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December 10, 1985

Mr. Jerry Bidwell
Hudson Bay Exploration and Development Company Ltd.
Whitehorse, Yukon Y1A 3V1
CANADA

Dear Jerry,

Enclosed are copies of all the figures from the Geoscience Forum poster exhibit. My apologies for not getting them to you earlier, but the figures were not done until the night before. I still have some more analyses to do and will present a revised version at the Cordillerian Roundup in Vancouver at the end of January.

The final analyses will be done by Spring and will be summarized in a more readable form for a paper in the Y.E.G. volume. I will send you a copy of the manuscript as soon as it is done.

Sincerely,

Larry Meinert

Dr. Larry D. Meinert
Assistant Professor

Enclosure

LDM/dal

Introduction

Skarns in the Whitehorse Cu Belt produced about 135 thousand tons of copper, 3 million oz. of silver, and 1/4 million oz. of Au from 11 million tons of ore between 1967 and 1982. By the end of mining activities in 1982, gold and silver contributed a significant proportion of the ore value, thus sparking a renewed interest in their occurrence. A calculated gold grade of 0.022 oz./ton for the deposit assuming 100% recovery is probably too low but neither exploration nor production drill holes were routinely assayed for gold. Hurreau (1982) estimated that the 10 million tons of tailings from the Whitehorse deposits contain 50,000 oz. of gold and Tenney (1981) reported that tailings assays ranged up to 8 oz./ton in some places. It appears likely that not all the gold was recovered from Whitehorse skarn ore, that the calculated average grade for the deposit is too low, and that further gold-silver potential in the district may exist.

There is a strong correlation between gold/silver grades and skarn mineralogy, particularly the presence and intensity of retrograde alteration. Silver is correlated with bornite/chalcocite and epidote whereas gold is better correlated with chalcopyrite and actinolite alteration.

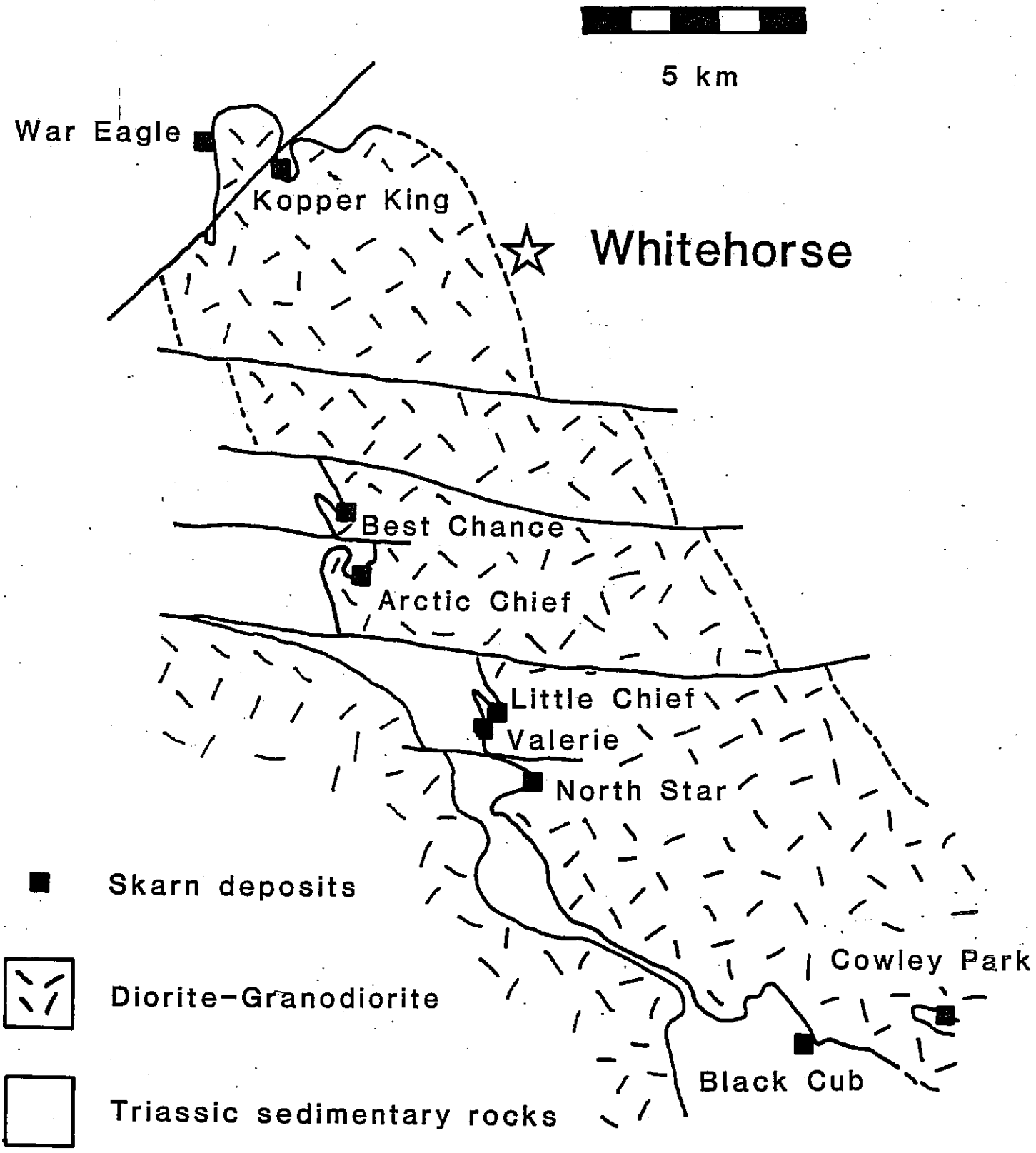
recovered grade 1.23% Cu
0.02 oz/ton Au
0.27 oz/ton Ag

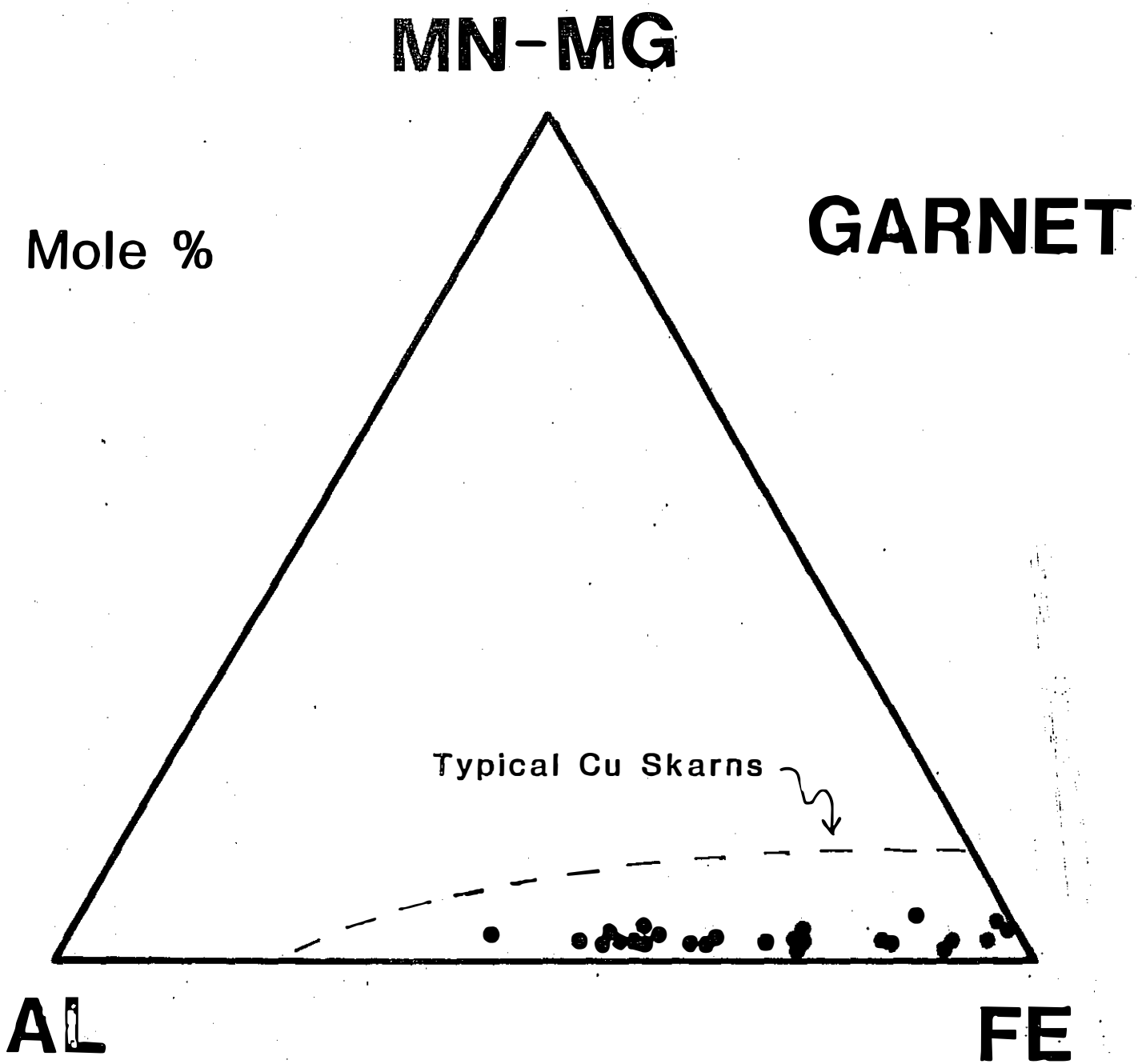
tailings grade
0.005

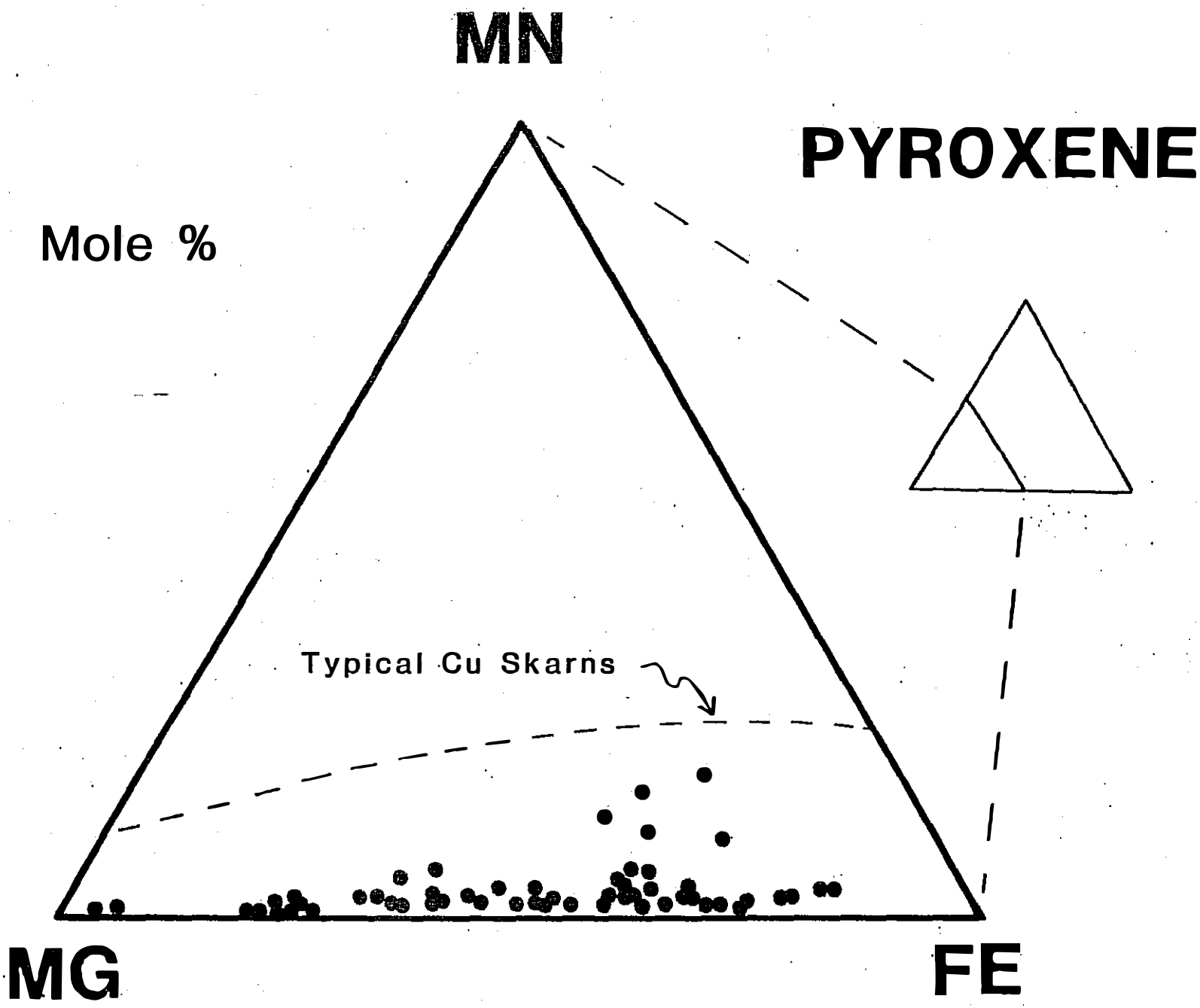
98 samples tailings in 1984

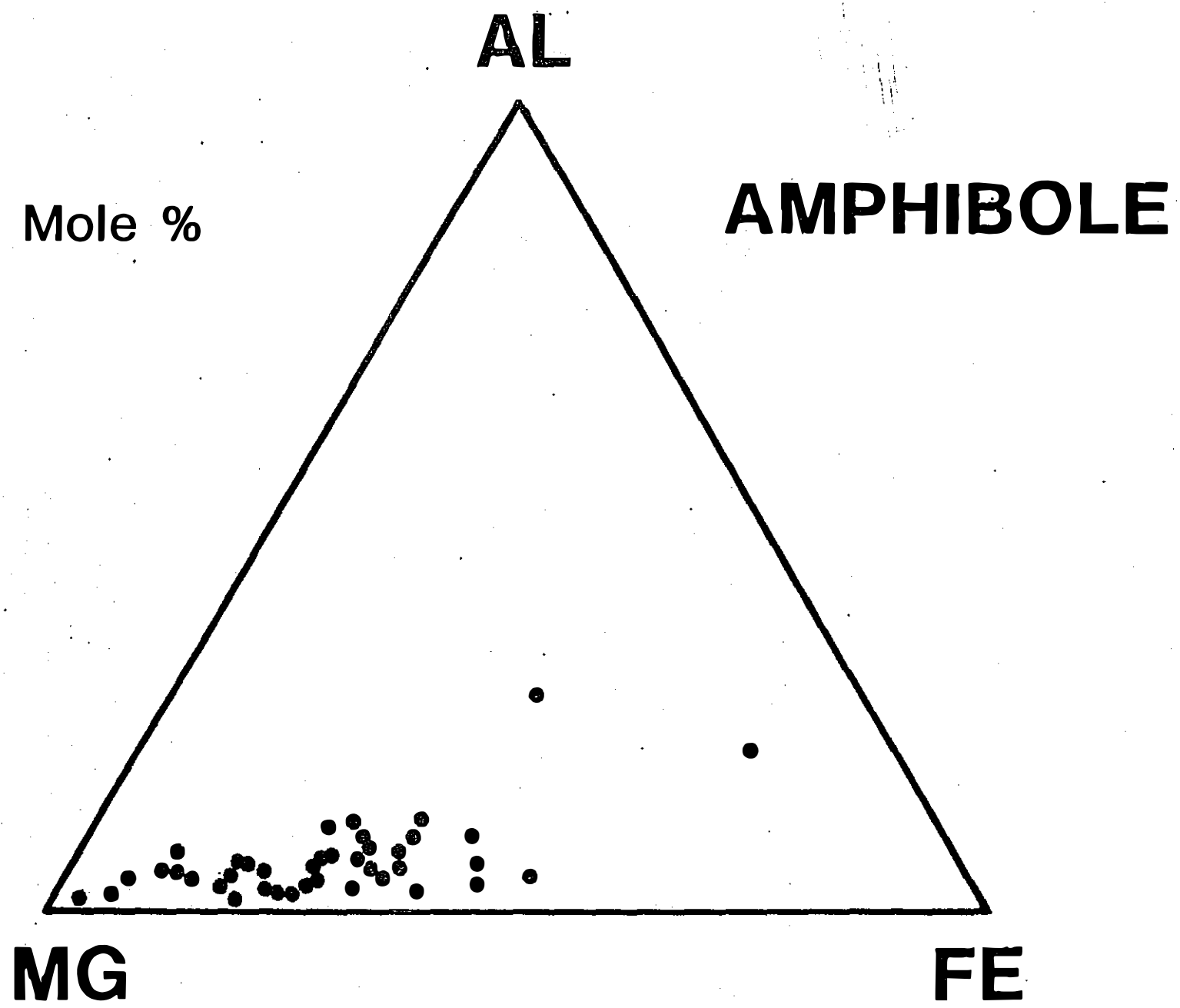
Assuming 0.005 as ore grade, probably would be close to 0.00337 ∴ 10 million tons would produce 33,700 oz.

See assay from drilling/geometric tailing report.

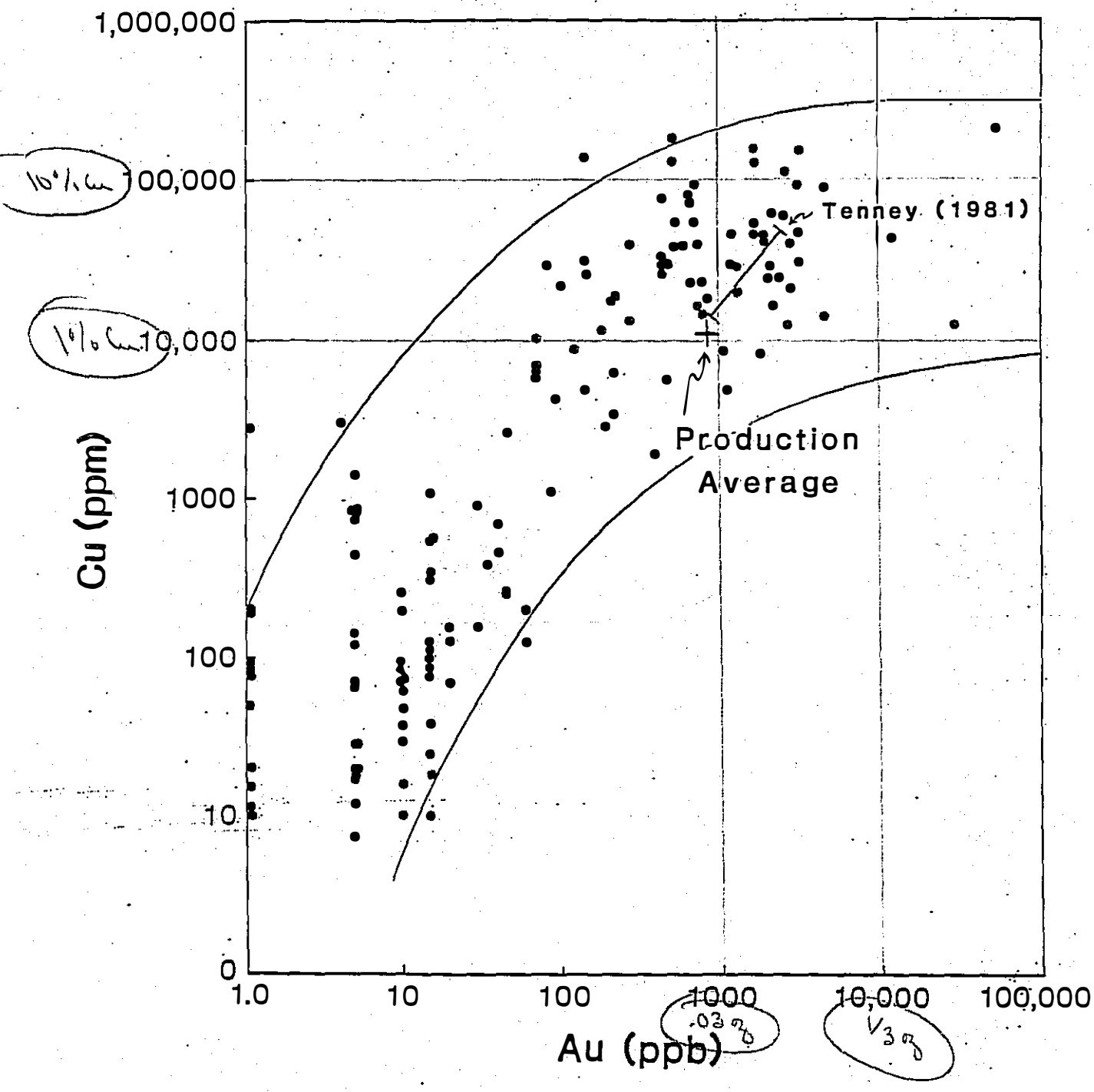

5 km
War Eagle
Kopper King
Whitehorse
Best Chance
Arctic Chief
Little Chief
Valerie
North Star
Cowley Park
Black Cub
Skarn deposits
Diorite–Granodiorite
Triassic sedimentary rocks


MN-MG
GARNET
Mole %
Typical Cu Skarns
AL
FE


MN
PYROXENE
Mole %
Typical Cu Skarns
MG
FE

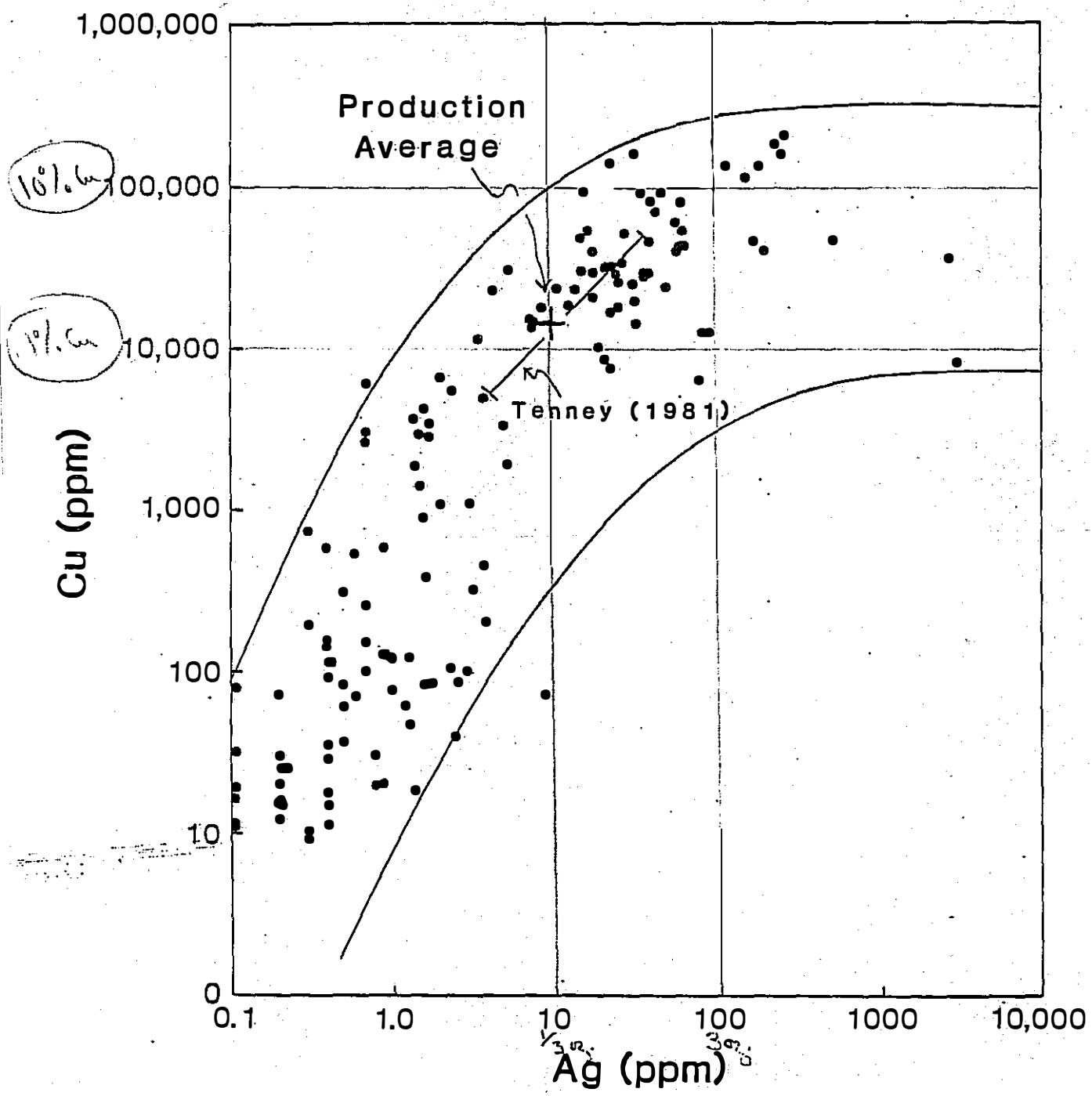

AL
Mole %
AMPHIBOLE
MG
FE

Spot Drill Core Assays



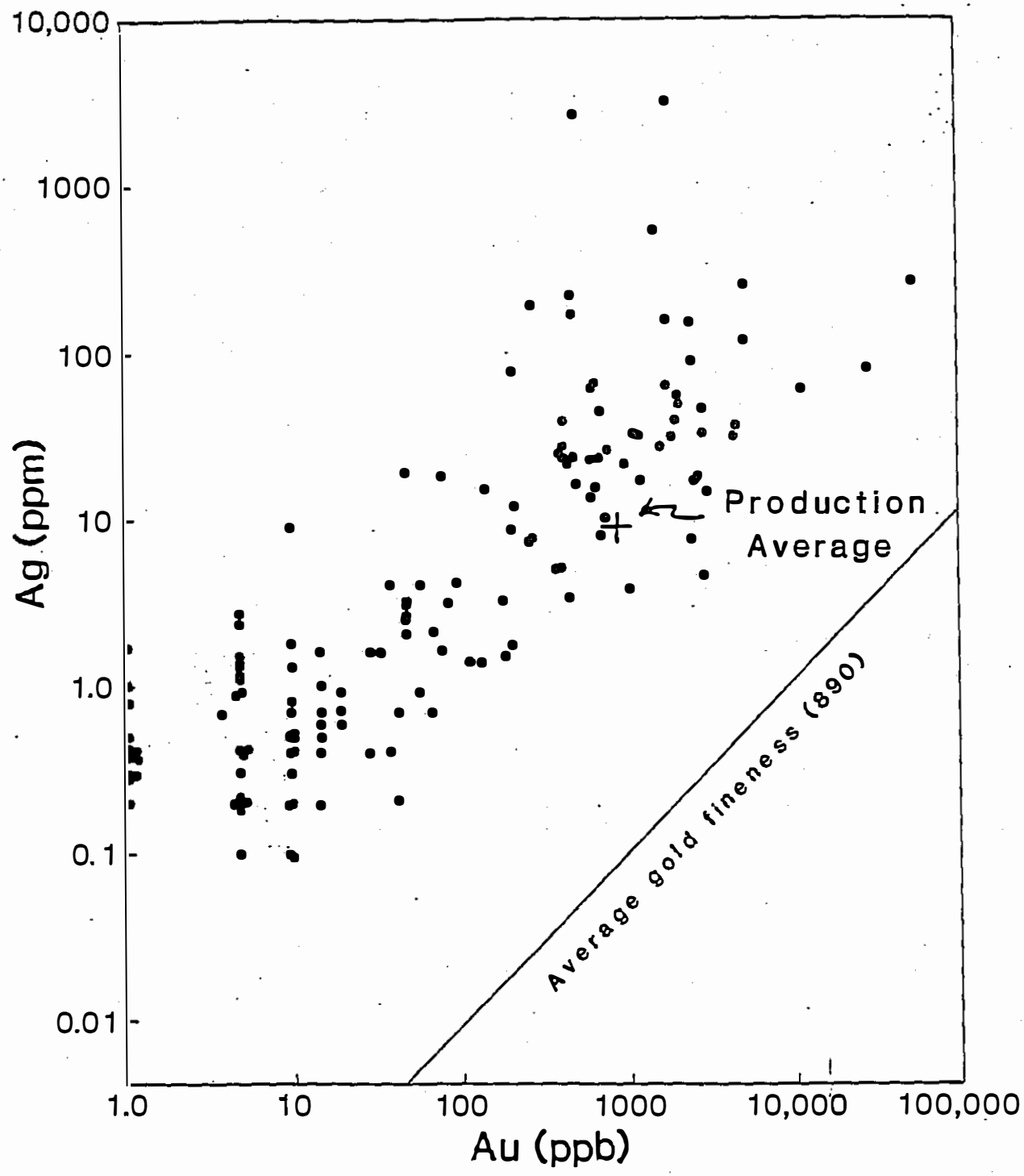
V. string Cu - Au correlation

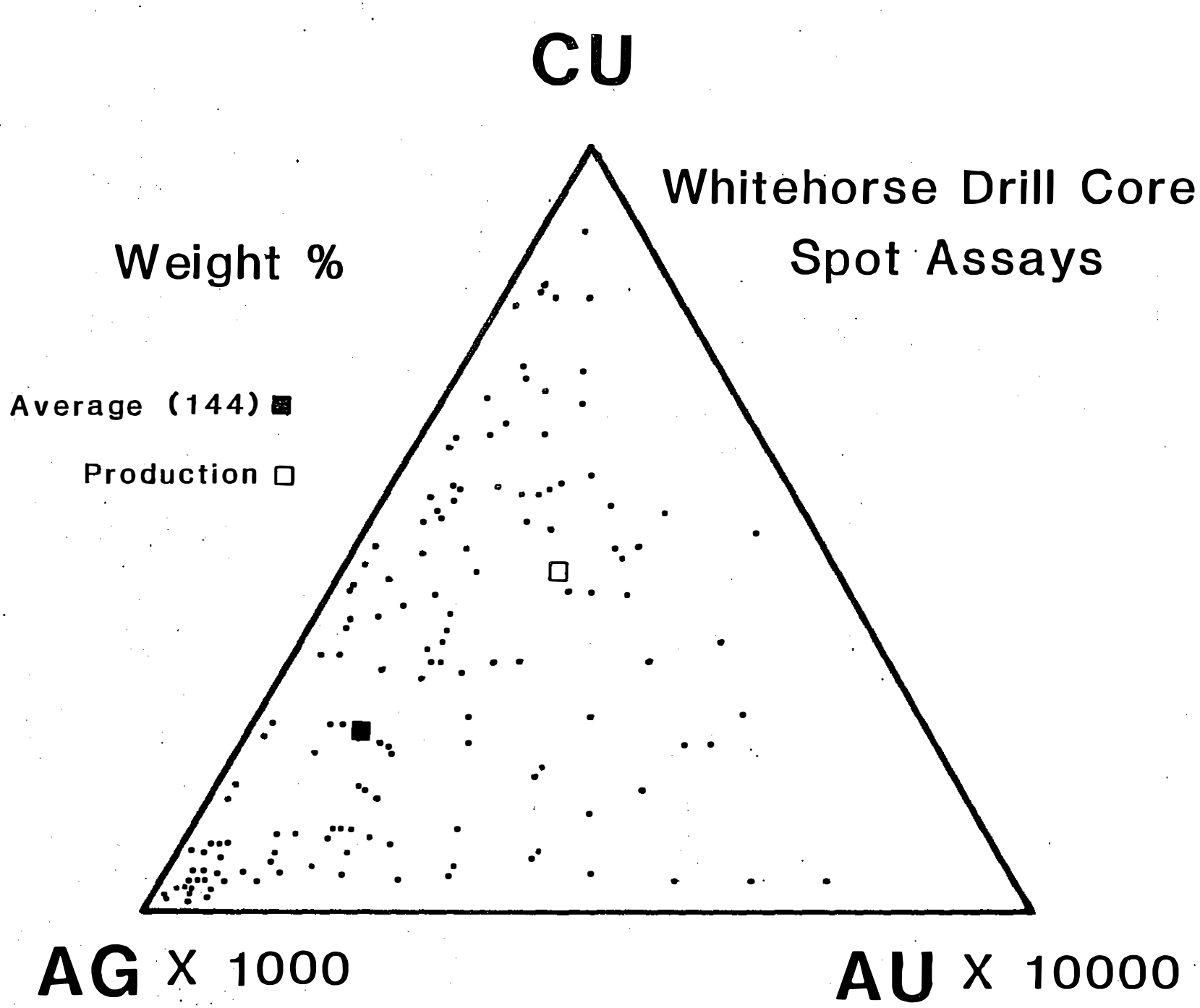
Spot Drill Core Assays



strong Cu – Ag correlation

Spot Drill Core Assays



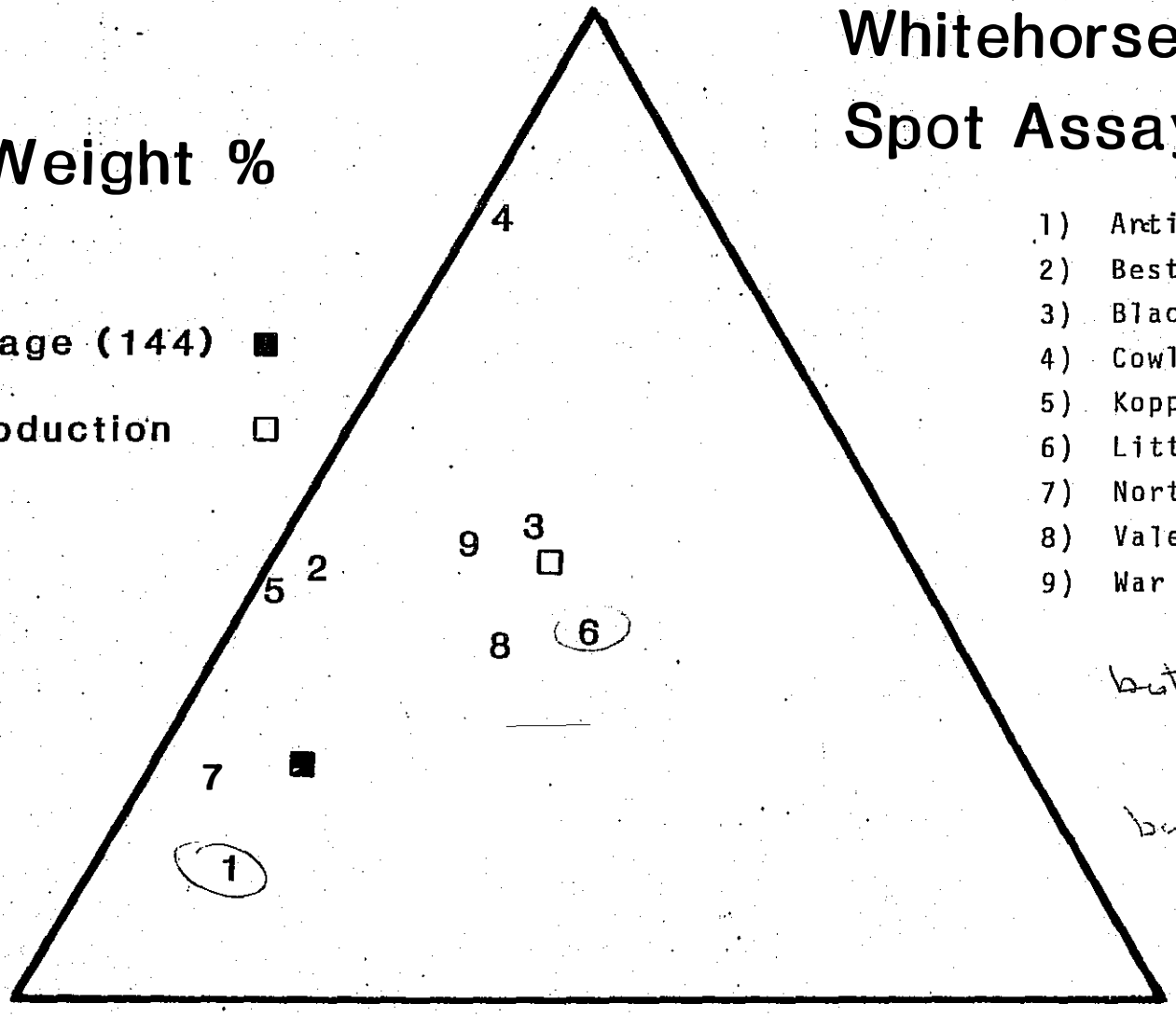

CU
Whitehorse Drill Core
Spot Assays
Weight %
Average (144)
Production
AG X 1000
AU X 10000

CU

Weight %

Average (144) ■

Production □



Whitehorse Drill Core
Spot Assay Averages

1) Arctic Chief (57)
2) Best Chance (8)
3) Black Cub (2)
4) Cowley Park (5)
5) Kopper King (2)
6) Little Chief (34)
7) North Star (29)
8) Valerie (3)
9) War Eagle (4)

but ... Little Chief

but ... Arctic Chief
North Star

AG X 1000

AU X 10000

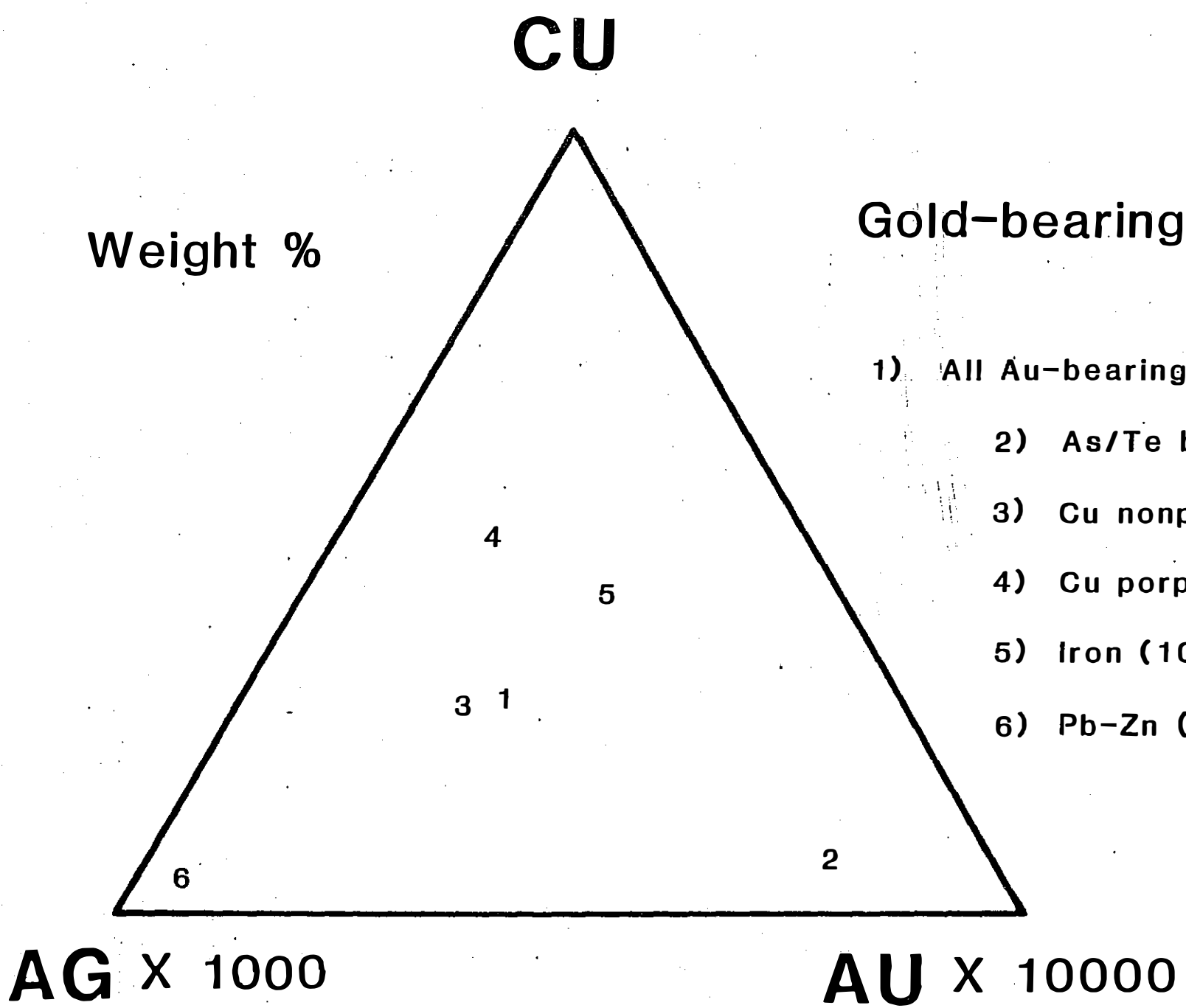
Production/Reserves of Au, Ag, and Cu from Gold-bearing Skarn Deposits

Skarn Type		Oz Gold	Oz Silver	Tons Copper	Gold/Cu
As/Te bearing skarns	(1)	16,900,000	16,100,000	61,000	277
Fe skarns	(2)	810,000	3,700,000	32,000	25
Cu skarns (non-porphyry)	(4)	1,500,000	23,400,000	588,000	2.5
Cu skarns (porphyry)	(5)	29,600,000	492,000,000	27,000,000	1.1
Pb-Zn skarns	(3)	1,600,000	160,000,000	110,000	14
	Total:	50,410,000	695,200,000	27,791,000	

Average Au, Ag, and Cu Grades for Gold-bearing Skarn Deposits

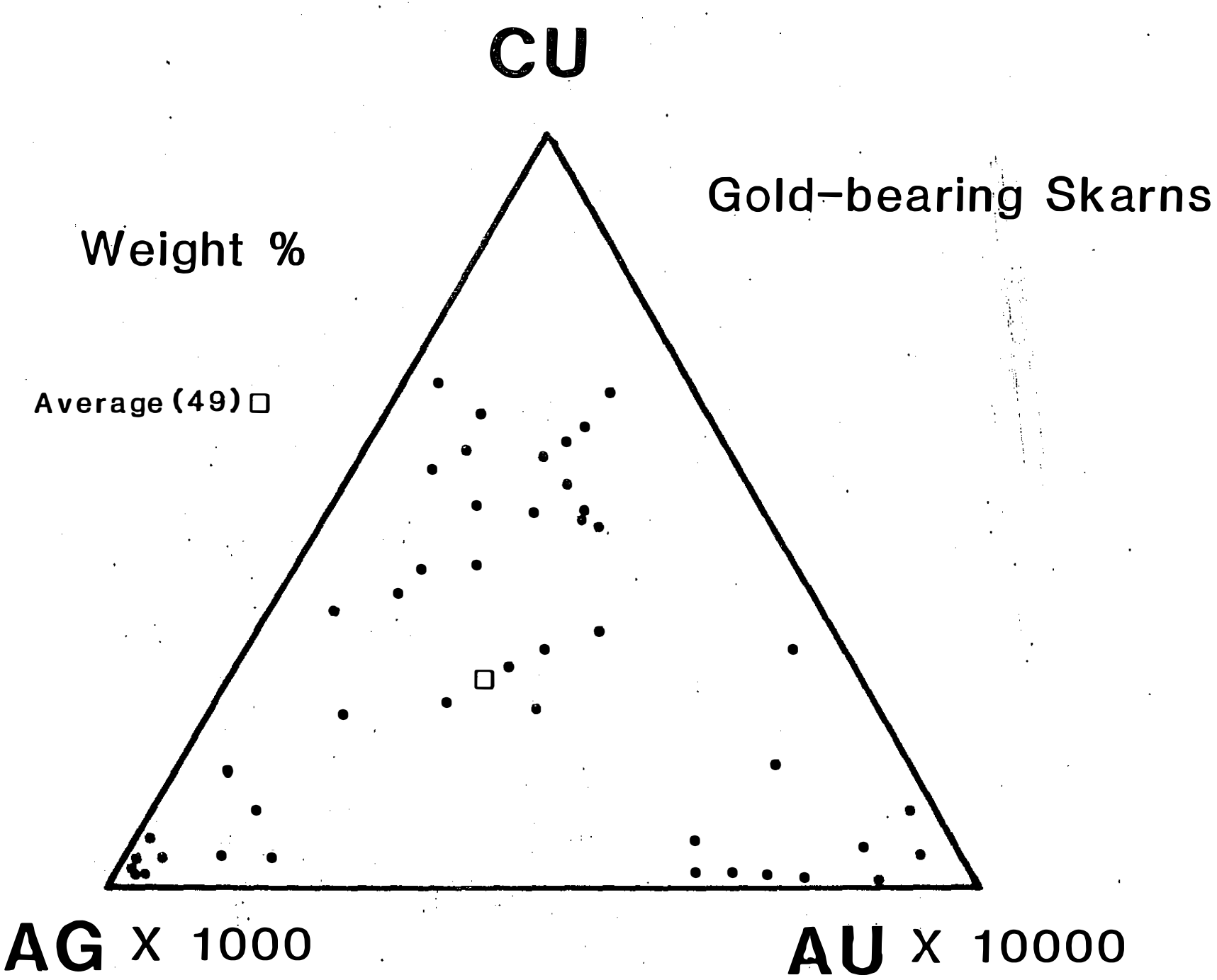
Skarn Type		Gold (oz.t) # - Avg. Range	Silver (oz./t) # - Avg. Range	Copper (%) # - Avg. Range
As/Te bearing skarns	(1)	9 - 0.378 (.09-1.18)	7 - 1.13 (.06-5.5)	7 - 0.63 (.05-3.00)
Fe skarns	(3)	10 - 0.041 (.002-.15)	10 - 0.33 (.06-1.5)	10 - 1.66 (.12-3.99)
Cu skarns (non-porphyry)	(2)	15 - 0.070 (.009-.24)	15 - 2.90 (.03-20)	17 - 2.60 (.33-8.00)
Cu skarns (porphyry)	(5)	12 - 0.017 (.0007-.07)	12 - 0.30 (.03-.70)	14 - 1.17 (.48-2.40)
Pb-Zn skarns	(4)	9 - 0.021 (.002-.05)	8 - 6.18 (.7-12.9)	8 - 0.52 (0.3-0.83)
	Total:	61 - 0.133 (.0007-1.3)	55 - 1.98 (.03-20)	57 - 1.55 (.05-8.00)

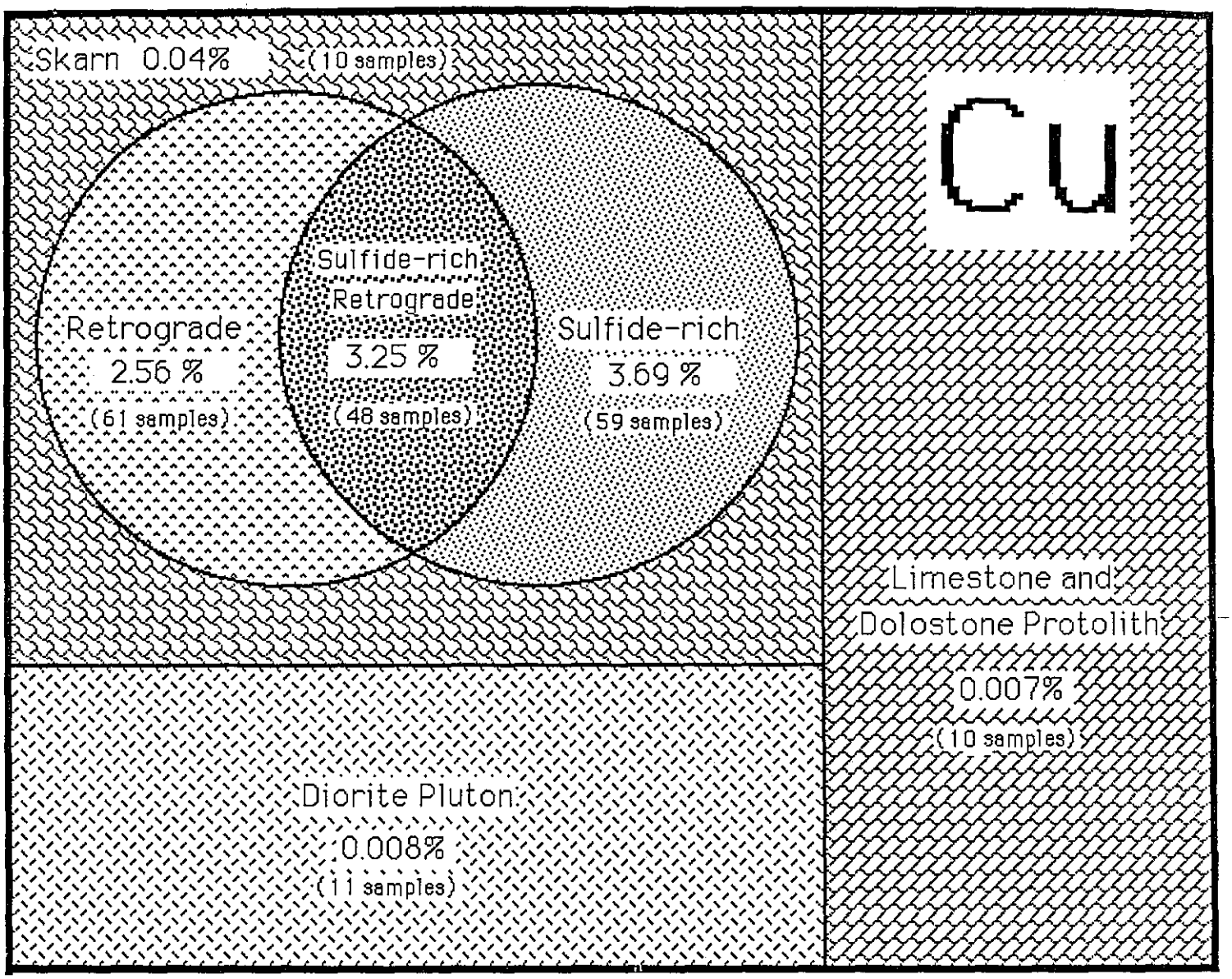
WCM, 0.022 0.27 1.23



Gold-bearing Skarns

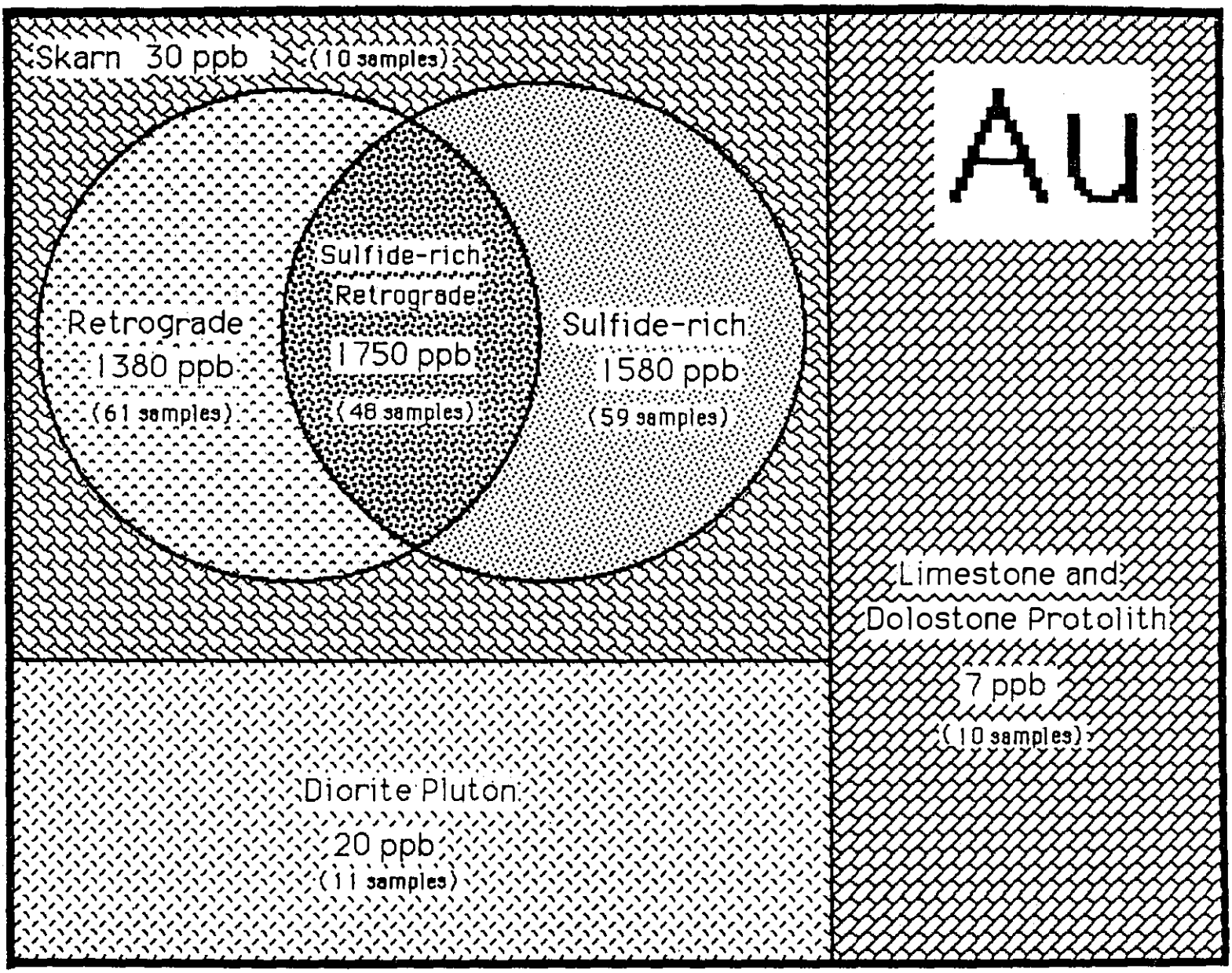
1) All Au-bearing Skarns (49)
2) As/Te bearing (7)
3) Cu nonporphyry (14)
4) Cu porphyry (10)
5) Iron (10)
6) Pb-Zn (8)


CU
Gold-bearing Skarns
Weight %
Average (49)
AG X 1000
AU X 10000



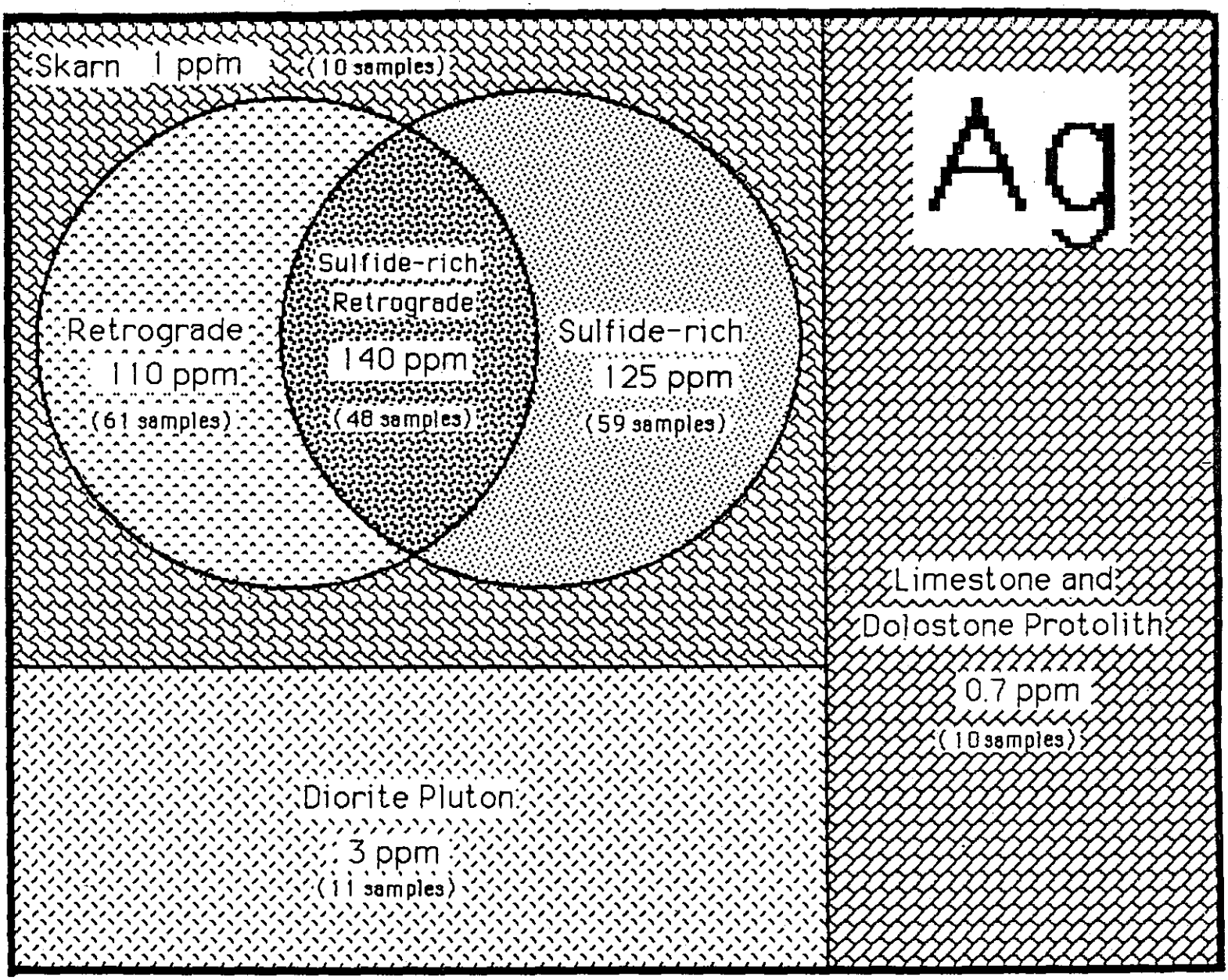
Cu Distribution in the Whitehorse Skarn

L. D. Meinert 1986



Au Distribution in the Whitehorse Skarn

L. D. Meinert 1986



Ag Distribution in the Whitehorse Skarn

L. D. Meinert 1986

The Occurrence of Gold in Skarns - An Example from the Whitehorse District, Yukon, CANADA

by

Lawrence D. Meinert, Geology Department, Washington State University, Pullman, Washington 99164 U.S.A.

Skarns in the Whitehorse District, Yukon, Canada, produced 134,000 tons of copper, 97,000 kg of silver and 7700 kg of gold from about 11 million tons of skarn ore. By the end of mining activities in 1982, gold and silver contributed a significant proportion of the ore value. Gold occurs as native gold grains up to one mm in diameter and as sub-microscopic inclusions (or in solid solution) in bornite, chalcocite, and chalcopyrite. Silver occurs mainly in bornite and chalcocite; no separate silver minerals have been identified.

Skarn in the Whitehorse district occurs in Triassic dolostone and limestone at the contact with a Mesozoic diorite pluton. Skarn mineralogy consists of garnet (Ad40-100), pyroxene (Hd3-85), aluminous actinolitic amphibole, epidote, and chlorite. In magnesian skarn, olivine, phlogopite, and serpentine are also abundant. In general skarn can be divided into early prograde relatively anhydrous minerals and later retrograde hydrous minerals. Copper and silver mineralization are associated with both stages of skarn development but the highest grades occur in zones of strong retrograde alteration and sulfide introduction. Gold is largely restricted to zones of retrograde alteration and sulfide introduction.

144 samples were assayed for Cu, Ag, and Au to determine the distribution and transport of these elements within the skarn system. In general there is a strong correlation between Cu, Ag, and Au values. Average Au contents are: unaltered carbonate protolith 7 ppb, diorite pluton 20 ppb, background skarn with no visible sulfides or retrograde alteration 30 ppb, skarn with visible retrograde alteration 1380 ppb, and sulfide-rich skarn with visible retrograde alteration 1750 ppb. Based upon these data, it appears the the host rocks are not a significant source for gold. The diorite pluton and skarn are both somewhat enriched in gold but neither is highly anomalous. The majority of gold appears to be introduced into the skarn system during retrograde alteration concurrent with the main stage of sulfide mineralization.

Comparision of the Whitehorse data with other gold-bearing skarn deposits indicates that Whitehorse is fairly typical of copper skarns associated with non-porphyritic plutons. Porphyry copper-related skarns typically have lower average gold grades, but due to their large size may contain more gold overall. Calcic iron skarns are typically very large and can contain zones with high gold grades. The skarn class with the highest average gold grade includes skarns which contain As and/or Te-bearing minerals. These As/Te-bearing skarns can be mined for their gold content alone and are a prime target for exploration.