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Tittel

Hydrocarbon Gas Chemistry of the Bieddjuvaggi Area, Norway, october 1984

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Fagområde	Dokument type	Forekomster (forekomst, gruvefelt, undersøkelsesfelt)
Geologi, Geokjemi		Bidjovaggefeltet

Råstoffgruppe	Råstofftype
Malm/metall	Cu,Au

Sammendrag, innholdsfortegnelse eller innholdsbeskrivelse

Det er innsamlet 117 prøver av metamorfe bergarter far området rundt Cu-forekomstene i Bidjovagge. Disse er analysert på lette hydrocarboner (C1 - C5). Opplegget er del av et kontinuerlig program, der studiet av hvilket potensiale hydrocarbongasser kan ha som sporfinnere i forbindelse med prospektering etter sulfidmineraliseringer.
Resultatene i Bidjovagge er oppmuntrende. C5+ og C3 gir god påvisning av smale vertikale soner (på samme måte som det også gjør det etter Zn/Pb-forekomster i Irland).
Regionalt er mønsteret mer komplisert. vegetasjon kan forurense prøvematerialet og gi feil opplysninger.

HYDROCARBON GAS GEOCHEMISTRY OF THE BIEDDJUVAGGI AREA, NORWAY

OCTOBER 1984

SUMMARY

A total of 117 samples of metamorphic rocks from around the copper mineralization at Bieddjuvaggi, in Norway, have been analysed for light (C1 - C5) hydrocarbons, as part of a continuing study of the potential for using hydrocarbon gases as pathfinders in mineral exploration. The results are encouraging, all the samples releasing significant amounts of a full range of hydrocarbons, with large variations in the relative proportions of the various species. Although the patterns of changes are quite complex there is clearly some correlation with the mineralization, sufficent to justify further research.

1. INTRODUCTION

In August 1983 a set of 39 samples of metamorphic rocks from around the copper mine at Bieddjuvaggi, in Norway, were analysed for hydrocarbon gases to investigate whether the techniques being developed by Mercury Hydrocarbons Ltd for mineral exploration in sedimentary rocks might also be applied in metamorphic terrains.

The results of this preliminary survey were encouraging, showing that there were significant amounts of light (C1 - C5) hydrocarbons in these high-grade metamorphic rocks, with large variations in the proportions of the different species similar to those found around the lead-zinc deposits in Ireland. This has prompted further work on the area with additional samples being collected during 1983 and 1984.

In total 117 samples have now been analysed, in four batches: the original 39 in August 83, 23 in November 83, 20 in July 84 and 35 in September 84. The majority of these were collected from the surface, across an area of about 12km by 7km, though 22 of the most recently analysed samples come from underground, close to the mineralization.

These rocks represent a wide variety of lithologies, ranging from amphibolites and meta sediment through meta basalts and diabase and including two samples of granite.

2. ANALYTICAL TECHNIQUE

The samples were all analysed for traces of trapped hydrocarbons using Mercury Hydrocarbon's standard heating technique, which involves heating coarsely crushed rock in sealed glass bottles and then analysing the headspace by gas chromatography. The amounts of 11 component gases are measured, the results being fed into a microcomputer which is used for data processing.

3. RESULTS

The additional samples analysed since 1983 confirm the findings of the original work that there are significant amounts of hydrocarbon gases trapped in these igneous and high-grade metamorphic rocks. Further evidence has also been found for systematic changes in the proportions of these hydrocarbons correlating with the known mineralization.

3.1 Detailed Variations Close to Mineralization

22 samples from underground have been collected along an E-W section across the ore zone, to investigate the small-scale variation in the gases, close to mineralization, (see figure 1).

This detailed sampling provides good evidence for a connection between the hydrocarbon gases and the mineralization. There are some very clear patterns in the data correlating with the ore zone, in particular there is an enrichment in the heaviest C5+ hydrocarbons (figure 2) and in an unknown component C3=A (figure 3). In addition there is some evidence for higher levels of saturated hydrocarbons like propane and ethane in samples 1014 and 1015, though there is not sufficent data to say if there is any pattern in this.

There are some changes in the levels of methane (figure 4), but on this scale there is no evidence for a methane halo.

The samples for this section represent several different lithologies, but significantly the main patterns cross-cut the boundaries, so that for, example the highest levels of C5+ occur in albite felsite (1021), meta tuff (1020, 1029, 1035) and meta diabase (1030, 1032); while the high levels of C3=A are found in albite felsite (1018, 1021, 1016, 1014) and graphitic felsite (1015).

3.2 Regional Variations

On a regional scale the patterns are more complex, though again there is some correlation with mineralization.

For example the amounts of methane, in ppb (figure 5) and as a percentage of the total weight of hydrocarbon (figure 6), show large variations between samples, with an enrichment in the centre which might conceivably represent a methane halo surrounding mineralizations though other highs to the east and west complicate the pattern.

The distribution of heavy C5+ hydrocarbon, as shown by the C5+/170 ratio (figure 7) shows areas of both enrichment and depletion near the ore zone, though again there are other similar highs about 1km to the southeast and in the extreme east of the map.

Finally, as would be expected from the detailed work, there is an enrichment in C3=A along the line of mineralization but, as can be seen on the map of the C3=A/C3=B ratio (figure 8), there are equally strong highs, immediately to the east and to the west.

3.3 Effect of Lithology

One might expect differences in lithology to have some effect on the heat extractable gases. For example, in Ireland, the background levels of hydrocarbon in shales and sandstones do seem to be quite different from those in limestones. In the case of this study there is not sufficent data to be sure of the influence of lithology, but there is certainly no obvious correlation between a particular rock-type and the patterns discussed above.

3.4 Possible Contamination of Samples

One problem with the extraction technique used for this work is that other materials besides rock will also release hydrocarbons when heated.

In particular vegatable matter such as moss or litchen release very large quantities of gas and can introduce serious bias into the results if present even in very small amounts.

Contamination from vegetation can be easily avoided by carefully removing the weathered surfaces of the rock sample before crushing, however, this was not fully appreciated in the early stages of the research and it is therefore, possible that some of the samples analysed in 1983 could be contaminated. Contamination is marked by higher levels of all gases, except methane, in particular the 170 and C5+ components and on this basis samples 1,3, 5, 11, 13, 14, 15, 22, 25, 26, 28, 29, 30, 33, 36, 37, 38, 39, 41, 42, 45 and 51 could be suspect.

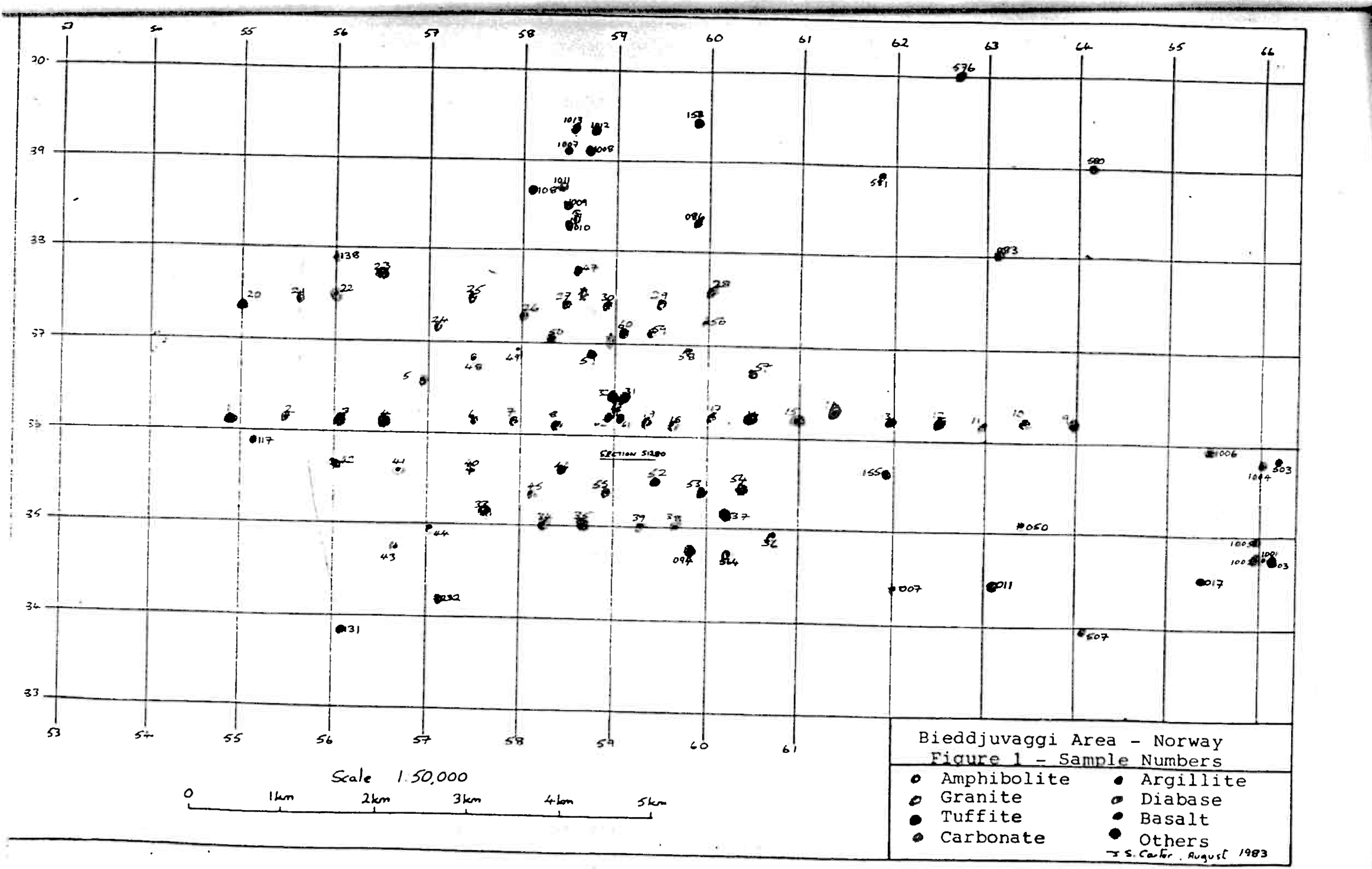
4. CONCLUSIONS

This study is only a preliminary investigation of hydrocarbon gases in metamorphic rocks and their possible association with sulphide mineralization, but it does provide encouragement that this line of research could be worthwhile.

The detailed sampling across the ore zone provides good evidence for a narrow vertical zone of enrichment in the heavy C5+ hydrocarbons and C3=A, coinciding with the centre of mineralization. This is especially significant since these same components are also found enriched close to the Irish lead-zinc deposits.

On a regional scale the pattern is more complicated. A case can be made for there being a N-S trending zone of high C3=A and C5+, running between the separate ore bodies, with perhaps a methane halo in the surrounding rocks. However, similar levels of hydrocarbon are also found in several other samples away from the known mineralization, suggesting either that other factors, such as lithology, have influenced the pattern, or possibly that there is further undiscovered mineralization in the area.

Dr. Jonathan Carter,
Mercury Hydrocarbons Ltd


Section 51280
Scale 1:50,000
0
1km
2km
3km
4km
5km
Bieddjuvaggi Area - Norway
Figure 1 - Sample Numbers
Amphibolite
Argillite
Granite
Diabase
Tuffite
Basalt
Carbonate
Others
J. S. Carter, August 1983

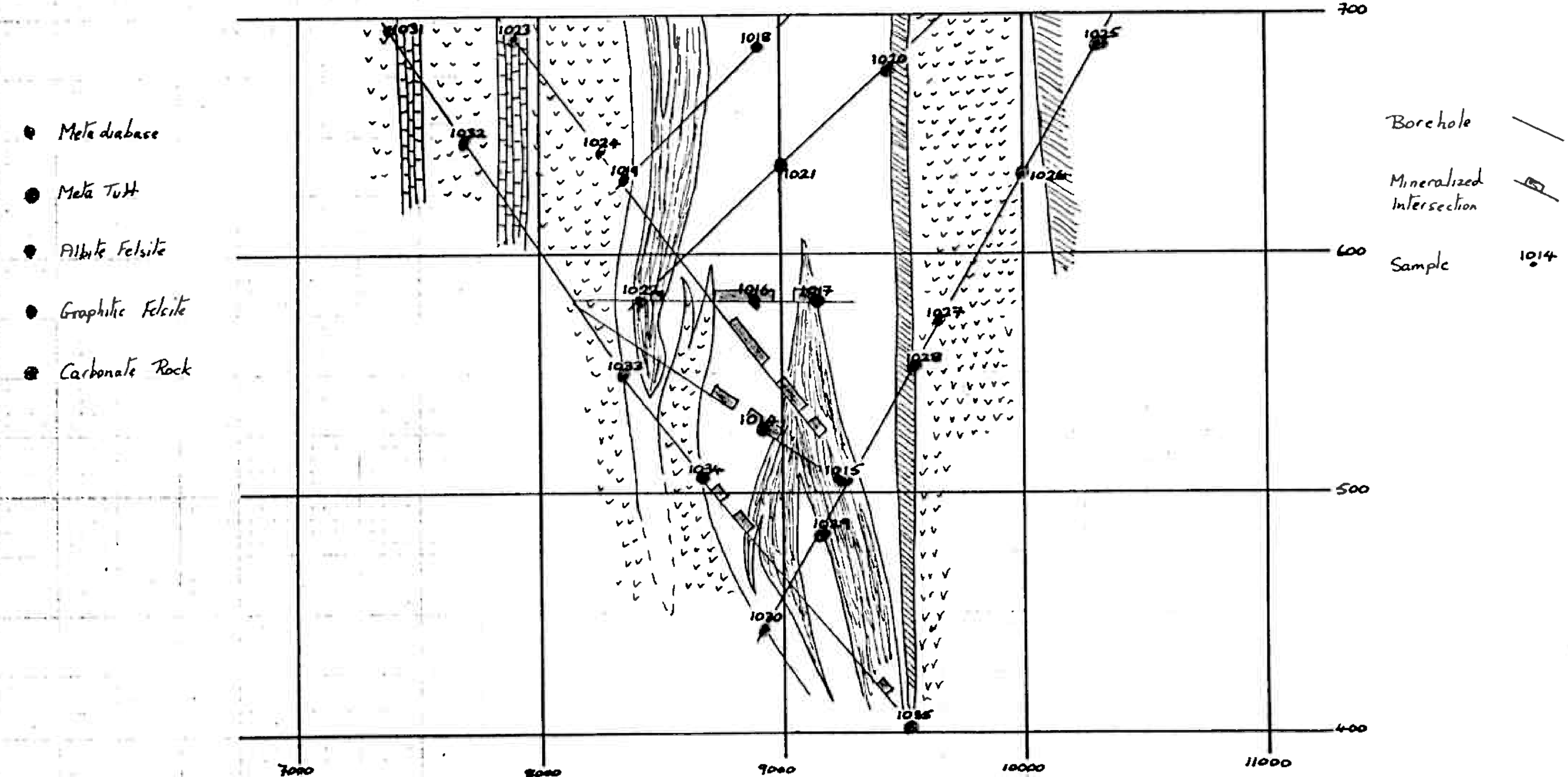


Figure 1A - Location of samples on section S1280.

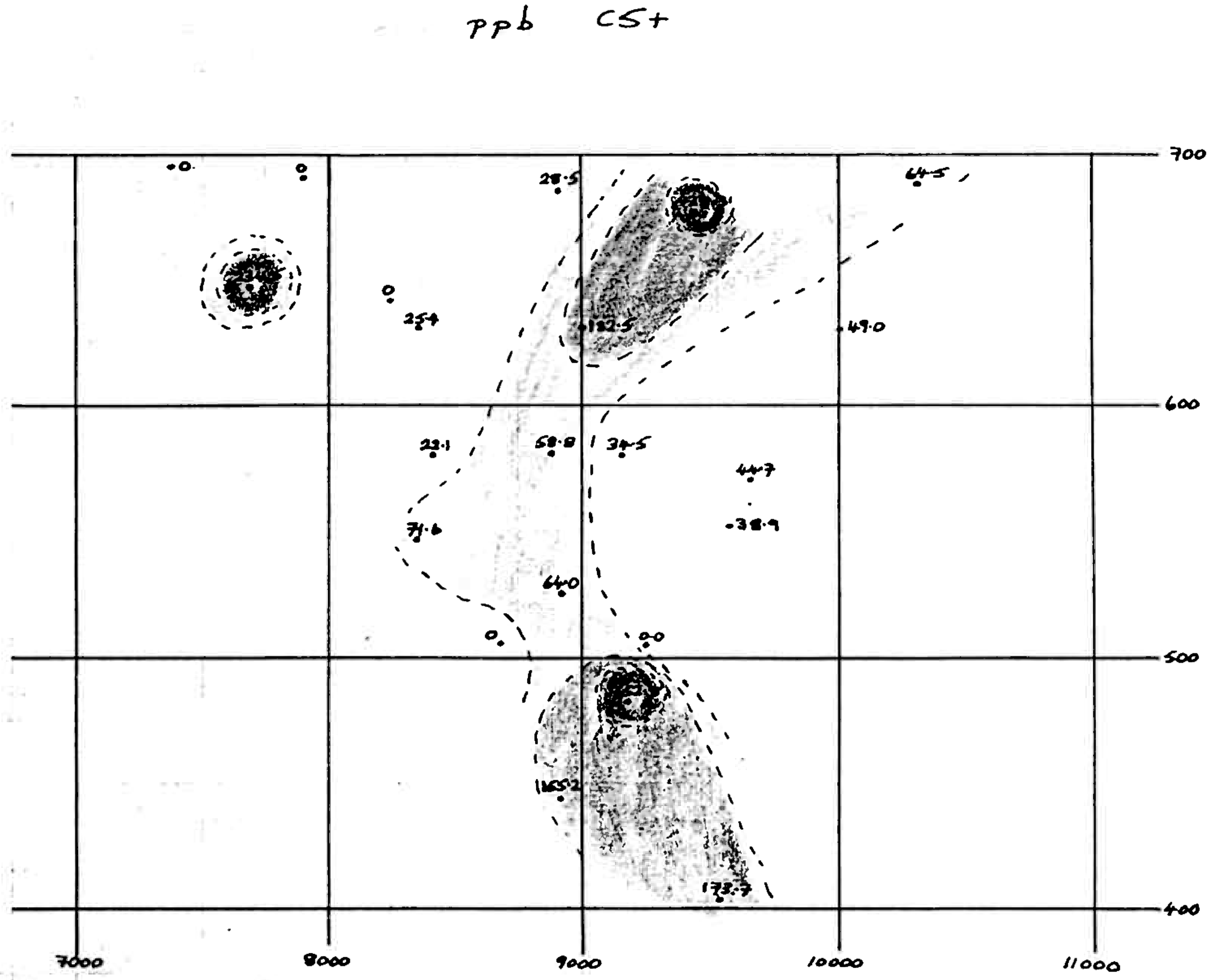


Figure 2 – ppb C5+

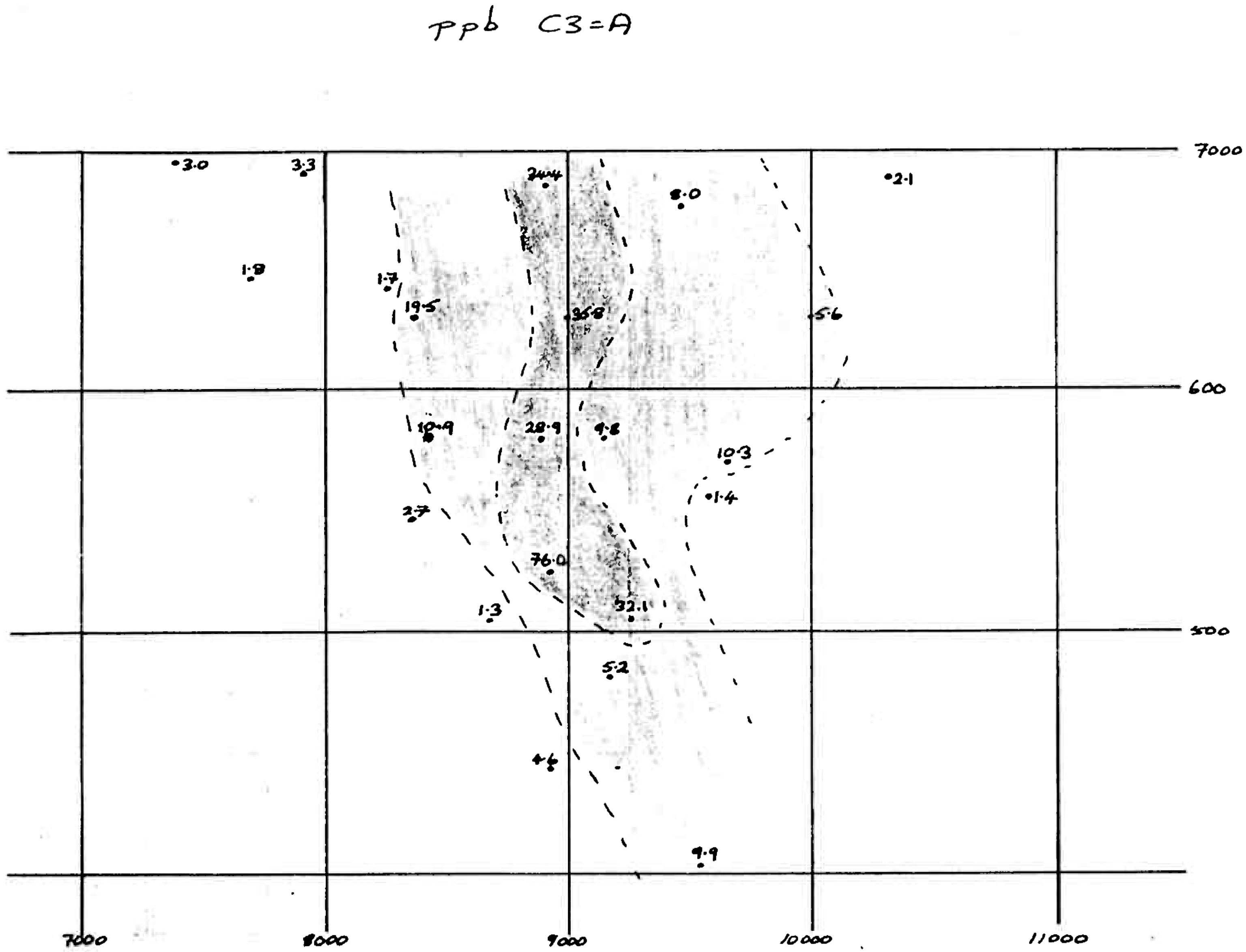


Figure 3 - ppb C3=A

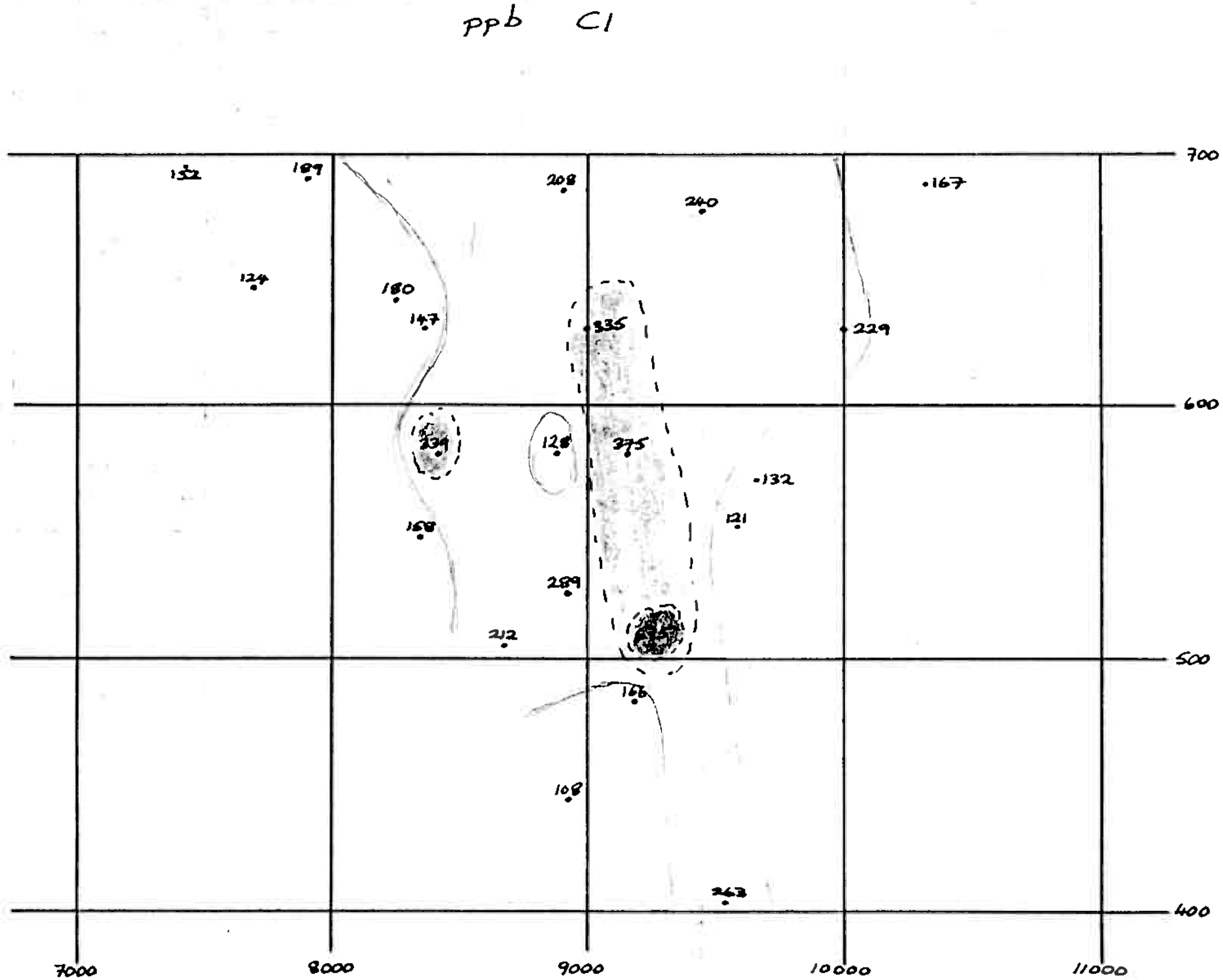
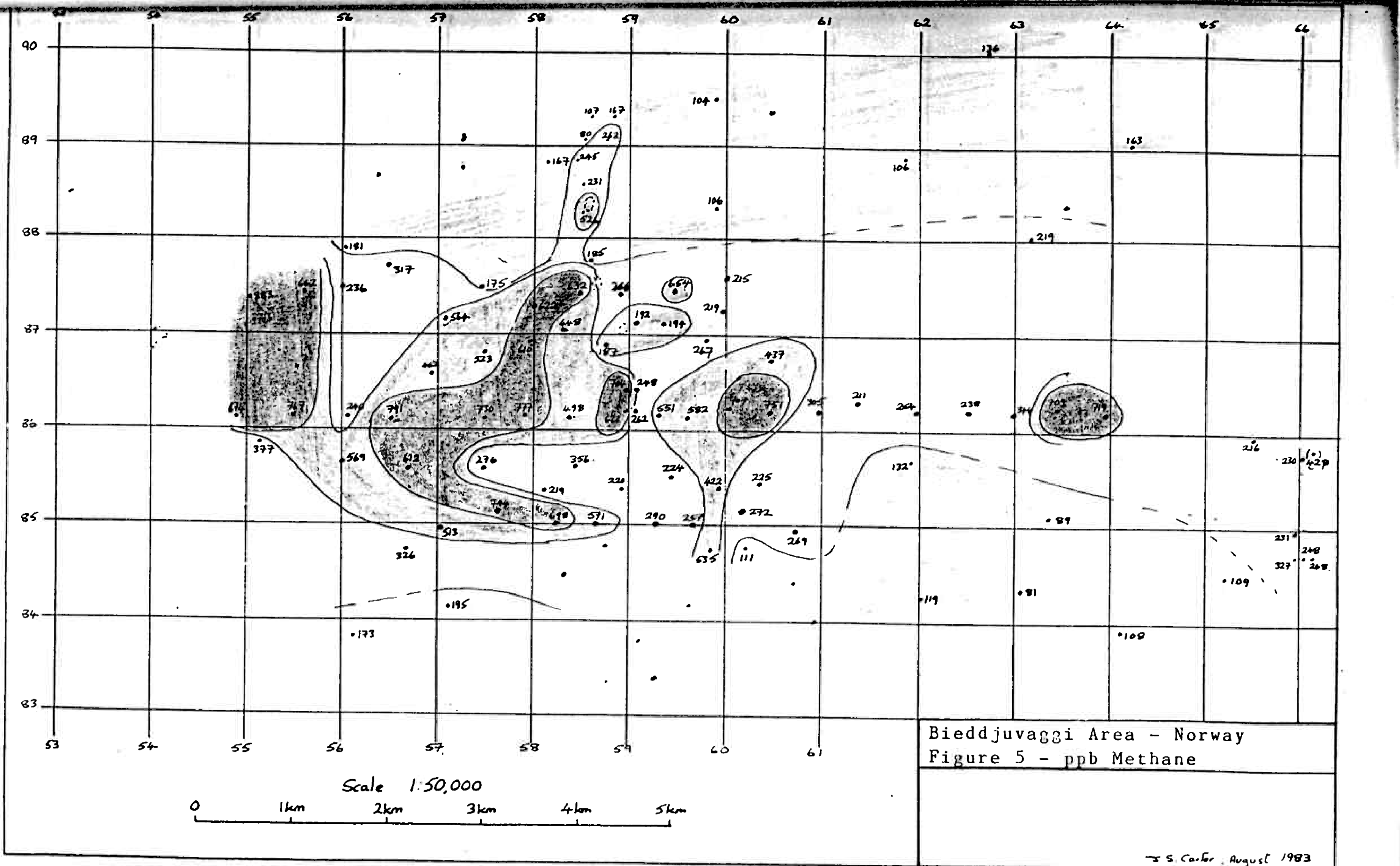
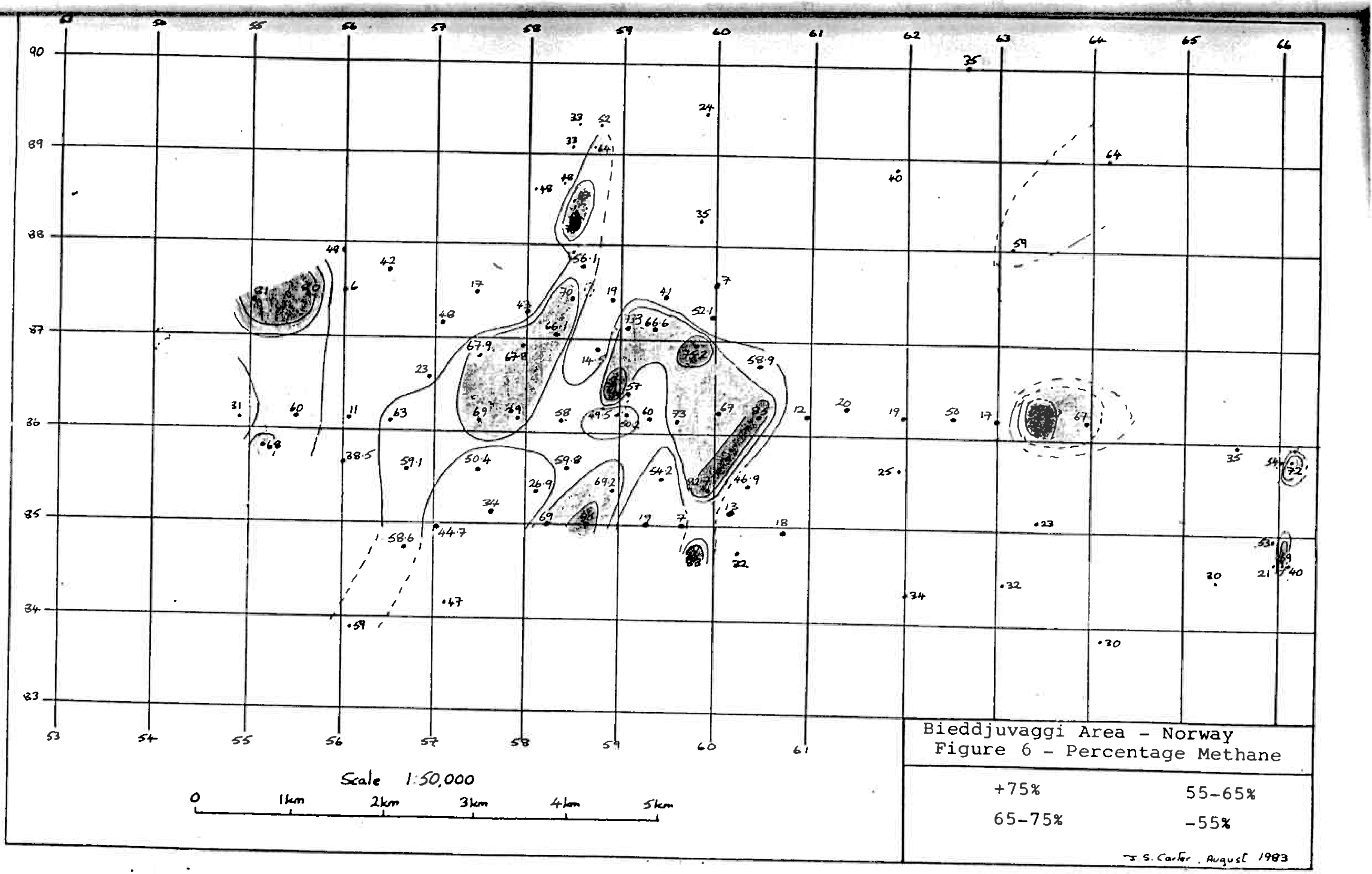


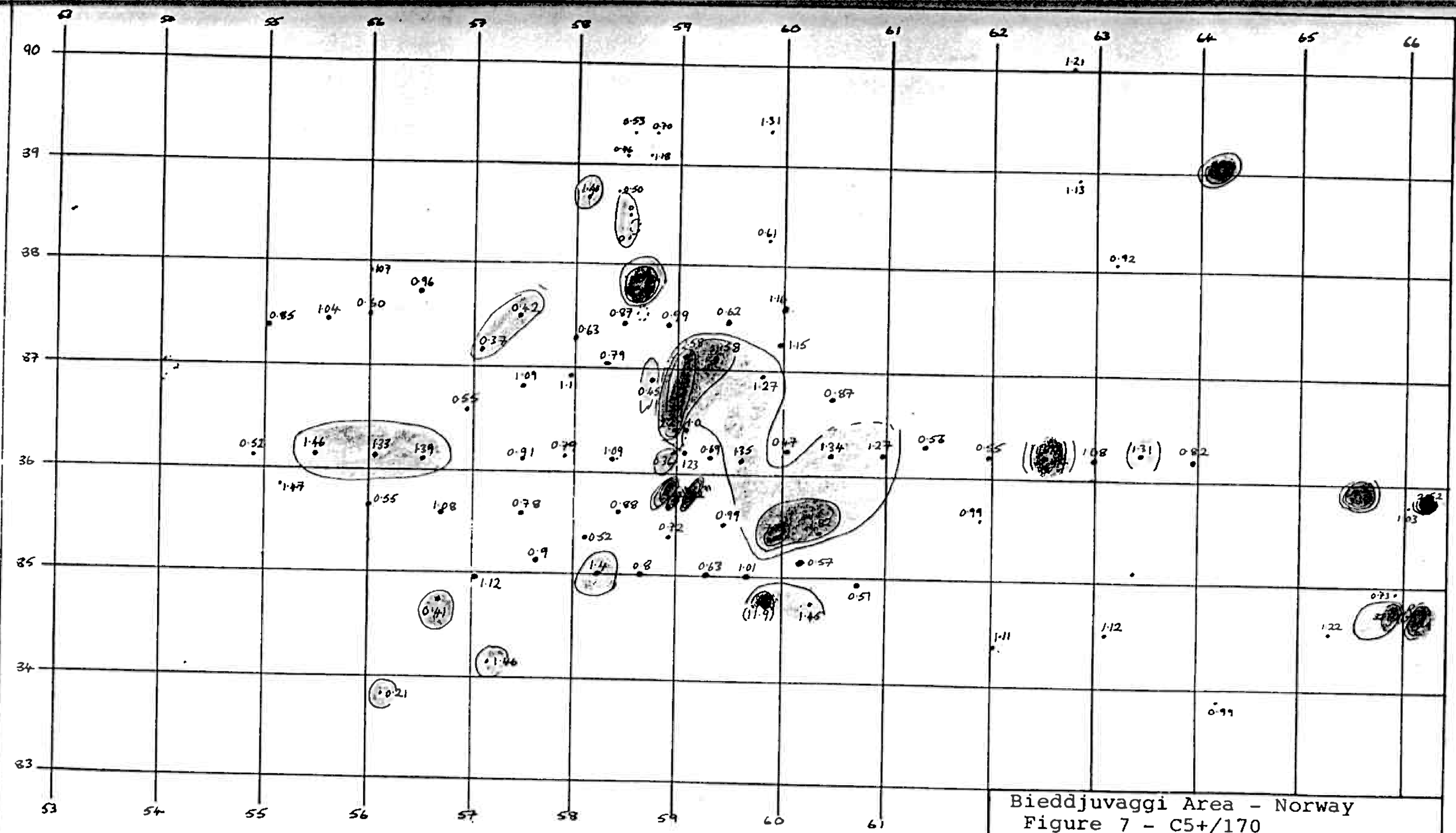
Figure 4 - ppb Cl



Bieddjuvaggi Area - Norway
Figure 5 - ppb Methane



Bieddjuvaggi Area - Norway
Figure 6 - Percentage Methane



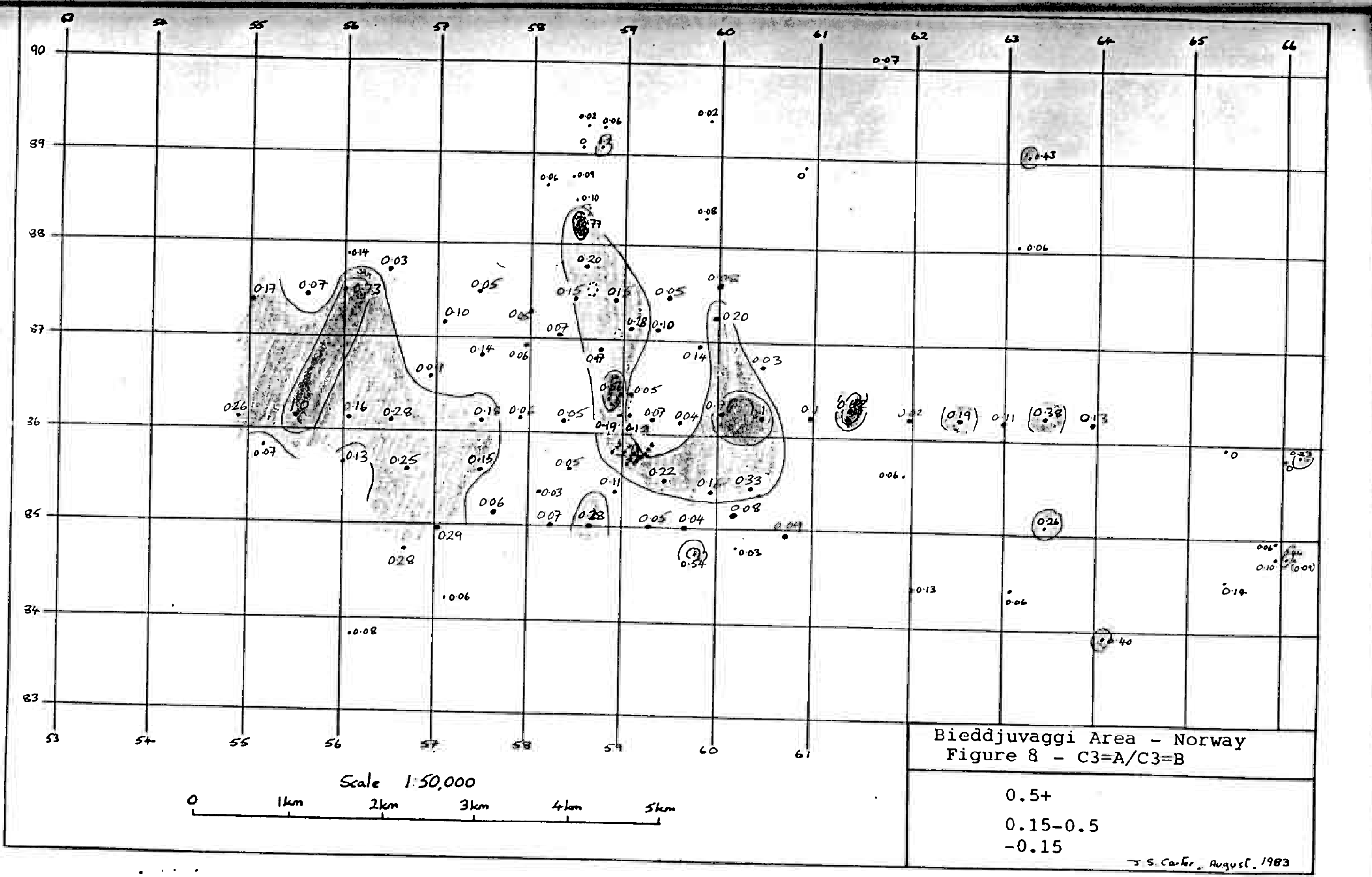
Scale 1:50,000

0 1km 2km 3km 4km 5km

Bieddjuvaggi Area - Norway
Figure 7 - C5+/170

2.0+	0.5-1.25
1.5-2.0	0.5-
1.25-1.5	

S. Carter . August 1983



Bieddjuvaggi Area - Norway
Figure 8 - C3=A/C3=B

0.5+
0.15-0.5
-0.15

J S. Carter, August, 1983