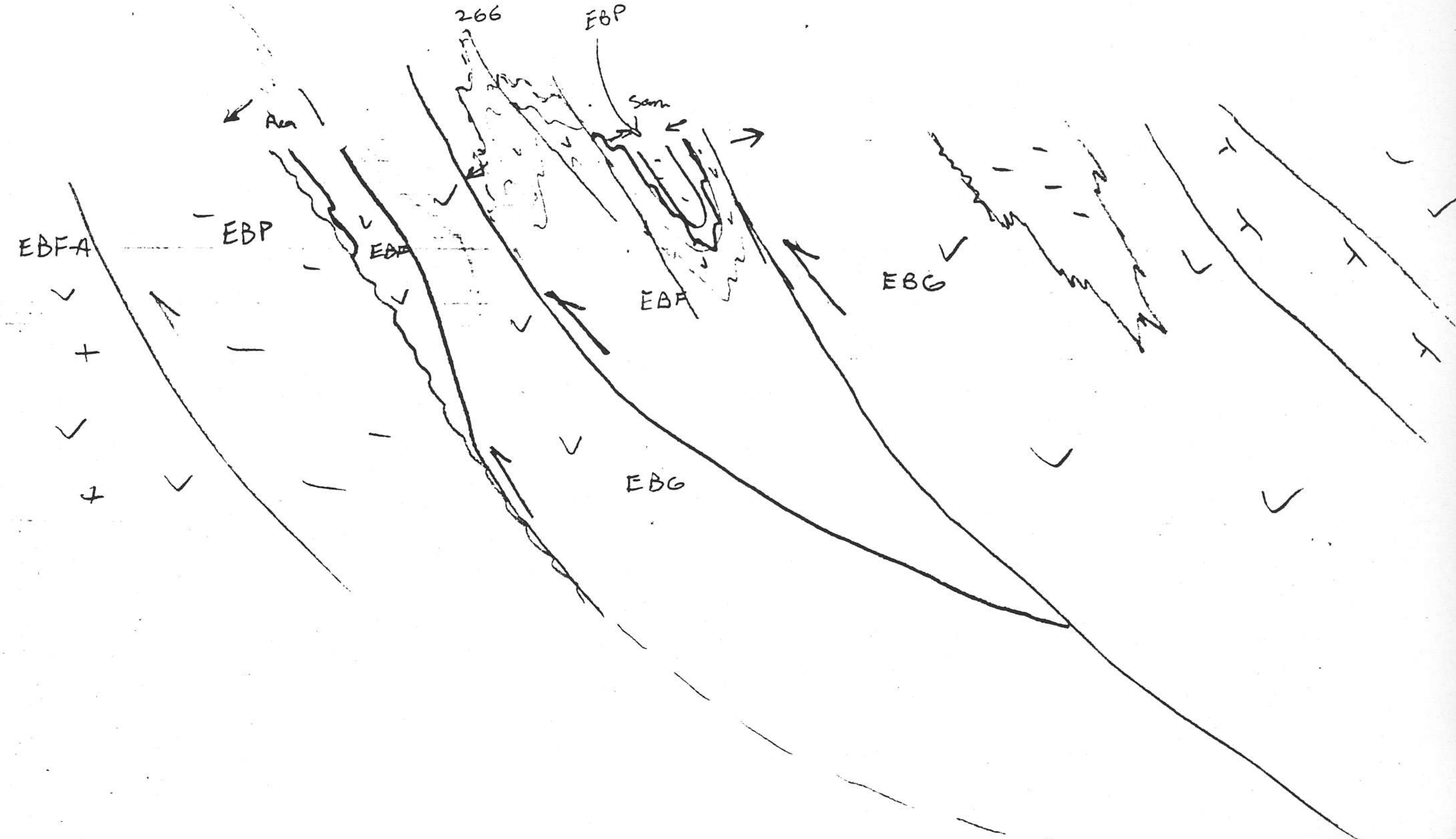
Mapping around Twin Mountain and the saddle toward Samatosum Mountain indicates that the sediments pinch out toward Twin Mountain, thickening to the north toward the tailings pond and to the southeast toward Adams Lake. This suggests that Twin Mountain is a volcanic centre (seamount?), with volcanics thinning basinward to the north and south. This is corroborated by an increased sedimentary component in the Sam hangingwall mafics on the Victory property.

The core of the sedimentary unit near Adams Lake is a hinge zone, possibly correlative with the Nikwikwaian Syncline on the east side of the lake (Schiarriza and Preto, 1987). The basal contact with Sam mafics appears to be faulted, with intense quartz veining and silicification in an exposure on the Adams Lake road, and intense brecciation of the chert in an exposure on the north slope of Samatosum Mountain. The possibility that this represents a major structural break between the Sam - Rea sequence and the Tshinikin limestone is mitigated by the occurrence of very Sam-like mafic volcanics both in the immediate footwall of the Tshinikin near Johnson Lake and in its hangingwall. Continuity of mafic lithologies, volcanic-sedimentary facies changes along strike, and occurrence of white marble beds from the Sam hangingwall to the northeast side of the Tshinikin makes this package hang together stratigraphically. This says that the major Cambrian - Devonian thrust is in fact the immediate Sam hangingwall.

6. Alteration, shearing and veining in the Sam mafics near the pit is partly related to an extension of the Twin Mountain shear zone. Limited mapping in the Twin Mountain area shows a zone up to 0.5 kilometres wide of anastomosing shears, with accompanying sericite - pyrite or quartz - carbonate alteration. Both pre-Jurassic and late quartz - carbonate (-barite) veins can be seen; the former contain galena, sphalerite and chalcopyrite. A very similar, narrower zone of S_1 - parallel shears, veining and alteration occurs in the Sam mafics below the pit, with a zone of chlorite - carbonate altered lapilli tuff between this zone and the Sam sediments. Sulfide mineralogy in the quartz - carbonate veins is similar to Twin Mountain. This zone can be traced along the northeast side of the pit to the southeast, and was apparently intersected just below the collar of DDH 254 (D. Heberlein, personal communication). Lead isotopes of Twin Mountain galena indicate a post - Devonian, pre - Jurassic age. Galena from the Sam mafic - hosted veins near the pit should be analyzed to test this relationship. Apparently similar, tetrahedrite - poor veins crosscut main stage veins in the Sam pit (B. Friesen, personal communication).

7. Three phases of deformation produce plunge reversals of primary structures. Observations in Rea and Sam turbidites indicate that phase 1 and 2 structures are sub-coaxial but have opposite plunges. Phase 1 is represented by the regional penetrative fabric and by tight to isoclinal folds of all scales. Phase 2 is defined by a crenulation cleavage, usually seen as a lineation on S_1. It could represent the late evolution of phase 1, coeval with thrusting. Unequivocal second phase folds have not been seen. First phase structures plunge to the northwest in the Rea turbidites, to the southeast in the Rea horizon itself (J. Oliver), to the southeast just outside the Sam pit in the argillite wedge, and to the northwest just downhill. Stratabound isoclinally folded veins locally have opposite plunges to phase 1 cleavage/bedding intersections, reflecting their crosscutting nature. Phase 3 is represented by east trending chevron and kink folds of S_1, locally

with a well-developed axial planar cleavage. Large scale phase 3 folds have not been observed, but may be in part responsible for plunge reversals of phase 1 and 2 structures. Rotation along east to northeast trending high angle faults could also be a factor.



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Sam
Aca
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