

46 Study Tetsuro.

March 1981

- A preliminary study, obviously he did not have the proper data together.
- ~~But~~ Total ~~is~~ disregarded for stratigraphic relationships which cannot be condoned.
- Mg rock / Mg chl relationship may be in part due to metamorphism as there is a consistency of Mg/Fe values within one sample, but initial values in rock are possibly due to hydrothermal alteration or original bulk composition.
- in general the study isn't worth much at all, but since ~~this is~~ these are preliminary results from a much larger study ~~lets see w~~ lets wait until all the results are in before we pass judgement on it.

PROGRESS REPORT ON
DY DEPOSIT, FARO, YUKON TERRITORY

No. 2. Lowest 4L horizon in the
Mt. Mye Formation

March, 1981

T. Urabe and S.D. Scott
Department of Geology
University of Toronto

In general I get the overwhelming feeling Scott & Urabe only wanted to see the trends they see in chel. comp. REE patterns & ϵ_1 or ϵ_2 isotopes. They've made up their minds to do isotopic work regardless of what the shale hosted deposit picture is. *agreed Bill*

- ① Originally intended to study 4L in horiz. 5. - presumably the least overprinted by successive hydrothermal events ϵ_1 & ϵ_2 samples (why #1? Obviously from X seat. 18+00)
- ② Chel. 's are taken from 4L & 3G (or at least questionable 4L) i.e. comparing apples to oranges. - incredible! No info. (modes, parageneses etc. etc.) for 4L as planned.
- ③ Problem of bulk comp. of ark. controlling comp. of chel. Part. to MgO in whole rock - particularly compare ~~the~~ in chel. trends are idyllic. ϵ_2 highly questionable that a "beautiful" relation to hydrothermal systems has been delineated.

Hydrothermally altered rock units (4 L units in mine terminology) are recognized within the Mt. Mye Formation below the DY deposit and are designated as "Horizon 1". It is not yet confirmed whether or not the altered units are strata-bound; however, relative continuity and conformity of Horizon 1 is observed along survey line L18 + 00E. In order to investigate the lateral variation within this horizon, eight representative samples were taken from eight drill holes along and nearby L18 + 00E (Fig. LL-1). Ore intersections within the topmost part of the Mt. Mye Formation have been reported from 6 drill holes, namely, high grade ones from 77X11, 80X09, 78X02, and 77X06 and low grade intersections from 80X07 and 79X07, respectively. No ore has been intersected within Horizon 1.

*you said it
BY*

The ratio Cu/Pb+Zn in the ore and the lateral distribution of altered rocks suggests that the center of mineralization was near the south end of the examined section, that is, near DDH 80X07 (DY 262) (Hall et al., 1979). Therefore, the sequence of samples from DY 262 to DY 264 may represent lateral zoning from core to margin of the hydrothermally altered horizon.

or that there was a restriction in supply of reduced S there causing pptn of only minerals with highest "affinity" for:

Mineral assemblages of the examined samples are all more or less similar (Table LL-1): the sulfides pyrrhotite,

chalcopyrite and sphalerite are within rutile-albite-chlorite-muscovite-quartz schist which also contains minor biotite after chlorite, carbonates, and manganese-rich ilmenite. It is noteworthy that ilmenite, rutile, and albite occur exclusively in muscovite-rich zones and all sulfides tend to occur in quartz-rich sublayers. The very high concentration of titanium-bearing minerals, ilmenite and rutile, in muscovite (-chlorite) rich zones suggests that these zones were originally volcanic tuffs.

sedimentary hydrothermal
 INTERESTING TO SEE WHICH TYPE OF AL THIS IS.

In volcanogenic massive sulfide deposits such as Kuroko and Archean types, albite is not a stable mineral in the core of the alteration halo but is replaced by chlorite and/or sericite. Also, in the Archean South Bay and Corbet deposits ilmenite in unaltered footwall rocks has been altered to rutile + sphene near the massive sulfide orebody (Urabe, Scott and Hattori, in preparation). In comparison to these deposits, the degree of hydrothermal alteration at DY is considered to be relatively low.

IF THE "CENTER" OF THE ORE AT DY IS TO THE SOUTH, IT IS INTERESTING TO NOTE THAT ILMENITE PERSISTS IN THAT DIRECTION.

One of the most interesting results to date is the lateral variation in chlorite chemistry. Even though, as mentioned above, the bulk mineralogy and chemistry show no appreciable variation (Fig. LL-2), Mg/Mg+Fe ratio in chlorite changes substantially along the section (Table LL-2 and Fig. LL-3). There are two subparallel segments which are

To an impartial observer the variation is less than overwhelming and not much better than variations of MgO in bulk rock - See trends on LL-2 & LL-3 plot.

surely the variation is as appreciable and probably as meaningful as MgO in chl.

separated between DY 267 and DY 263. Within each segment, the Mg/Mg+Fe ratio in chlorite decreases towards the margin except for a reversal between DY 265 and DY 264. The reason for the large discontinuity between the two segments is not known. Possibilities include a fault or a change in stratigraphic horizon.

BOTH ARE DIFFICULT TO FIT TO THE SECTION
 BUT INTERESTING POSSIBILITY

no fault
 DY 267

There does not appear to be any systematic lateral zoning in the concentration of major elements (Fig. LL-3).

However, they can be subdivided into two groups, i.e.

those of Al_2O_3 -affinity and those of anti- Al_2O_3 -affinity.

The elements in the Al_2O_3 -affinity group include TiO_2 , Cr_2O_3 , and K_2O which show a proportional relation to that

of Al_2O_3 and Na_2O and MnO which have positive correlation with Al_2O_3 . The anti- Al_2O_3 -affinity group includes SiO_2 ,

CaO , FeO , and MgO which have similar patterns and all have negative correlations with Al_2O_3 . One of the implications

of this classification is that the rock itself could be a mixture of two different components. Most plausible

candidates are (i) a tuffaceous component which supplied lithophile elements like Al, Cr, Ti, K, Na, and Mn and

(ii) a chemical component which supplied Si as silica, Fe as sulfides, and Ca and Mg as carbonates. This model fits

well with the previously described mineralogical observations.

Neither manganese nor aluminum content in chlorite show

Hydrothermal Sedimentary component. Influx, Ti, bands, Sedimentary

less than
 Straining fit
 between
 data and
 model but
 the idea
 seems
 plausible (and
 sounds quite
 familiar
 (4L = tuffaceous
 exhalite))
 such advances
 brought to
 you through
 the miracles
 of modern
 chemistry!

obvious systematic variation although they may have an antipathetic relation, that is, aluminous chlorite contains less manganese and vice versa. The reason for this phenomenon is not known.

As was discussed in the extended abstract by Urabe and Scott (1980), the Mg/Mg+Fe ratio in chlorite from footwall rocks of volcanogenic massive sulfide deposits decreases towards the margin of the alteration halo. The maximum distance from the orebody of noticeable change in chlorite chemistry is about 1.5 km in many cases and comprises a good local exploration tool. The results from DY indicate that the chlorite chemistry may also be useful in exploration for Anvil type shale-hosted massive sulfide deposits. Oxygen isotopic data are urgently needed for these samples to check for the possibility of oxygen isotope zoning along the section as has been found for volcanogenic massive sulfide deposits (Green & Ohmoto, 1980; Beaty, 1980; Urabe, Scott and Hattori, in preparation).

How, where is the appreciable variation across the deposit!?

urgently needed because the chl composition is bombarded

the fact that biotite bearing specimens are all those with low Mg/Fe in chl perhaps suggests that some metamorphic mineral assemblage control on chl composition exists. Further there is a reasonable possibility that rock composition exerts some control on chl composition.

THIS WORK SHOWS A BLATANT DISREGARD FOR THE IMPORTANCE OF METAMORPHISM at the very least some discussion of the potential effects is needed.

REFERENCES

- Beaty, D.W. (1980). The oxygen isotope geochemistry of the the Abitibi belt: Unpubl. Ph.D. thesis, part II, Calif. Inst. Technology.
- Green, G.R. and Ohmoto, H. (1980). Oxygen isotope and alteration zonation in volcanic rocks from around the Fukazawa Kuroko deposit, Japan, and its implication for mineral exploration: G.S.A. Annual Mtg., Program with Abstracts, v. 12 , p. 436-437
- Hall, B.V., et al. (1979). Talk at Geoscience Forum, Whitehorse.
- Urabe, T. and Scott, S.D. (1980). Comparison among Kuroko, Besshi-type and Archean volcanogenic massive sulfide deposits: Extended abstract, Report to Rio Tinto Canadian Exploration Ltd.
- Urabe, T., Scott, S.D., and Hattori, K. (in preparation). A comparison of Kuroko and Canadian Archean massive sulfide deposits.

Table LL-1. Mineral assemblages of the "Horizon 1" rocks along L18 + 00E, DY deposit, Faro.

Sample No.	DDH	Depth m	Qtz	Musc	Chl	Biot	Ab	Ilm	Rutile	Po	Py	Carbonate	Others
SW DY 262 ↑	80X07	884.5	+++	+++	++		+	+	+	+			cp, sph
DY 266 ↑	77X11	835.2	+++	+++	++	+	+	+	+	+		Mn-calc	cp, sph
DY 268 ?	80X09	952.0	+++	+++	++		++	+		+			cp, sph
DY 267 ↑	78X02	762.8	+++	+++	++	+	+	+	+	+		Mn-calc	sph, cp
DY 263 ?	77X06	783.0	+++	+++	++		+		+	+		Do+Ca	cp, sph
DY 261 ?	79X07	666.8	+++	+++	++		+		+	+	+	Ca	cp
DY 265 ?	78X03	865.0	+++	+++	+++	+	+	+	+	+		+	cp
NE DY 264 ?	77X08	847.0	+++	+++	+		+		+	+		Sd+Do	K-feldspar, cp

↑ all prob = same horizon

+++ , abundant; ++ , common; + , minor to rare.

Table LL-2. Lateral variation in chemical composition of chlorite from "Horizon 1" along L18 + 00E, DY deposit, Faro. (Analyses by electron microprobe.)

Sample No.	DY 262	DY 266	DY 268	DY 267
DDH	80X07	77X11	80X09	78X02
Depth (m)	884.5	835.2	952.0	762.8
No. of Analyses	5	7	3	4
Oxide wt%				
MgO	11.37(0.92) ¹	9.01(0.91)	8.95(1.53)	6.52(1.81)
FeO	27.88(0.81)	30.74(0.63)	32.50(1.46)	33.86(2.30)
MnO	0.05(0.10)	1.62(0.18)	0.27(0.25)	1.21(0.07)
Al ₂ O ₃	21.84(0.48)	21.19(0.23)	22.13(0.32)	21.18(0.46)
SiO ₂	23.70(0.22)	23.78(0.51)	22.82(0.23)	22.93(0.83)
H ₂ O ²	10.83	10.76	10.76	10.49
Total	95.67	97.10	97.43	96.19
Atomic proportions				
Mg	1.88	1.50	1.49	1.11
Fe	2.58	2.87	3.03	3.24
Mn	0.00	0.15	0.03	0.12
Al ^{vi}	1.48	1.44	1.45	1.48
Al ^{iv}	1.37	1.35	1.45	1.38
Si	2.63	2.65	2.55	2.62
Sample No.	DY 263	DY 261	DY 265	DY 264
DDH	77X06	79X07	78X03	77X08
Depth (m)	783.0	666.8	865.0	847.0
No. of Analyses	5	9	7	9
Oxide wt%				
MgO	13.68(1.01)	11.12(0.81)	8.43(0.94)	8.79(0.71)
FeO	24.45(1.19)	27.64(1.49)	31.90(1.06)	28.55(1.25)
MnO	0.36(0.21)	0.29(0.21)	0.74(0.18)	0.17(0.14)
Al ₂ O ₃	21.44(0.72)	22.30(0.33)	21.10(0.66)	23.44(1.35)
SiO ₂	24.47(0.43)	23.67(0.36)	23.63(0.57)	24.19(1.68)
H ₂ O	10.97	10.86	10.65	10.88
Total	95.37	95.88	96.36	96.02
Atomic proportions				
Mg	2.23	1.83	1.42	1.44
Fe	2.24	2.55	3.01	2.63
Mn	0.03	0.03	0.07	0.02
Al ^{vi}	1.44	1.52	1.45	1.71
Al ^{iv}	1.32	1.38	1.34	1.33
Si	2.68	2.62	2.66	2.67

¹ 1 σ

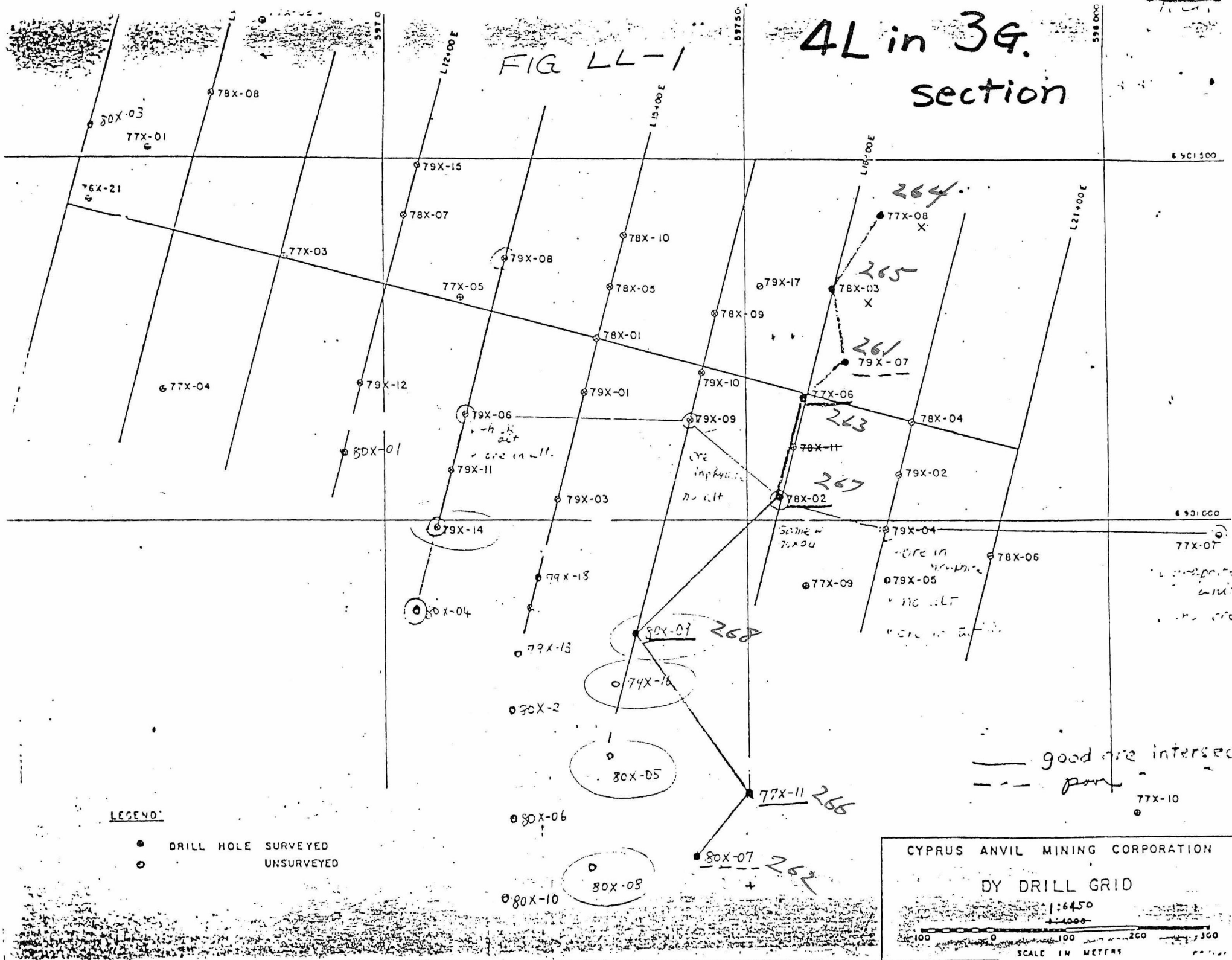
² Calculated from the formula (Mg,Fe,MnAl)₆(Si,Al)₄O₁₀(OH)₈

FIGURE CAPTIONS

- Fig. LL-1. Drill grid over the DY orebody. Closed circles locate a traverse of diamond drill holes from which samples were taken for study (see Table LL-1). Other holes not sampled are indicated by open circles. Dashes outline the zone of mineralization.
- Fig. LL-2. Bulk composition of Horizon 1 along sample traverse.
- Fig. LL-3. Composition of chlorite from Horizon 1 along sample traverse. Distances are relative to DDH 80X07 (see Fig. LL-1). Data are from Table LL-2.

4L in 3G. section

FIG LL-1



LEGEND:

- DRILL HOLE SURVEYED
- UNSURVEYED

CYPRUS ANVIL MINING CORPORATION

BY DRILL GRID

1:6450

1:4000

SCALE IN METERS

FIG 44-2

4L in 3G BULK

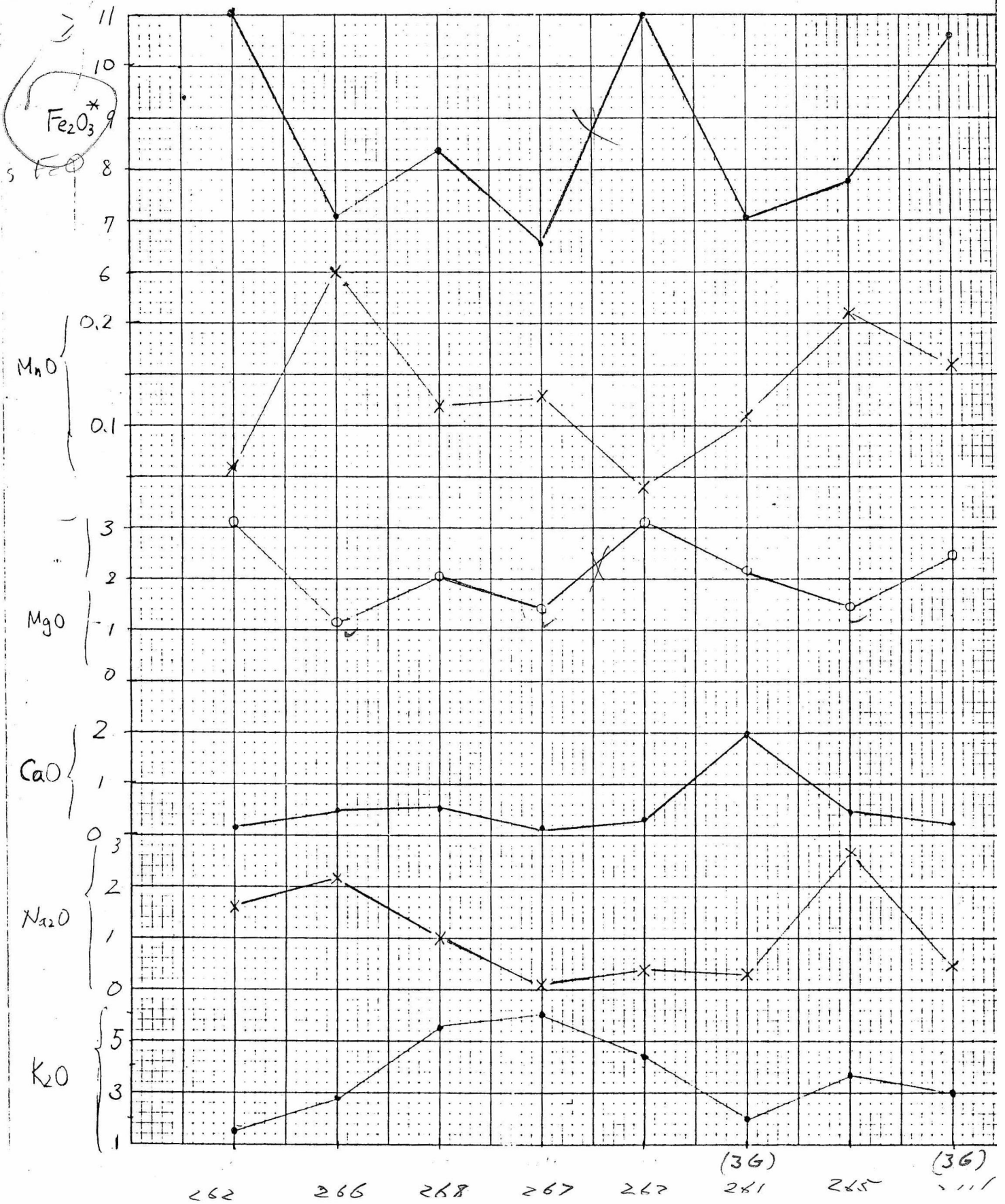
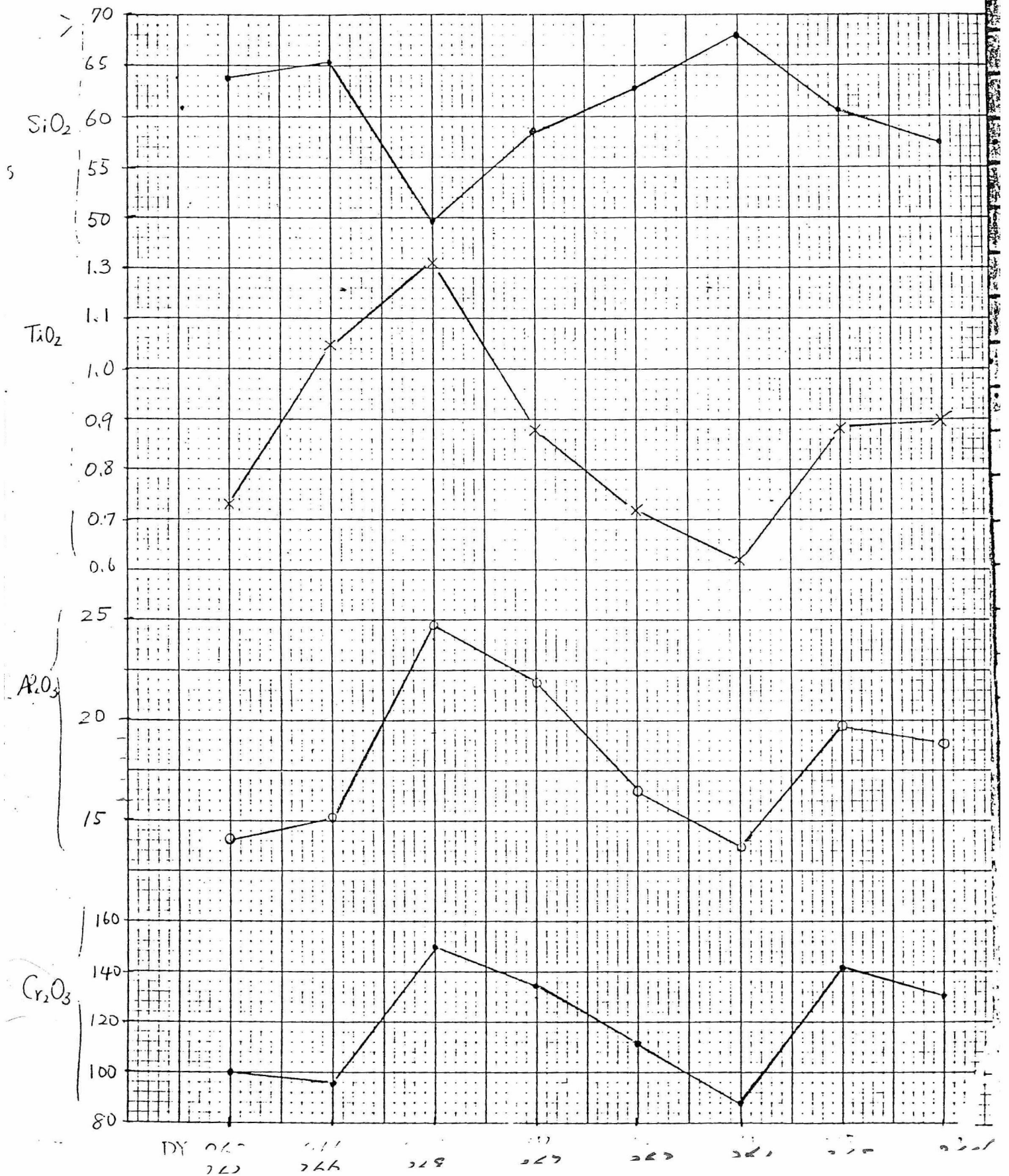


FIG LL-2 Cont'd...

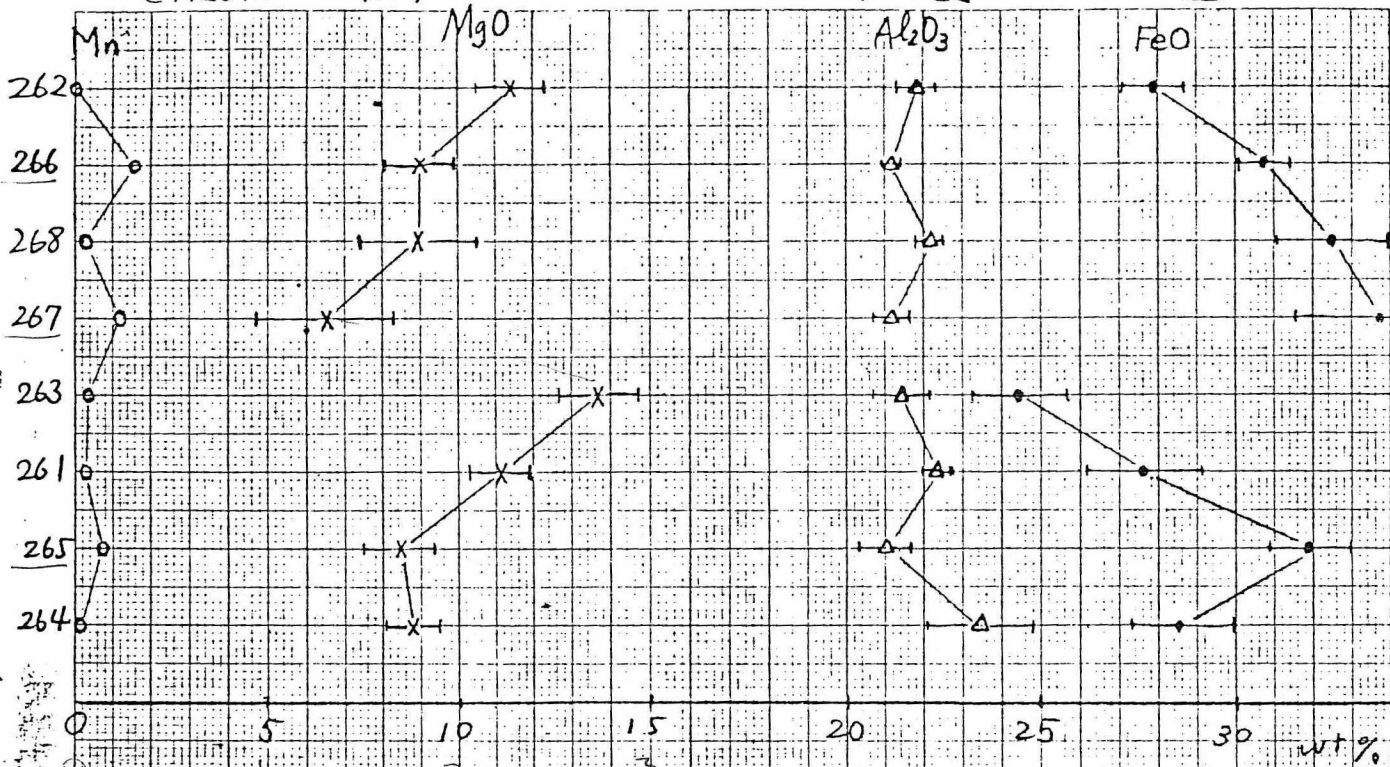
4L in 3G BULK (1/2)

T. D. 17/81



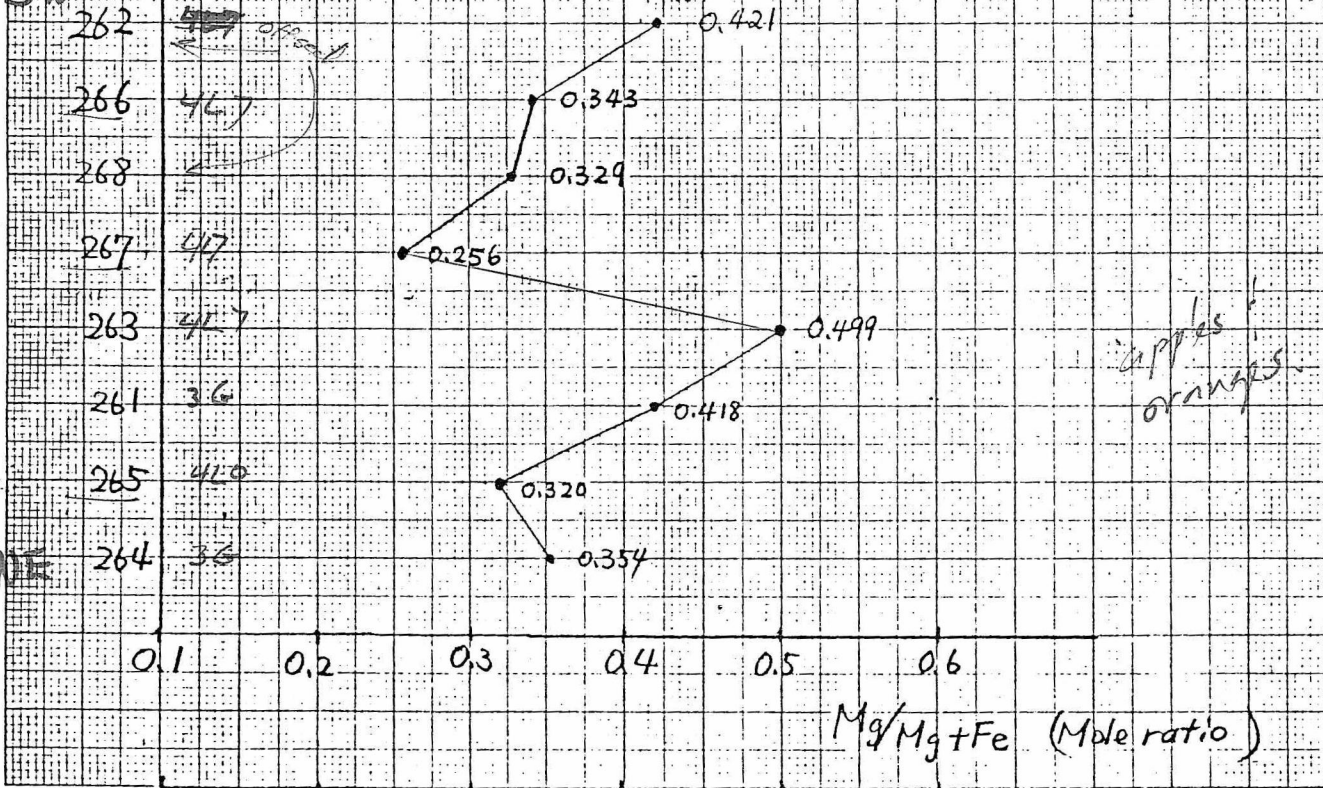
CHLORITE WT% bar = 1σ

FIG LL-3



CHLORITE Mg, Fe RATIO

SW



0.8 0.7 0.6 0.5 0.4

~~Fe/(Fe+Mg)~~ when not plot Fe/(Fe+Mg) (mole ratio)
 the samples (vertical axis)
 to scale (i.e. correct distance)

LDY

av

COI