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NATIONAL GEOCHEMICAL SURVEY PROJECT



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A. Itamar, M. Shirav (Schwartz) and L. Halicz

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ABSTRACT

Within the framework of The National Geochemical Mapping Project, which is carried out by the Geological Survey of Israel, a total of 343 samples were taken from ephemeral streams within the drainage system of the Makhtesh Ramon area and analyzed for their major and trace element content. The -100 mesh (-0.150 mm) fraction was analyzed after total Na_2O_2 digestion, by means of Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES) and Atomic Absorption (AA). Major and trace elements occur in associations which can be explained on the basis of the mineralogy of the stream sediment (depicting the exposed source rocks) or by known and inferred mineralization phenomena; these associations are statistically supported by inter-element correlation and factor analysis. Aluminum, iron, titanium and rare-earth elements (REE) are usually associated with clays and heavy minerals. Some REE enrichment is related to the known mineralization in Shen Ramon. A notable anomaly of these elements is indicated in the north-eastern part of the area, where trachytic dykes and sills outcrops are widespread. The possibility that these intrusions are associated with a similar mineralization needs to be addressed. Samples enriched in V, Fe, Ti, Ni, Cr, Cu and Zn occur in proximity to basic rocks exposures. Gypsum rich stream sediments originating from the Mohila Formation are characterized by high concentrations of S, Mg, Sr and Ca. Arsenic and antimony are enriched in sediments mainly within the drainage area of the Gavnunim intrusions, portraying the known polymetallic mineralization which contains arsenides and sulfoarsenides. The occurrence of As and Sb rich stream sediments in the vicinity of the Saharonim Dome may indicate a possible mineralization in this area.

Few stream sediment samples contained up to 0.5 ppm gold, calling for a more detailed survey in this region.

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INTRODUCTION

The National Geochemical Mapping Project aims at a comprehensive sampling, analysis and interpretation of various geochemical parameters. These data are used in determining the natural geochemical background, locating mineralization occurrences and in designating anthropogenic activity causing enrichment of potential hazardous trace elements. This project is being carried out by the Geological Survey of Israel.

This study presents the results of a stream sediment geochemical survey of the Makhtesh Ramon area.

GEOGRAPHICAL AND GEOLOGICAL BACKGROUND

The Makhtesh Ramon erosional "cirque", the largest in the Negev, is a low depression in the center of the highest mountain range in the area (Fig. 1). The surrounding area is 800-1000 m above mean sea level in elevation; the low, central part is only 450-500 m high, and is enclosed by steep cliffs. The Ramon erosional "cirque" is 40 km along its longest axis (WSW-ENE), and up to 12 km across the short axis. Mizpe Ramon, on the northern cliff, is the only settlement in the area. Within the cirque there are quarries which exploit bentonite, flint-clay, kaolinite and gypsum. The development of the Ramon erosional depression was a result of two processes: (1) the formation of a NNE-SSW, large faulted anticlinal structure, at the Late Cretaceous and Early Tertiary age (Garfunkel and Derin, 1988); (2) The development of joints within the hard dolomitic cap-rocks of the anticline crest, accompanied by decomposition of lower friable sandstones (Ben-david and Mazor, 1985).

The sedimentary sequence of Makhtesh Ramon consists of Triassic to Cretaceous formations of various lithologies (Fig. 2). The **Triassic** sequence from base to top (Zak, 1957; 1968; Druckman, 1974) consists of ~150 m thick sandstone, partly quartzitic, with an upper shale unit (Gevanim Formation); ~250 m thick organogenic limestone ("Mushlkalk"), intercalated by some dolomites and shales (Saharonim Formation); and the uppermost units are ~150 m thick gypsum layers, intercalated with some dolomites and shales, capped by ~25 m of

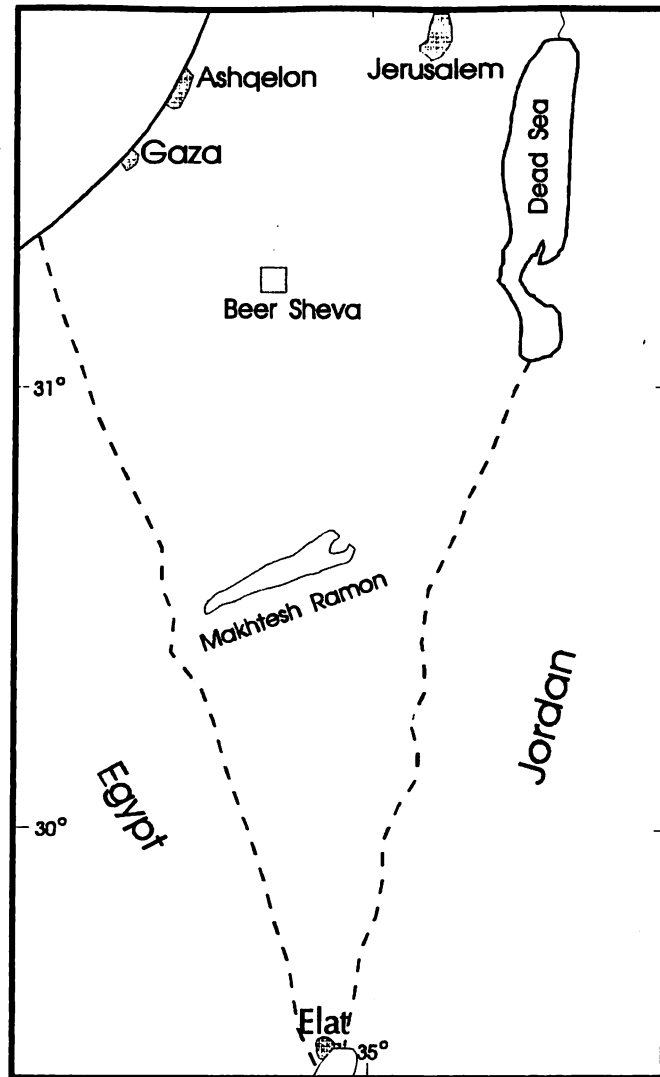


Figure 1: Location map of the Makhtesh Ramon area.

black organogenic limestone (Mohila Formation). The **Jurassic** sequence lies unconformably on the upper Mohila limestone (Goldberg and Friedman, 1974), and it consists of: ~30 m flint-clay, appearing in erosional pockets within the top of the Mohila Formation; ~30 m thick limestone (Ardon Formation) and ~70 m thick sandstone which contains abundant fossil flora in several localities. The boundary between the Jurassic and the Cretaceous is marked by a thin but a significant

conglomerate, the Arod conglomerate, which overlies both Triassic and Jurassic units, indicating a dip early Cretaceous truncation and erosion. The **Early Cretaceous** is represented by a ~170 m thick cross-bedded sandstone with few marine intercalations. The upper cliffs and cap rocks of the Makhtesh are **Cenomanian** dolomites.

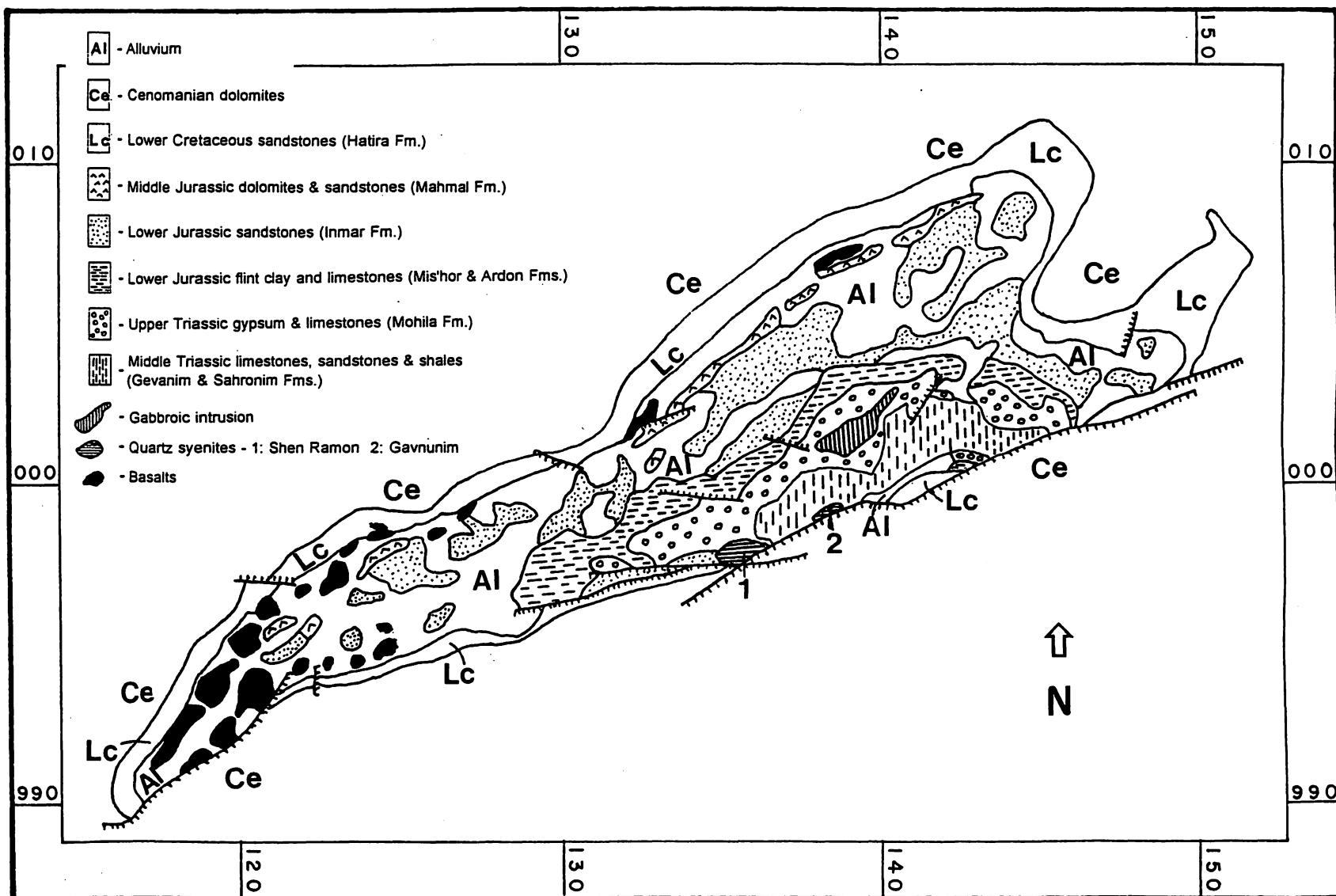
The Ramon area is marked by variegated magmatic activity of Early Cretaceous age, described in numerous works (Bentor, 1952, 1963; Mazor, 1954; Zak, 1957; Weissbrod, 1962; Garfunkel and Katz, 1967; Bonen, 1980; Starinsky et al., 1980; Itamar and Baer, 1986, 1987; Recanati, 1986; Baer and Reches, 1987; Rophe, 1987; Garfunkel and Derin, 1988; Lang et al., 1988; Itamar et al., 1993). The magmatic rocks, according to the above works, consist of four main units, which cut and overly the Triassic and the Jurassic strata: The gabbroic intrusion within the Mohila Formation, in the center of the cirque; the basaltic lava flows, pyroclastic rocks and vents which appear around the margins of the cirque; the basaltic-trachybasaltic (partly kaolinitic) dyke systems which are spread all over the cirque; and the quartz-syenitic system which appears at the central-southern part of the cirque. These syenites and quartz-syenites consist of stocks, bosses, dikes and sills, extending from the Gate of Ramon ("Bab Ramon") in the west to the Gevanim Valley in the east. The largest and the most important exposed bodies of this group are the Shen Ramon and the Gavnunim intrusions.

The quartz syenites have a trachytic to equigranular texture, composed mainly of alkali-feldspars, quartz and amphiboles. The rocks in Shen Ramon were influenced by hydrothermal alteration and late weathering (Itamar, 1992). Polymetallic, hydrothermal vein-type mineralization occurs as veins and lenses within breccia, fault and joint zones at the roof of the quartz-syenitic intrusions, mainly in the Gavnunim bodies, but also in Shen Ramon (Itamar, 1988).

The mineralization in Gavnunim has a wide geochemical span, including Ag, Pb, Zn, Cd, Cu, Co, Ni and Fe. These elements occur in several paragenetic groups: (1) Zn-Pb-Ag; (2) Cu-Zn-Pb-Ag; (3) Cu-Zn-Pb; (4) Ni-Co-Ag; and (5) Ni-Co-Fe. As a result, a varied and complicated primary mineralogy was developed, including the following main mineral groups: Sulfides, Arsenides, Sulfo-arsenides and native tin.

Although containing some of the above mentioned sulfidic types, the mineralization in Shen Ramon is characterized mainly by REE (Ce, La, Eu, Nd).

Figure 2: Generalized geological map of Makhtesh Ramon.



The most prominent enrichment zone of REE is the contact between the Jurassic Ardon Fm. limestones and the quartz syenitic intrusion.

Secondary sulphates, arsenates, carbonates, chlorides, silicates and oxides formed from the primary minerals as a result of alteration and weathering. The latter process is still ongoing. Gangue minerals include widespread quartz and anhydrite with rare K-feldspar and fluorite. Paragenetic indicative mineral assemblages, as well as direct temperatures calculations, indicate the temperatures of formation to be 350°C to 150°C. K-Ar age determinations of gangue K-feldspar in the veins and alteration zones yielded an age of 125±2 m.y. (Itamar and Steinitz, 1988), indicating that the hydrothermal veining was the last stage of the quartz syenitic magmatic activity, which was dated previously, yielding an age of 130±5 MY. Stable isotope data of oxygen (quartz) and sulphur (sulfides) are strongly different from any known hydrothermal, vein - type mineralization, suggesting a very low water/rock ratio (~0.02) and strong interactions between the fluids and high ^{18}O , low ^{34}S , overlying sedimentary rocks (Itamar and Matthews, 1988).

The sedimentary rocks intruded by the quartz-syenites are of importance in understanding the mineralization. The quartz syenites containing the polymetallic mineralization in the Gevanim valley generally appear at the contact with the Triassic Gevanim Formation, and especially with its clay member. Other sedimentary rocks at the contacts with the intrusions, especially the limestones of the Ardon Formation, are hydrothermally altered (Itamar et. al. 1983) and enriched in rare earth elements and other metallic minerals. This enrichment attest to the chemical reactions between intrusions and sedimentary rocks. The presence of that limestone is widespread near these contacts. These data suggest a strong interrelation between sediments, intrusions and mineralization in the overall area of Makhtesh Ramon.

PREVIOUS STREAM SEDIMENT STUDIES

The Makhtesh Ramon area, and especially the environs of the magmatic bodies, has been a target for stream sediment surveys in the past. Zilberfarb and Lifshitz (1985) conducted an orientation study around the mineralizations of the Gevanim area and concluded that high concentrations of some elements may be recorded up to several hundreds of meters downstream from anomalous sites. This

conclusion is in agreement with the findings of Weissbrod and Bogoch (1988) who sampled some 90 stream sediments within the catchment area of Shen Ramon. This study indicated some anomalous values of Zn, Cu, V, Cr and Pb. Within the framework of the Uranium Exploration Project (carried out by the Geological Survey and the Soreq Nuclear Research Center), a detailed stream sediment study covering an area of approximately 50 km² in the center of the Ramon Crater has been carried out (Steinitz et al., 1988). This study employed grain size fraction of <2mm and Atomic Absorption analysis of a limited number of trace elements after HNO₃/HCl treatment of the samples. The spatial distribution of samples with high concentrations of some trace metals analyzed in this study exhibited correlation with the known geochemistry of the magmatic and mineralized rocks in the area. The most prominent were the association of V, Co, Cr, Ni, Cu and Zn with basic rocks (i.e., the gabbroic intrusion, Mohila Fm.), and Mn + Zn within the catchment areas of Gavnunim and Shen Ramon.

A comparative study of the sampling and analytical methods employed in the previous and current studies was carried out by Shirav et al., 1992, who concluded that for geochemical mapping in an arid environment, analysis after total digestion (by Na₂O₂ or other reagents) of the <100 mesh fraction is preferable.

Part of the samples which were used in the survey of Steinitz et al., 1988 and coincide with the recent study's sampling framework, were re-sieved to pass <100 mesh and re-analyzed using the methods described in the coming chapter.

METHODS

(A) Sampling and Sample Preparation

Stream (wadi) sediment samples sites (Fig. 3) were chosen according to the drainage pattern, at an average density of ~1.5 samples per 1 square kilometre. After scraping away the upper layer of the stream bed to depth of about 20 cm, one kg sample sieved to pass a 1 mm sieve, was taken and packed in marked polyethylene bags. Field data were recorded on mnemonic - coded, single-page data cards.

In the laboratory, the samples underwent dry sieving to pass a 100 mesh sieve. The <100 mesh (<0.150 mm) fraction was used for chemical analysis.

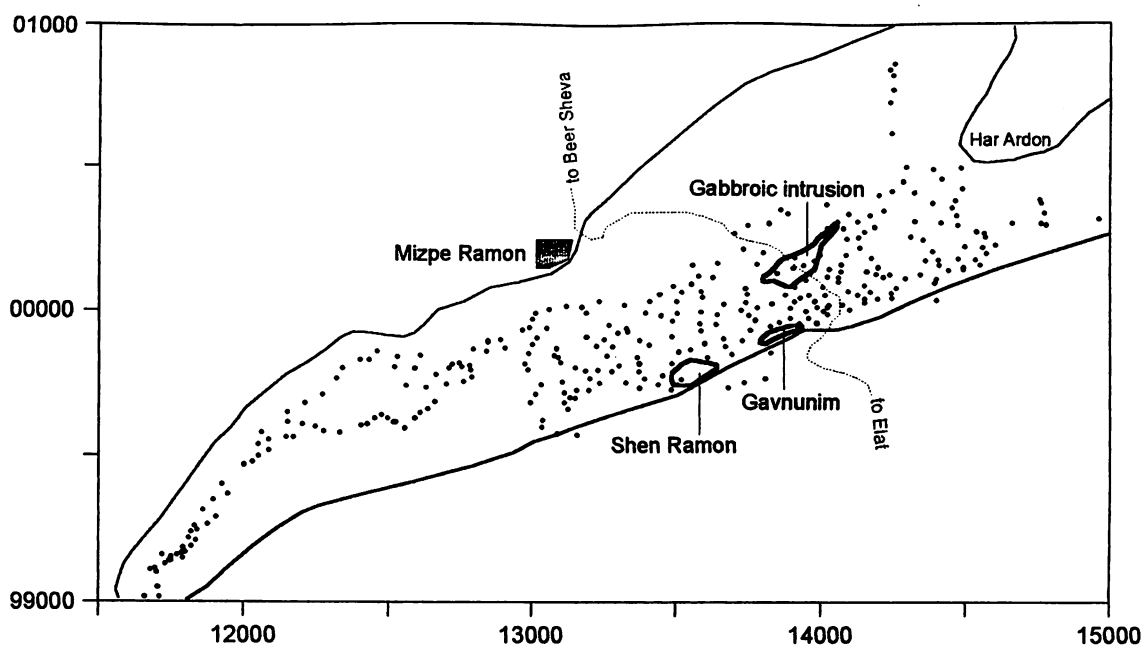


Figure 3: Sampling sites at the Makhtesh Ramon area.

(B) Analytical Procedures

Inductively Coupled Plasma - Atomic Emission Spectrometry (ICP-AES) was applied for the determination of major and trace elements in the stream sediment samples. Synthetic solutions were used for calibration, matched with Na_2O_2 and hydrochloric acid. Scandium (Sc II 361.384 nm) served as an internal reference and substantially reduced short-term variability.

500 mg of the sample was mixed with 2.5 g Na_2O_2 (Merck GR) in a zirconium crucible and heated for 40 minutes in a muffle furnace (500°C). After cooling to room temperature, the crucible was rinsed in 50 ml water and 25 ml of 1+1 HCl (v/v) added rapidly in order to achieve clear solutions. Scandium was added to the solutions so that the final volume (100 ml) contained 5 mg/l Sc.

Arsenic and antimony were determined separately using a hydride generator (Plasmatherm) with direct introduction into the ICP. Curves for multi-element determination were established by calibration with composite standards prepared by stepwise dilution of stock solutions made from pure metals or analytical grade salts. Natural Standard Reference Materials were analyzed using the procedure described above in order to test the accuracy and precision of the determinations. For the determination of Au, 20 gm of sample were roasted for one hour at 600°C

in a muffle furnace to remove sulphur. After cooling, the sample was digested with aqua regia (50 ml) on a hot-plate for one hour. The mixture was then evaporated to a moist state, 20 ml of hydrochloric acid (1+4) added, and the sample filtered. The solution was transferred to a volumetric flask (100 ml). A 5 ml portion of "Aliquat 336" + DIBK mixture (saturated with 1+1 HCl) was added and the flask shaken. The concentration of gold in the organic phase was measured using atomic absorption spectrometry.

Elements routinely determined by the above methods and their limit of detection (in ppm) are: -

Majors:

Si	200	Fe	50
Al	100	Ti	50
Ca	100	P	1000
Mg	10	S	1000

Traces:

Ag	2.0	La	3.0
As	0.2	Mn	0.5
Au	10 (ppb)	Mo	3.0
Ba	1.0	Ni	5.0
Be	0.2	Pb	5.0
Cd	1.5	Sb	0.1
Ce	5.0	Sr	0.1
Co	3.0	V	5.0
Cr	0.5	Y	1.0
Cu	1.5	Yb	0.5
Eu	0.1	Zn	1.0

RESULTS

(A) Data Presentation

Detailed information on all stream sediment samples collected at the Makhtesh Ramon area in the course of this study is presented in Appendix A. Table 1 summarizes the descriptive statistics of these samples, including minimum, maximum, mean, median, standard deviation, the 25 and 75 percentiles.

Single-element geochemical maps were prepared for all trace and some major elements in order to examine their aerial distribution and relation to the environment. Geochemical maps of 19 trace elements, exhibiting the main spatial distribution trends, are displayed on pages 19-27 (Figs. 6-23). The categories (data bins) used for presentation of the results on almost all maps are percentile

classes - 75, 85, 90, 95, 98 and 100%-ile.

(B) Inter-elements Relationships and Aerial Distribution

In order to study the inter-relationships among the elements, R-mode factor analysis (Principle Components, varimax rotated) was applied, using the NCSS software (Hintze, 1992). Since the variables (=elements) are measured on different scales and metrics, the data was standardized before the computation. For a variable X_i the transformation is:

$$Z_i = \frac{X_i - \bar{X}_i}{S_i}$$

where $\bar{X}_i$ and S_i are the mean and standard deviation of variable i . The results of the factor analysis are presented in figure 4, illustrating the elements associated with each factor and their relative loadings.

Five main factors are indicated, and can be largely explained on the basis of the mineralogy of the stream sediment, and hence related to the rocks exposed within the sampled catchment basins. Figure 5 presents the locations of samples which attained the highest factor scores for factors I to IV. The significant correlation between Y, La, Ce, Yb, Be, Eu and Al (**Factor I**, explaining 39.3% of the total variance) usually represents a trace element suite which is associated with the clay fraction of the sediment, along with partial contribution of heavy and ore minerals (Bogoch et al., 1993). Additional contribution of some REE rich stream sediments in the vicinity of Shen Ramon is associated with the REE mineralization. Table 2 presents the geochemistry of some unaltered rock samples from the Gavnunim and Shen Ramon intrusions. The LREE concentrations are in the order of magnitude typical for these rock types, ~200 ppm (Wedepohl, 1978), whereas along the intrusive contact of Shen Ramon, the contents of Ce and La increase abruptly by more than an order of magnitude (Itamar et al., 1993). Although these concentrations are very high, it seems that they are very localized and thus contribute (within the given sampling density) only few samples with elevated concentrations of these elements. A notable anomaly of these elements is indicated in the north-eastern part of the area, near Nahal Ardon (see Figures 9,13,14,21). In this area, trachytic dykes and sills are widespread and the possibility that these intrusions are associated with a similar mineralization needs

to be addressed. This is the first indication of a probable new mineralization locality. **Factor II** (explaining 19.5% of the total variance), which includes Ca (positive values) and Si (negative values), represent a "mirror" effect, separating statistically between stream sediments originating from magmatic rocks and carbonate rocks (Shirav et al., 1990). Zn and Cu which are also included in this factor indicate higher concentrations of these elements in basic rocks (see relevant maps on pp. 22,27).

The close relationship between V, Fe, Ti, Ni, and Cr (**Factor III**, explaining 12.8% of the total variance) is indicative of ferro-magnesian minerals. Samples enriched in these elements occur in the south western and the central part of the studied area (Fig. 5) where basic rocks exposures are abundant.

Factor IV (explaining 11.5% of the variance) indicates high correlation between As and Sb. Stream sediments enriched with these elements are located almost conclusively within the drainage basin of the magmatic bodies of Gavnunim (Figs. 6,19). Some As and Sb rich samples are located also within the catchment area of the Shen Ramon intrusion (Fig. 5). The aerial distribution of As-Sb rich stream sediments depicts the known arsen-rich mineralization associated with the Gavnunim intrusions. The cluster of some similar samples near the Saharonim Dome (north-east of Gavnunim) may suggest that in this area an analogous mineralization could exist. Samples from the Saharonim Formation exposed in this area contain an average of 60 ppm arsenic.

Factor V (explaining 8.8% of the variation) displays a very clear correlation between sulphur, magnesium, strontium and calcium, which is attributed to stream sediments with high content of gypsum, originating from outcrops of the Mohila Formation.

Relatively high concentrations of gold and silver are located around the Gavnunim and Shen Ramon intrusions (see Figure 23). While high concentrations of silver could be related to the known mineralization, the source of the gold content in stream sediments should be investigated in a subsequent, detailed study.

Table 1: Statistical parameters of stream sediment major and trace element data from the Makhtesh Ramon area.

	N*	min.	25%	median	75%	max.	mean	Std. Dev
Wt%								
SiO ₂	343	7.2	38.5	45	55	98.9	47.5	14.7
Al ₂ O ₃	334	0.2	5.7	6.9	8	31.0	7.3	3.3
Fe ₂ O ₃	343	0.6	3.0	3.5	4.7	44.4	4.3	3.4
CaO	331	1.3	13.5	18.3	22.2	47.6	18.2	7.1
MgO	343	0.3	1.9	2.7	3.6	8.8	2.9	1.4
TiO ₂	330	0.07	0.64	0.83	1.12	9.95	0.98	0.71
P ₂ O ₅	287	0.1	0.1	0.2	0.2	5.0	0.22	0.29
SO ₃	92	0.1	0.3	1.1	5.9	9.9	2.9	3.4
ppm								
As	209	1	2	3	4	26	3.3	2.1
Ba	343	35	285	335	370	900	332	95
Be	333	0.2	1	1.2	1.5	7	1.3	0.68
Ce	334	5	43	50	61	210	53	20
Co	330	3	16	27	34	224	26	18
Cr	334	6	60	75	100	534	86	48
Cu	343	4	18	23	34	560	36	50
Eu	229	0.1	0.4	0.5	0.7	2	0.5	0.3
La	334	4	22	25	30	74	27	9.5
Mn	343	16	351	424	535	6360	496	504
Mo	73	3	6	7	10	16	8	2.6
Ni	303	6	25	35	47	276	41	29
Pb	299	10	20	28	35	100	28	13
Sb	103	0.1	0.3	0.4	0.4	2.4	0.4	0.23
Sr	343	37	300	378	950	9000	1070	1665
V	343	6	60	771	87	625	80	52
Y	343	1	22	32	42	94	34	15
Yb	331	1	2	2	3	6	2.2	0.8
Zn	331	1	31	42	63	400	50	35

N* - Number of samples with concentrations above detection limit.

Std. Dev. - Standard Deviation.

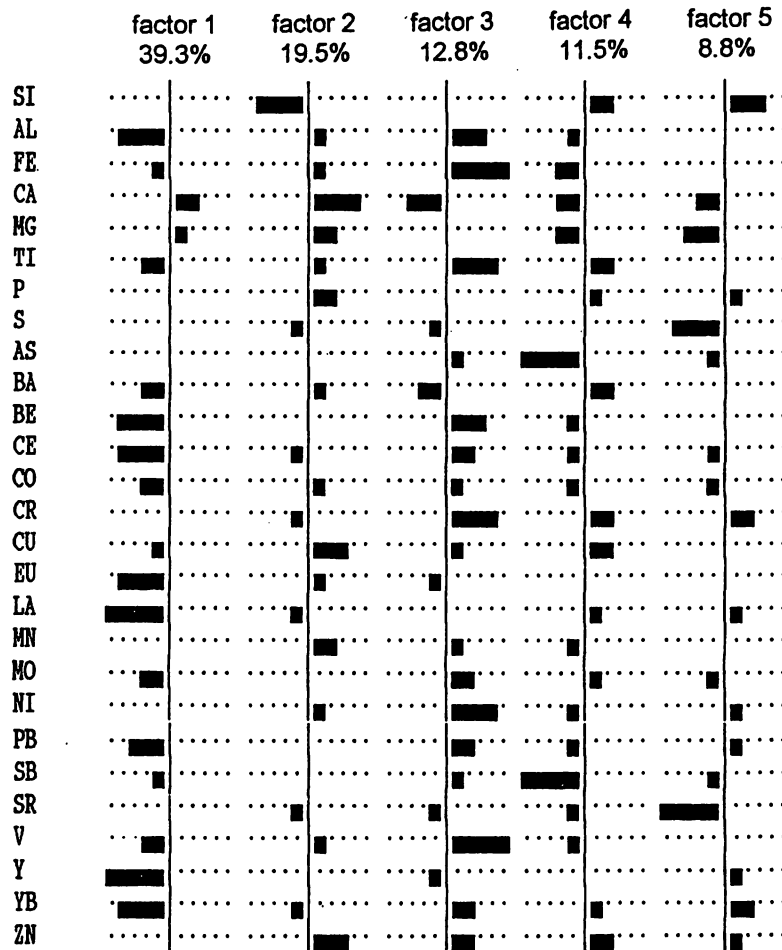


Figure 4: Factor analysis results. The length of the horizontal bars is relative to the loadings of the elements for each factor. The variance explained by each factor is given in percent.

Table 2: Major and trace elements content in quartz syenite samples from Shen Ramon and Gavnunim (after Itamar, 1988).

Sample	1	2	3	10	11	12
<hr/>						
Wt%						
SiO ₂	63.7	66.8	69.95	61.6	60.9	67.9
Al ₂ O ₃	13.3	12.7	12.5	16.2	13.6	13.1
TiO ₂	0.42	0.4	0.39	0.34	0.28	0.19
Fe ₂ O ₃	6.8	5.8	4.88	7.9	10.0	6.0
CaO	1.1	1.71	1.37	0.31	0.3	0.34
MgO	0.07	0.08	0.1	0.01	0.05	0.1
K ₂ O	4.5	4.4	4.48	4.6	5.2	4.87
Na ₂ O	6.5	4.6	4.18	4.9	5.3	4.5
SO ₃	1.3	0.22	<	0.66	0.5	<
MnO	0.28	0.17	<	<	0.5	0.11
LOI*	2.0	2.5	1.8	2.9	1.3	2.1
CO ₂	0.2	1.5	<	0.1	0.02	<
ppm						
Ag	<	20	<	250	<	<
Ba	50	217	160	288	265	40
Cd	<	2	<	2	5	<
Ce	140	170	150	235	130	180
Co	2	10	<	3	1	<
Cr	130	270	90	77	80	100
Cu	1	48	5	10	10	7
La	65	88	90	145	68	110
Mo	10	8	5	15	4	<
Ni	5	21	7	7	6	5
Pb	26	75	30	33	33	20
Sr	34	127	80	155	17	55
Y	60	68	50	53	27	45
Yb	7	7	5	6	4	5
Zn	215	525	360	107	95	25

Samples 1-3: Gavnunim; 10-12: Shen Ramon

* - Loss On Ignition

< - Under detection limit



Figure 5: Location of samples which gained high factor scores (upper 10% for each factor) and the explained variance for each factor (%).

SUMMARY AND CONCLUSIONS

A total of 343 samples were taken from ephemeral streams within the drainage system of the Makhtesh Ramon area, covering an area of $\sim 250 \text{ km}^2$. These were analyzed for their major and trace element contents. Statistical analysis of the element data indicates that they occur in associations which can be explained on the basis of the mineralogy of the stream sediment (depicting the expected source rocks) or by known and inferred mineralization phenomena:

- Y, La, Ce, Yb, Be, Eu and Al are associated with clays, heavy and ore minerals, and some REE enrichment related to quartz syenitic bodies.
- Samples enriched in V, Fe, Ti, Ni, Cr, Cu and Zn occur in proximity to basic rocks exposures.
- Gypsum rich stream sediments originating from the Mohila Formation are characterized by high concentrations of S, Mg, Sr and Ca.
- As and Sb are enriched in sediments mainly within the drainage area of the Gavnunim intrusions, portraying the known polymetallic mineralization containing arsenides and sulfoarsenides.

Although a significant light rare earth mineralization is located in the contact zone between hydrothermally altered quartz syenite and Jurassic carbonate rocks in Shen Ramon, this mineralization is not entirely manifested in stream sediments within its drainage basin. It thus appears that due to limited downstream dispersion of these elements in this type of area, a much more dense sample network is needed in order to accurately determine the extension of such mineralization. At the east-northern part of the Ramon Crater, near Nahal Ardon, a prominent enrichment of REE, Pb, Mo and Be in the stream sediments was detected. This enrichment could be associated with the abundant trachytic sills and dykes in the area and it is thus suggested that this issue, as well as a more detailed geochemical study of the REE mineralization in Shen Ramon, will be the subjects of an advanced study.

The fact that the known mineralization in the Gevanim Valley is indicated only by an enrichment of As, Sb, Mn and to some extent Ag (although the rocks contain major amounts of Cu, Ni, Pb and Zn), suggests that at the sampling density employed in regional geochemical mapping ($\sim 1\text{-}1.5 \text{ sample/km}^2$), local, well

delineated mineralizations could be detected mainly by the most mobile elements. The occurrence of As and Sb rich stream sediments in the vicinity of the Sahronim Dome (north-east of the Gavnunim intrusions) may indicate a possible mineralization in this area.

A detailed stream sediment study aimed at the detection of the gold anomaly is recommended.

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SINGLE ELEMENT MAPS

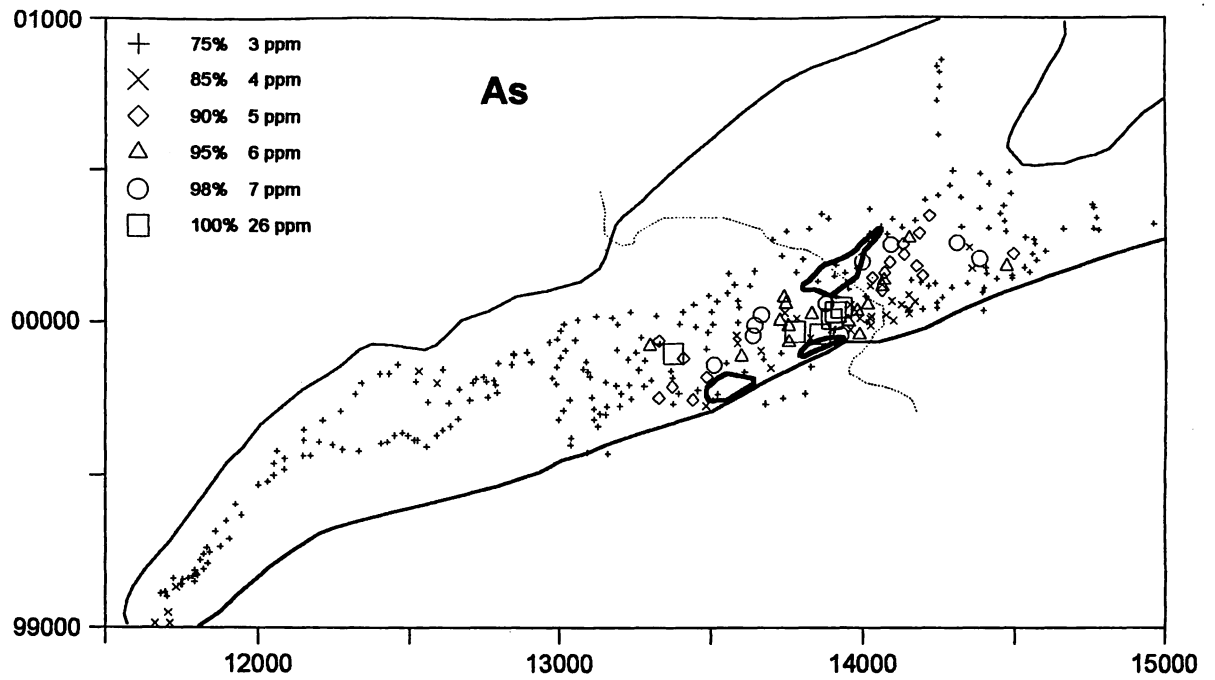


Figure 6: Concentrations of arsenic in stream sediments from Makhtesh Ramon.

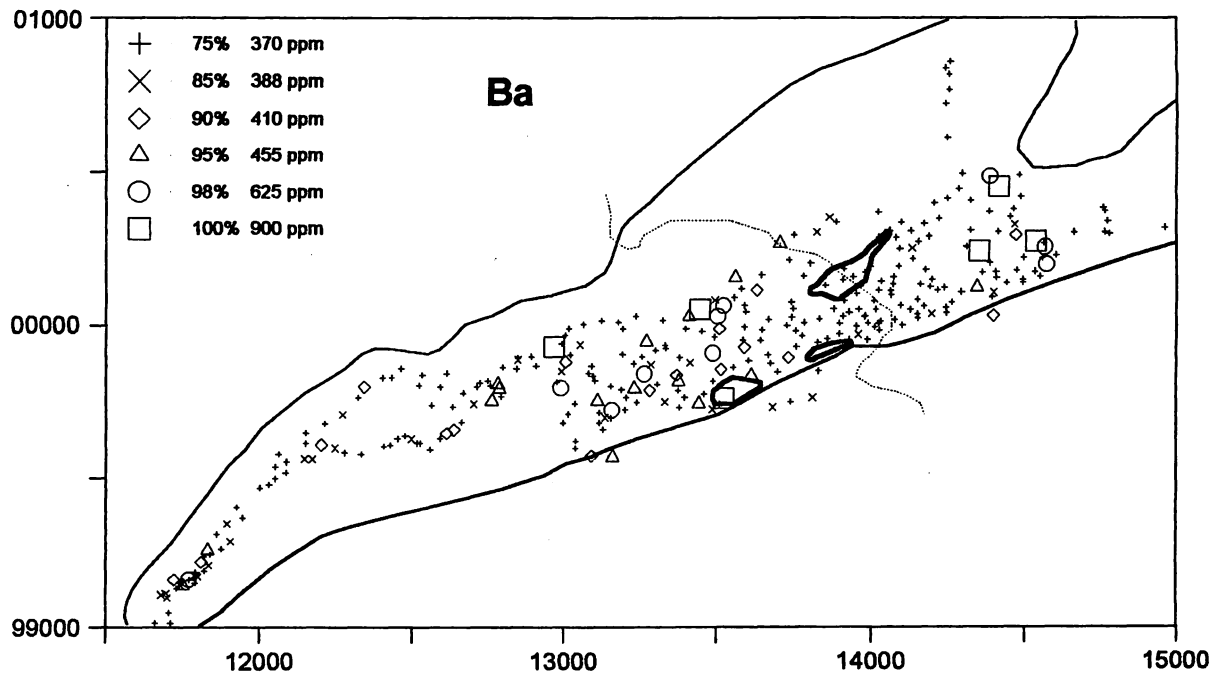


Figure 7: Concentrations of barium in stream sediments from Makhtesh Ramon.

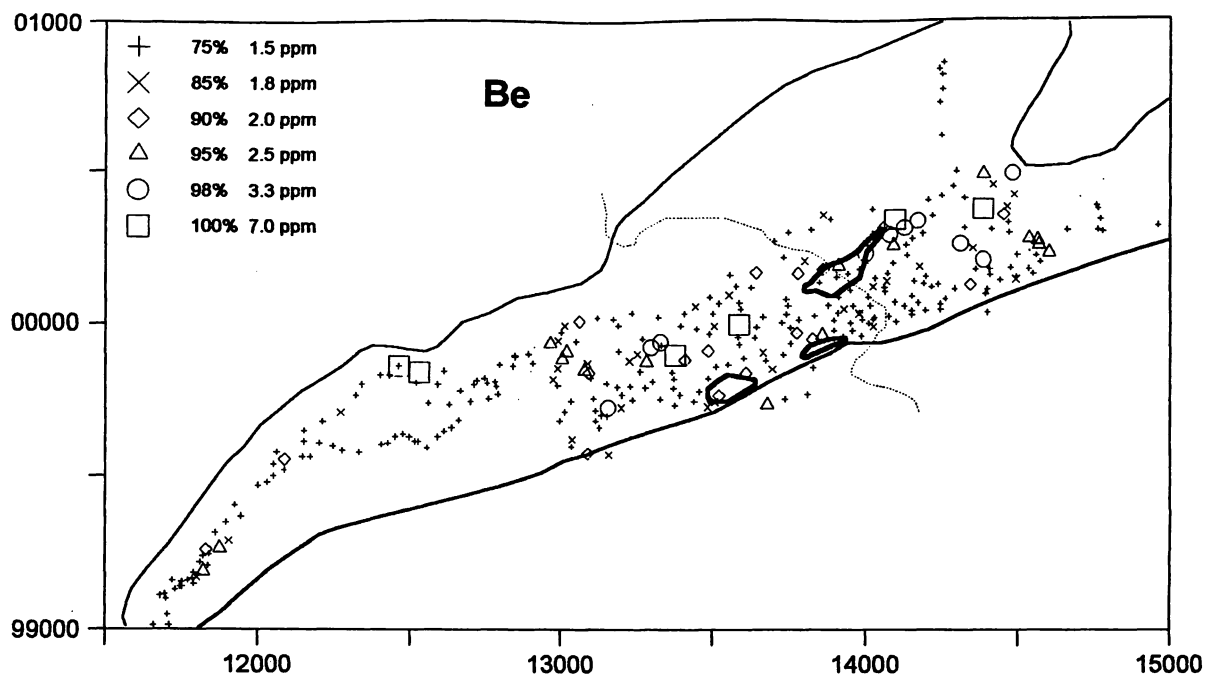


Figure 8: Concentrations of Beryllium in stream sediments from Makhtesh Ramon.

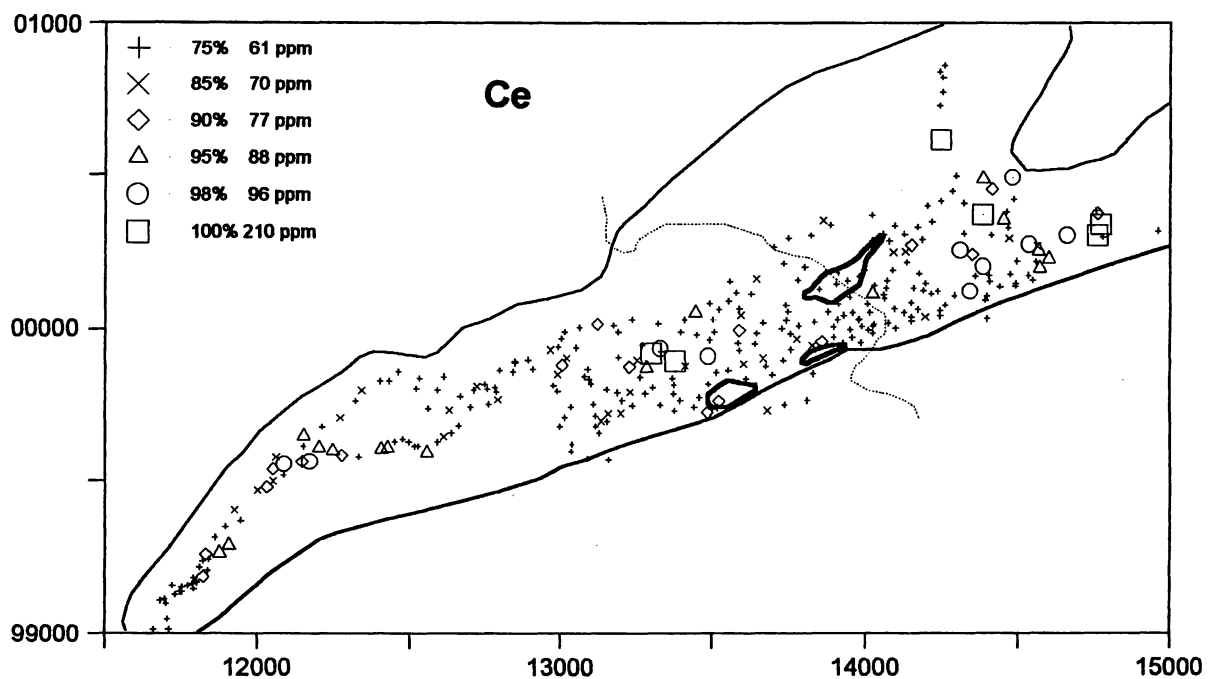


Figure 9: Concentrations of cerium in stream sediments from Makhtesh Ramon.

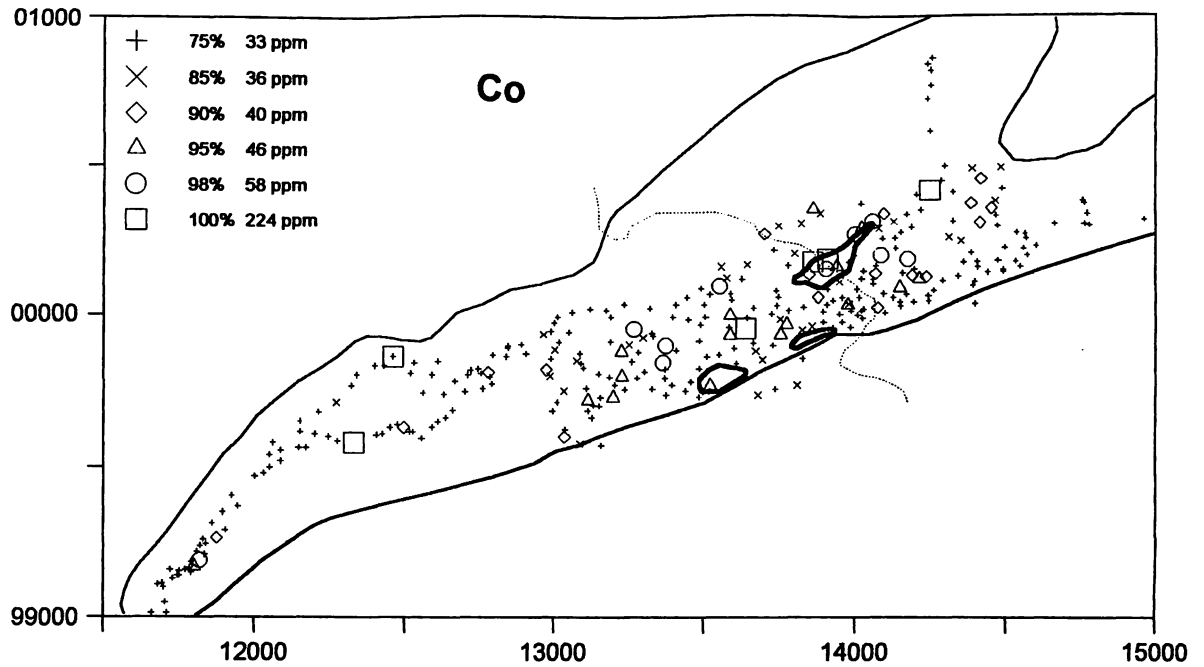


Figure 10: Concentrations of cobalt in stream sediments from Makhtesh Ramon.

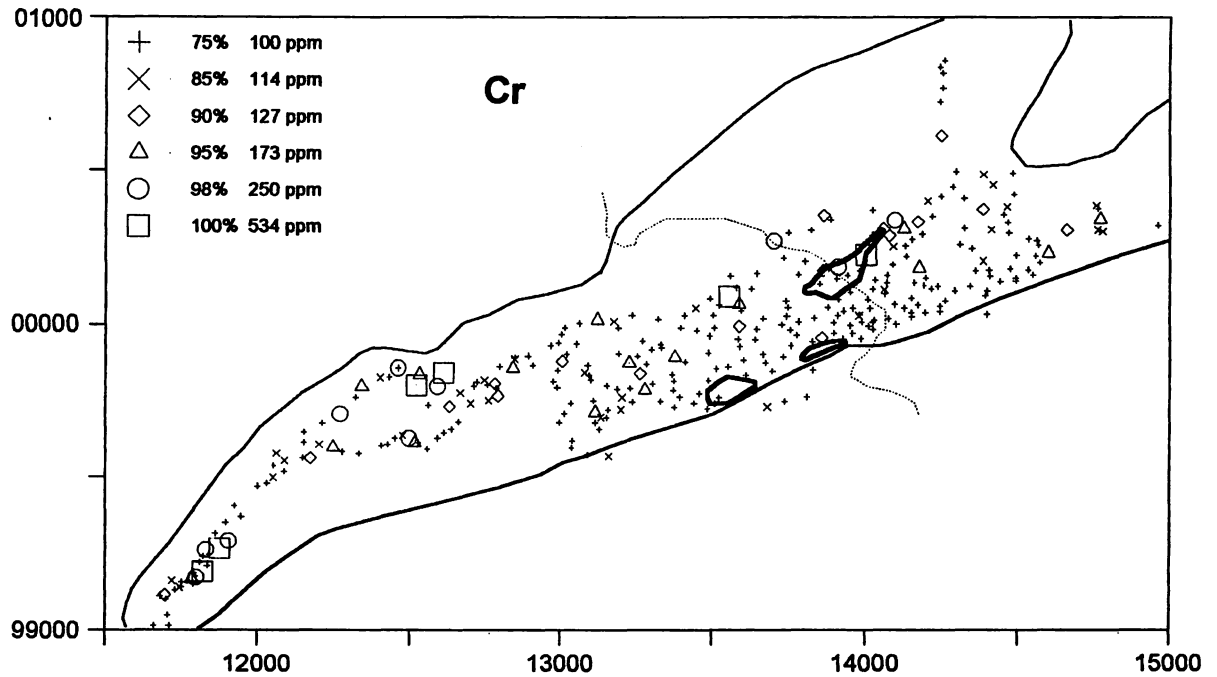


Figure 11: Concentrations of chromium in stream sediments from Makhtesh Ramon.

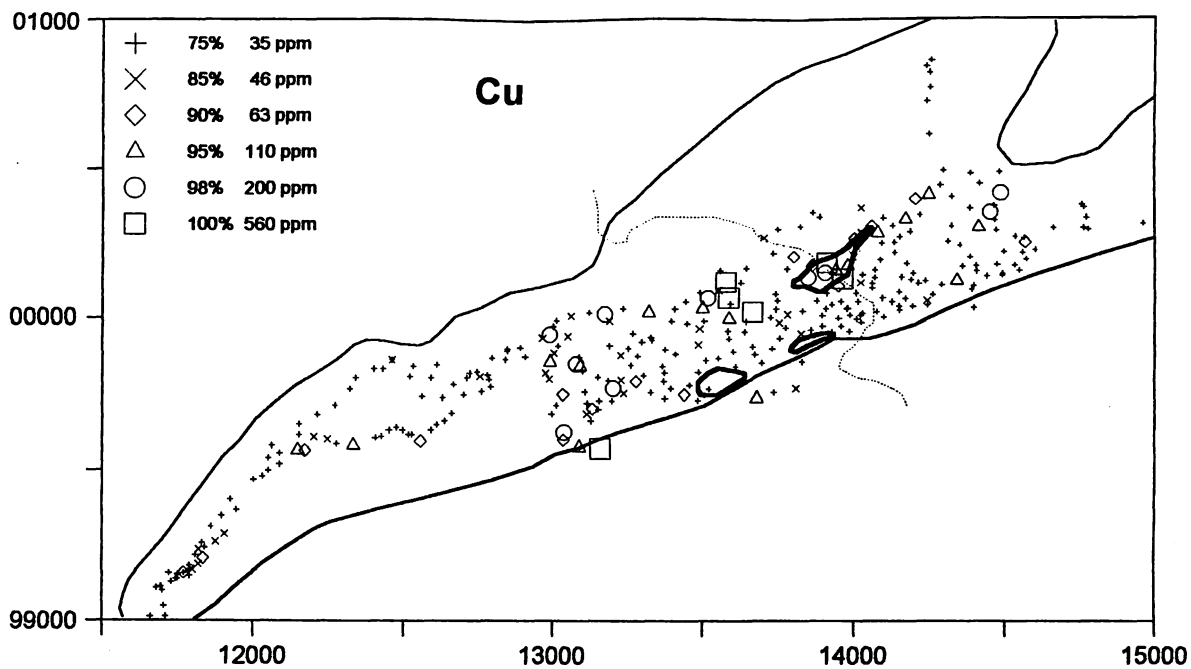


Figure 12: Concentrations of copper in stream sediments from Makhtesh Ramon.

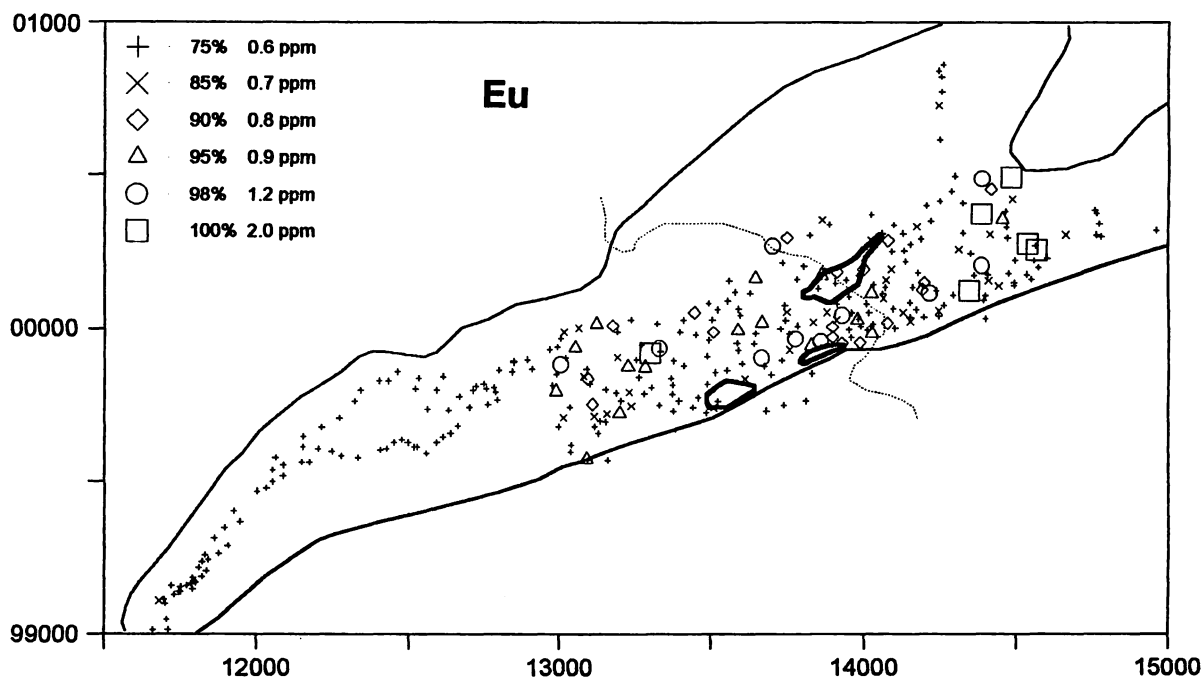


Figure 13: Concentrations of europium in stream sediments from Makhtesh Ramon.

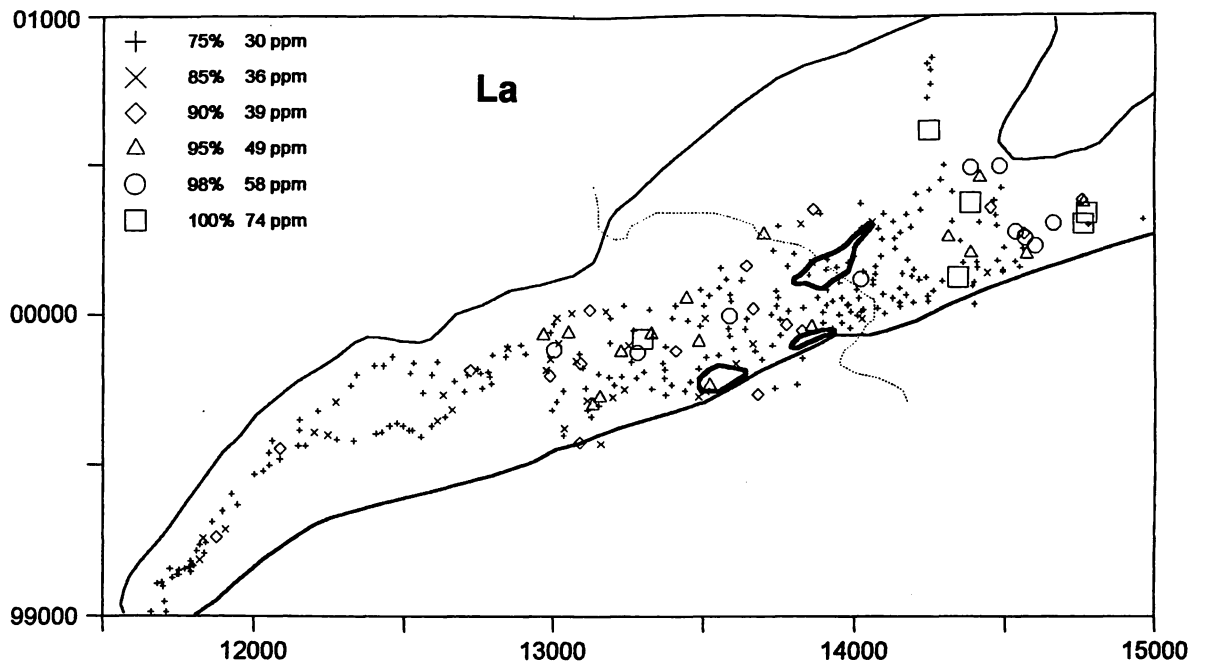


Figure 14: Concentrations of lanthanum in stream sediments from Makhtesh Ramon.

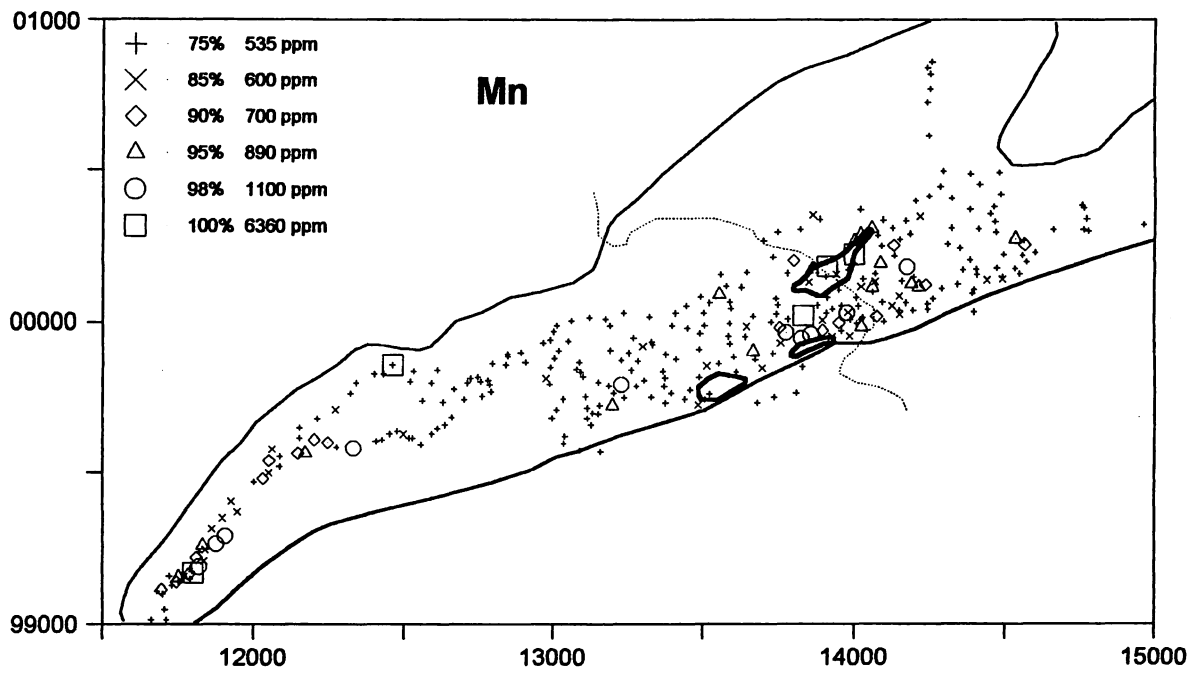


Figure 15: Concentrations of manganese in stream sediments from Makhtesh Ramon.

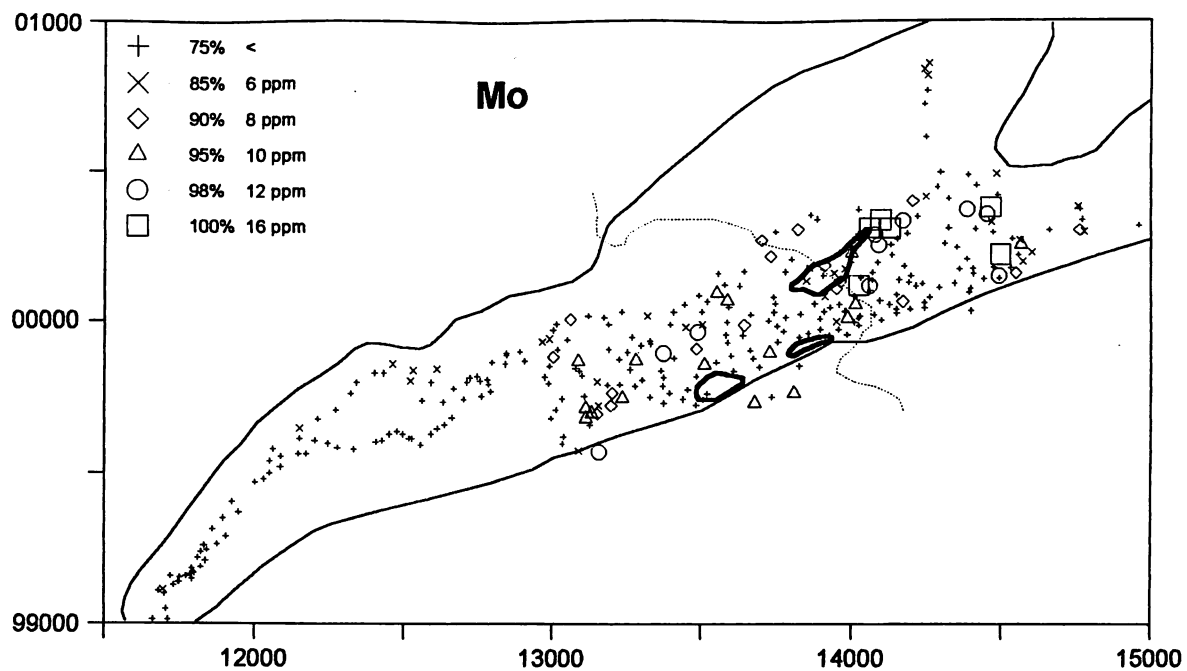


Figure 16: Concentrations of molybdenum in stream sediments from Makhtesh Ramon.

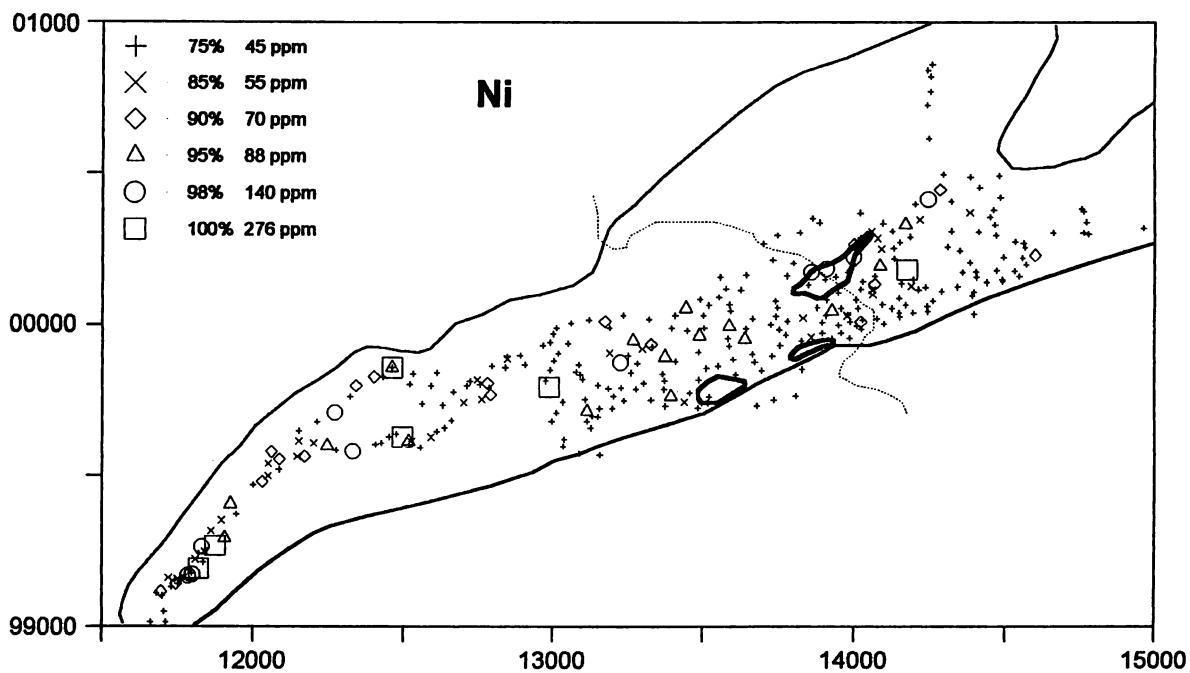


Figure 17: Concentrations of nickel in stream sediments from Makhtesh Ramon.

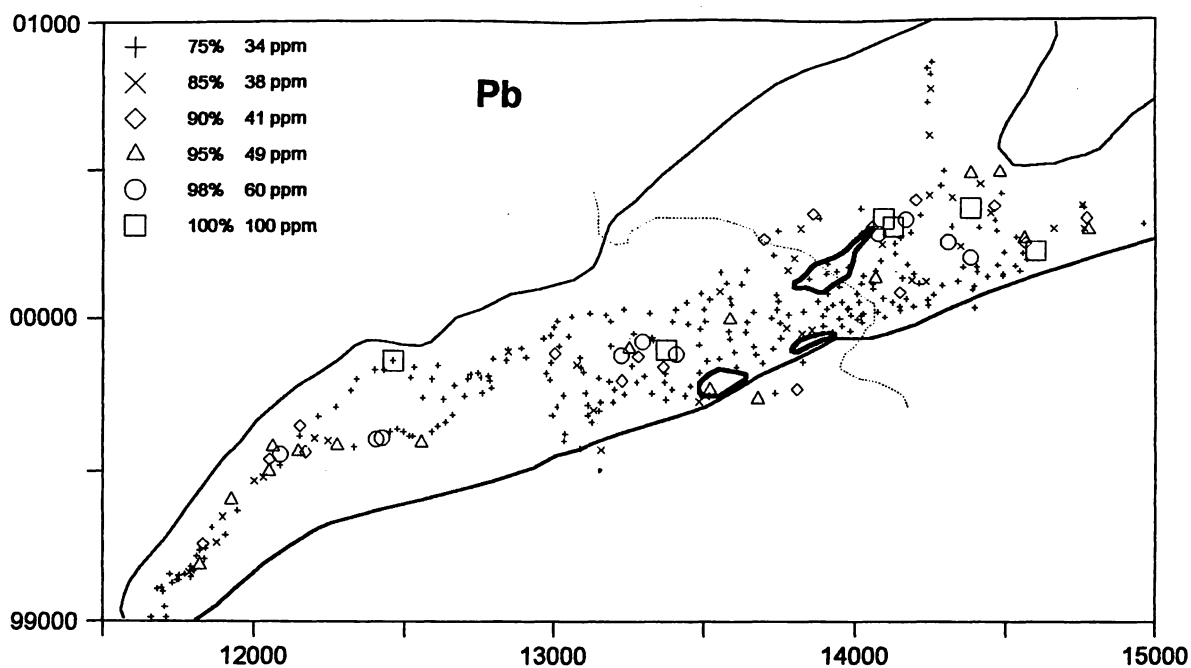


Figure 18: Concentrations of lead in stream sediments from Makhtesh Ramon.

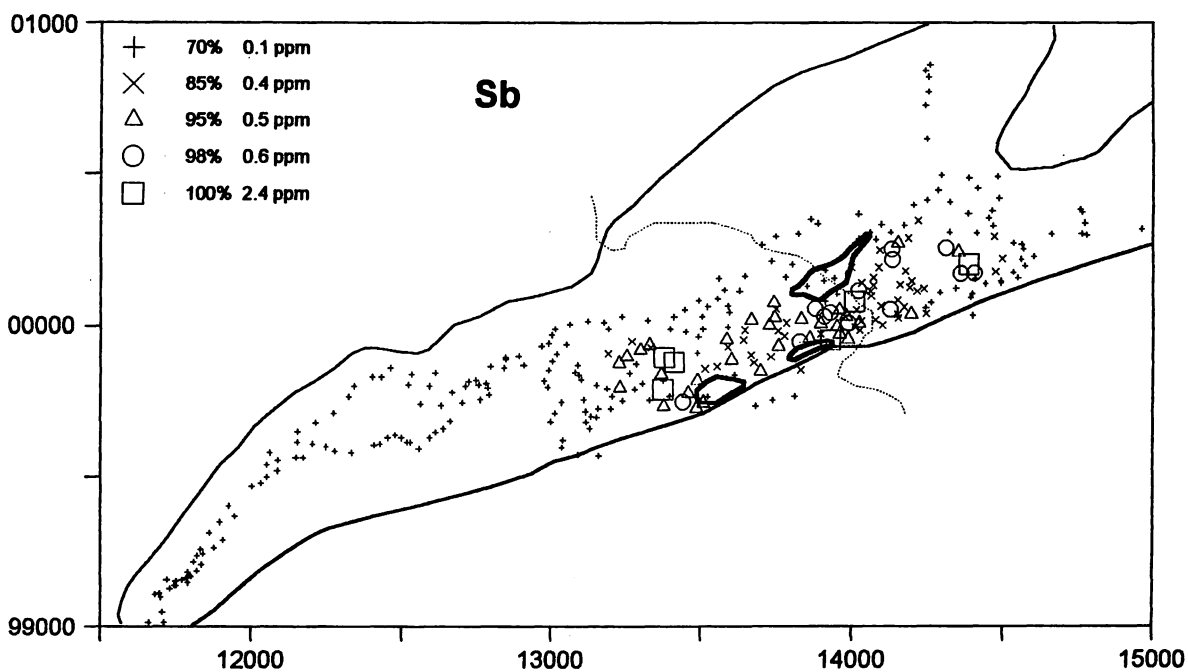


Figure 19: Concentrations of antimony in stream sediments from Makhtesh Ramon.

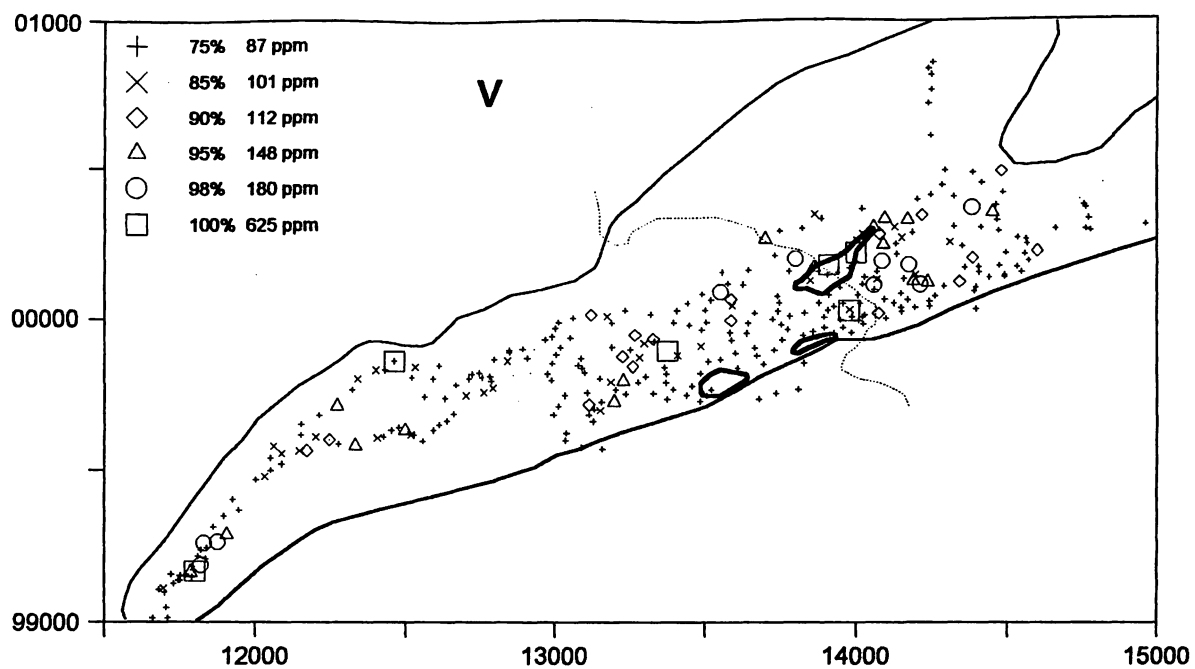


Figure 20: Concentrations of vanadium in stream sediments from Makhtesh Ramon.

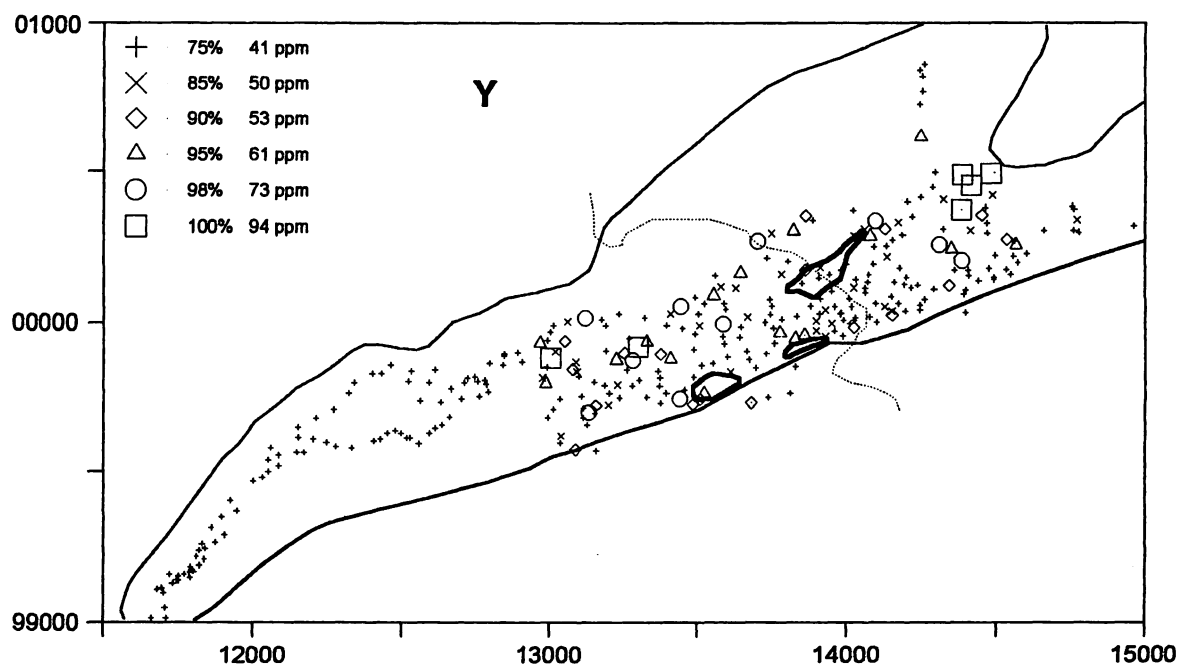


Figure 21: Concentrations of yttrium in stream sediments from Makhtesh Ramon.

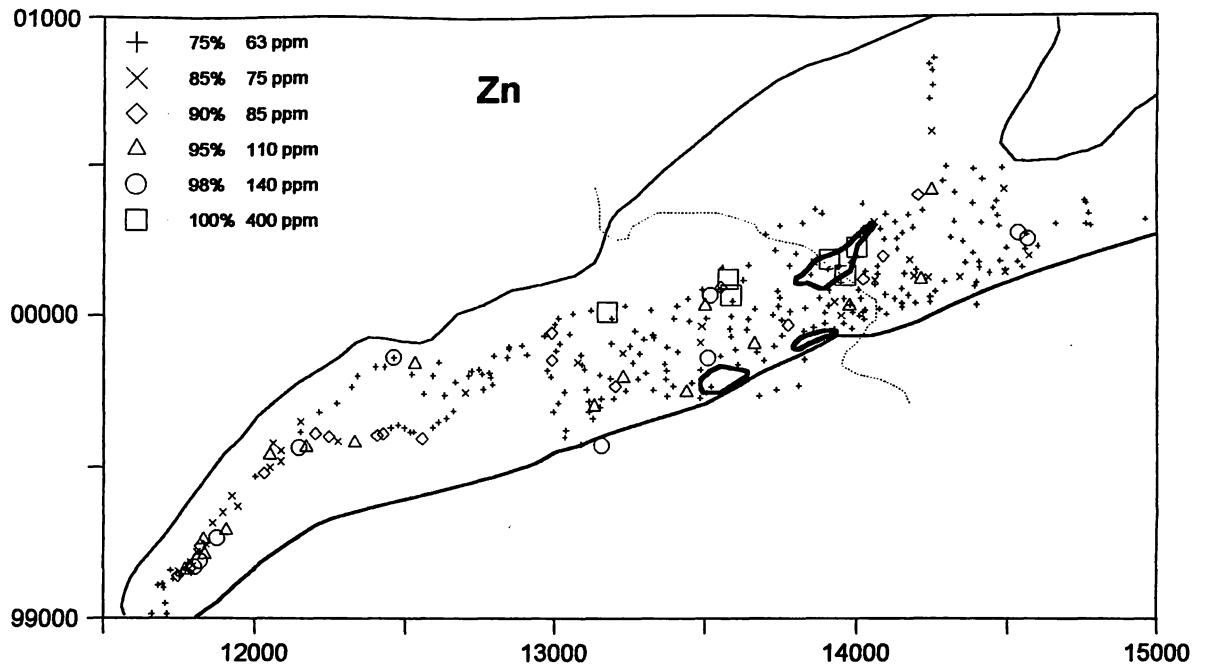


Figure 22: Concentrations of zinc in stream sediments from Makhtesh Ramon.

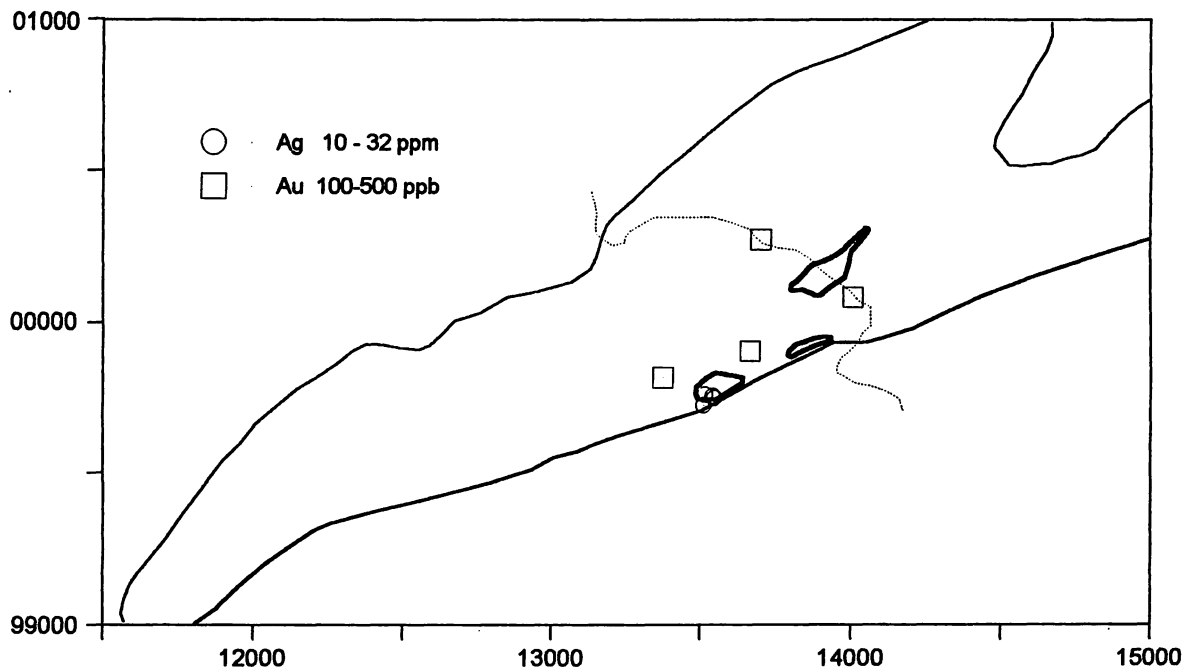


Figure 23: Anomalous concentrations of gold and silver in stream sediments from Makhtesh Ramon.

APPENDIX A

Analytical Results of Stream Sediment Samples from Makhtesh Ramon

0 = Below Detection Limit

S A M P L E	E A S T	N O R T H	S I D E	A L O N G	F E E D	C A R O	M A G I C	T I M E	P O W E R	S O U R C E	A S S E S S M E N T	B E H A V I O R	C O N D I T I O N	C O N T R O L	C O N T R O L	C O N T R O L	E N V I R O N M E N T	L E V E L	M E A S U R E M E N T	N O I S E	P R O B L E M	S O L U T I O N	V A R I A N T	Y E A R	Y E A R	Y E A R	Z O N	
1001	11660	99015	21.8	4.4	1.7	38.5	1.1	0.32	0.2	0.1	4	283	0.5	17	0	75	17	0.1	14	188	0	33	0	0.1	53	16	1	45
1002	11710	99015	15.6	3.7	1.3	41.5	0.8	0.23	0.1	0.1	4	247	0.4	14	0	83	18	0.3	13	115	0	33	0	0.1	51	15	1	49
1003	11705	99050	24.5	5.9	1.7	33.5	1.0	0.53	0.3	0.1	4	296	0.7	29	0	91	20	0.6	20	158	0	34	13	0.1	62	19	2	49
1004	11700	99100	37.7	6.5	2.7	24.2	1.7	0.54	0.3	0.1	3	375	0.9	29	16	65	17	0.6	22	342	0	33	31	0.1	58	18	2	40
1005	11680	99110	41.2	6.9	3.7	20.2	2.6	0.73	0.3	0.1	3	373	0.9	38	14	72	18	0.7	24	427	0	41	14	0.1	68	18	2	38
1006	11730	99130	28.6	5.1	2.1	31.8	1.3	0.48	0.2	0.1	4	348	0.6	25	0	83	18	0.1	18	236	0	34	13	0.1	59	17	2	46
1007	11720	99360	59.6	6.5	4.6	22.3	2.0	0.85	0.2	0.1	3	406	0.9	34	17	105	19	0.1	23	466	0	52	20	0.1	77	20	2	42
1008	11695	99115	46.0	7.4	5.8	15.9	2.4	1.11	0.2	0.1	3	380	1.2	41	21	124	20	0.1	26	612	5	60	19	0.1	93	21	2	43
1009	11750	99140	35.1	5.9	3.4	26.0	1.7	0.70	0.3	0.1	3	413	0.8	30	22	89	19	0.1	21	341	0	44	16	0.1	70	21	2	43
1010	11790	99150	44.2	7.1	3.6	18.8	2.6	0.74	0.2	0.1	3	343	1.0	34	14	66	17	0.1	23	478	0	32	18	0.1	68	19	2	36
1011	12905	99870	43.7	6.6	4.1	14.7	2.1	0.92	0.2	0.1	3	362	1.0	42	16	90	17	0.4	26	404	0	40	21	0.1	75	20	2	35
1012	12890	99900	55.5	5.5	2.8	22.2	3.1	0.62	0.1	0.1	3	314	0.7	33	9	64	12	0.3	21	374	0	27	23	0.1	57	18	2	32
1013	12845	99895	42.9	7.3	3.9	20.6	3.1	0.77	0.2	0.1	3	318	1.0	42	13	87	18	0.6	26	374	0	41	28	0.1	74	20	2	42
1014	12845	99890	41.2	8.0	4.8	17.1	2.4	1.04	0.3	0.1	3	380	1.2	57	18	100	19	0.5	31	414	0	53	35	0.1	85	23	2	42
1015	12665	99780	43.1	6.0	3.4	12.8	1.6	0.97	0.2	0.1	2	297	0.9	55	14	102	15	0.1	30	317	0	34	29	0.1	69	21	2	32
1016	12710	99800	47.3	8.0	3.9	18.9	2.3	0.98	0.2	0.1	3	349	1.1	46	14	99	18	0.1	28	412	0	39	15	0.1	79	23	3	42
1017	12720	99815	71.6	5.4	3.2	9.2	1.3	1.06	0.1	0.1	2	299	0.7	63	13	97	16	0.1	36	218	0	35	13	0.1	62	25	3	28
1018	12745	99820	54.2	7.7	4.7	15.3	1.9	1.12	0.2	0.1	3	357	1.1	45	16	100	19	0.1	27	424	0	46	18	0.1	75	23	3	42
1019	12755	99805	46.5	7.6	4.3	19.1	2.5	0.92	0.2	0.1	3	347	1.0	44	16	88	36	0.1	24	403	0	45	18	0.1	76	20	2	49
1020	12780	99810	55.2	7.1	5.7	13.9	2.1	1.23	0.2	0.1	2	417	1.0	50	39	118	19	0.1	25	354	0	65	15	0.1	87	27	3	39
1021	12795	99865	46.9	6.2	3.5	16.1	2.2	0.89	0.1	0.1	2	298	0.8	48	14	77	15	0.1	23	316	0	33	13	0.1	65	21	2	32
1022	12660	99685	48.1	7.5	4.0	16.8	2.5	0.92	0.1	0.1	3	340	1.0	57	16	87	32	0.1	31	364	0	39	12	0.1	76	20	2	41
1023	12635	99660	45.8	7.5	3.0	21.3	2.1	0.75	0.2	0.1	3	402	0.9	42	0	68	15	0.1	21	355	0	33	12	0.1	67	20	2	33
1024	12610	99648	57.7	6.9	3.3	14.3	1.9	0.98	0.1	0.1	2	395	0.9	63	12	81	16	0.1	33	290	0	31	22	0.1	70	27	3	31
1025	12590	99630	43.0	7.8	4.4	19.9	2.5	0.94	0.2	0.1	3	357	1.0	48	16	84	18	0.1	22	439	0	47	0	0.1	80	20	2	39
1026	12525	99615	47.5	7.2	4.1	19.2	2.5	0.92	0.2	0.1	3	338	1.0	47	17	82	16	0.1	23	376	0	45	15	0.1	76	20	2	34
1027	12515	99615	47.0	7.7	6.1	16.1	2.1	1.23	0.2	0.1	3	357	1.1	49	25	140	21	0.1	24	446	0	88	0	0.1	94	21	2	41
1028	12495	99630	55.6	7.8	9.9	10.0	1.7	1.98	0.2	0.1	3	370	1.4	57	39	250	29	0.1	29	559	0	155	15	0.1	138	24	3	52
1029	12450	99630	42.7	6.5	3.4	21.5	3.2	0.72	0.2	0.1	2	359	0.9	43	11	62	17	0.1	21	395	0	30	13	0.1	68	18	2	36
1030	12475	99640	48.6	6.6	4.0	18.8	2.1	1.02	0.2	0.1	3	347	1.0	52	19	102	15	0.1	24	451	0	39	15	0.1	80	22	3	34
1031	12630	99735	54.2	7.6	3.2	17.4	1.8	1.15	0.2	0.1	3	358	1.1	62	14	114	19	0.1	32	351	0	32	29	0.1	76	27	4	36
1032	12700	99745	50.0	7.1	5.0	19.0	2.5	0.97	0.2	0.1	3	381	1.0	54	23	110	18	0.1	24	410	0	52	14	0.1	88	20	2	74
1033	12760	99755	48.6	7.6	5.4	18.1	2.7	1.30	0.2	0.1	2	439	1.2	57	21	113	20	0.1	25	455	0	54	16	0.1	94	24	3	38
1034	12790	99770	52.1	8.3	5.9	15.1	2.5	1.26	0.2	0.1	3	340	1.1	62	30	125	20	0.1	28	357	0	68	21	0.1	89	24	3	42
1035	12785	99795	47.1	6.8	3.0	22.1	2.5	0.67	0.2	0.1	3	421	1.1	48	13	60	14	0.1	21	413	0	25	13	0.1	62	19	2	35
1036	12560	99740	47.3	7.5	3.8	19.8	2.3	0.81	0.2	0.1	3	352	1.1	54	16	77	19	0.1	23	361	0	34	20	0.1	73	21	2	35
1037	12430	99830	47.3	6.9	3.9	20.8	2.4	0.77	0.2	0.1	2	357	1.0	48	18	78	18	0.1	20	395	0	43	18	0.1	74	18	2	38
1038	12400	99830	44.5	7.4	5.9	19.1	2.3	1.11	0.1	0.1	3	345	1.1	55	23	102	20	0.1	23	465	0	59	16	0.1	96	20	2	41
1039	12340	99800	50.0	7.7	5.9	16.8	2.1	1.26	0.2	0.1	2	393	1.2	64	27	140	18	0.1	27	403	0	65	12	0.1	100	22	3	34
1040	12320	99765	50.1	6.8	3.5	19.5	2.8	0.76	0.1	0.1	2	338	0.9	59	17	71	16	0.1	25	387	0	36	17	0.1	72	18	2	34
1041	12270	99710	54.3	8.9	8.1	11.3	1.9	1.57	0.2	0.1	2	374	1.6	68	34	193	26	0.1	30	577	0	94	21	0.1	126	24	3	43
1042	12210	99680	50.6	5.7	2.8	19.7	2.6	0.64	0.1	0.1	3	323	0.8	47	14	63	15	0.1	18	342	0	24	28	0.1	62	19	2	34
1043	12150	99615	47.7	6.5	3.8	20.7	2.5	0.82	0.2	0.1	3	333	0.9	54	16	89	16	0.1	21	438	0	46	16	0.1	76	19	2	35
1044	12840	99860	61.9	4.9	5.1	14.2	2.2	1.16	0.2	0.1	0	343	0.9	58	25	130	17	0.1	23	467	0	43	21	0.1	93	21	3	37
1045	11770	99160	37.0	6.9	4.0	26.6	2.6	0.84	0.4	0.1	2	488	1.0	35	4	98	59	0.1	24	570	0	50	28	0.1	77	23	3	87
1046	11745	99140	42.5	8.4	5.6	18.2	2.8	0.95	0.2	0.1	2	372	1.2	33	8	110	29	0.1	26	666	0	65	32	0.1	84	19	2	75

S	E	N	S	A	F	C	H	T	P	S	A	B	B	C	C	C	C	E	L	M	M	N	P	S	V	Y	Z	
A	A	O	I	L	E	A	G	I	2	O	S	A	E	E	O	R	U	U	A	N	O	I	B	B				
M	S	R	O	2	2	O	O	O	O	3																		
P	T	T	2	O	O			2	5																			
L		H		3	3																							
E																												
1047	11785	99166	39.4	9.8	7.8	16.8	3.0	1.24	0.3	0.1	2	356	1.4	40	16	134	34	0.1	28	696	0	92	34	0.1	120	21	2	84
1048	11750	99155	47.4	7.8	5.0	17.5	2.8	0.88	0.2	0.1	2	352	1.1	39	14	81	24	0.1	23	700	0	54	29	0.1	75	19	2	70
1049	11770	99160	70.6	4.5	2.5	9.6	1.8	0.63	0.1	0.1	1	290	0.6	36	3	48	22	0.1	22	120	0	25	25	0.1	41	19	2	47
1050	11800	99170	39.7	10.0	12.2	14.1	2.9	2.32	0.3	0.1	1	378	1.7	44	44	201	38	0.1	24	1530	0	140	29	0.1	200	21	3	120
1051	11795	99175	59.2	8.4	4.4	13.2	2.4	0.90	0.2	0.1	2	388	1.0	54	8	90	37	0.1	29	482	0	45	22	0.1	76	28	4	68
1052	11820	99190	37.7	14.5	15.8	7.5	2.7	2.32	0.3	0.1	2	250	2.0	74	46	262	45	0.1	33	926	0	163	42	0.1	177	23	2	123
1053	11835	99210	35.7	7.0	4.9	24.9	3.6	0.67	0.2	0.1	2	385	1.1	50	7	67	61	0.1	22	580	0	44	22	0.1	72	19	2	86
1054	11790	99185	45.7	6.5	4.8	20.3	2.8	0.72	0.2	0.1	2	345	0.9	59	6	81	25	0.1	27	518	0	42	29	0.1	69	20	2	68
1055	11810	99220	42.9	7.4	5.1	21.0	3.1	0.77	0.2	0.1	2	390	1.1	45	8	79	26	0.1	23	635	0	50	34	0.1	74	19	2	70
1056	11820	99240	54.0	6.6	4.8	16.1	2.9	0.76	0.2	0.1	2	350	1.1	61	9	88	39	0.2	26	430	0	42	29	0.1	71	24	3	83
1057	11875	99265	37.6	12.4	13.0	11.6	3.2	2.09	0.4	0.1	2	365	2.1	79	38	260	42	0.1	38	980	0	153	37	0.1	175	23	3	113
1058	11840	99245	39.3	7.1	4.5	23.3	3.0	0.84	0.4	0.1	2	356	1.1	50	8	91	26	0.1	24	565	0	53	30	0.1	83	20	2	75
1059	11830	99260	41.2	10.0	9.6	15.4	3.1	1.44	0.4	0.1	2	440	1.8	71	28	216	34	0.1	32	862	0	137	39	0.1	150	21	2	91
1060	11860	99315	44.8	7.0	4.1	19.9	3.4	0.71	0.2	0.1	2	355	1.1	56	8	72	24	0.1	25	555	0	45	27	0.1	72	19	2	70
1061	11905	99290	44.0	9.1	8.7	14.5	4.4	1.50	0.3	0.1	2	370	1.7	80	27	208	40	0.1	31	936	0	77	34	0.1	142	23	2	98
1062	11895	99350	41.0	7.2	4.0	21.9	3.9	0.66	0.2	0.1	2	377	1.2	59	10	71	32	0.1	23	577	0	46	35	0.1	75	19	2	73
1063	11945	99370	30.0	8.0	3.8	27.9	3.5	0.58	0.1	0.1	2	218	1.0	44	6	65	30	0.1	17	550	0	37	32	0.1	70	15	1	71
1064	11925	99405	50.6	8.3	4.7	15.4	3.6	0.86	0.2	0.1	2	348	1.3	62	11	99	30	0.1	30	555	0	78	43	0.1	85	20	2	72
1065	12000	99470	53.6	6.6	3.6	17.3	3.2	0.75	0.2	0.1	2	330	1.0	65	9	80	23	0.1	24	454	0	41	35	0.1	71	20	2	63
1066	12030	99480	42.8	8.4	4.7	19.8	3.9	0.82	0.2	0.1	2	353	1.3	74	11	98	33	0.1	29	605	0	60	36	0.1	92	22	2	82
1067	12050	99500	47.2	7.4	4.5	18.9	3.5	0.95	0.2	0.1	2	352	1.1	70	10	107	22	0.1	26	592	0	55	42	0.1	84	21	2	71
1068	12050	99540	47.6	7.7	4.7	18.3	3.9	0.83	0.2	0.1	2	340	1.2	74	14	90	28	0.1	28	610	0	55	40	0.1	85	23	2	85
1069	12086	99556	55.7	11.0	5.2	11.7	2.5	1.43	0.2	0.1	2	270	1.9	89	10	109	24	0.1	37	470	0	65	49	0.1	94	28	3	72
1070	12085	99520	44.0	7.2	3.6	21.3	3.2	0.65	0.2	0.1	2	352	1.0	57	8	66	26	0.1	23	528	0	35	34	0.1	72	20	2	72
1071	12060	99580	48.6	8.3	4.8	17.7	3.0	0.94	0.2	0.1	2	337	1.3	69	13	101	28	0.1	27	540	0	63	44	0.1	90	23	2	75
1072	12170	99565	49.6	8.8	6.0	14.0	3.7	1.29	0.2	0.1	2	384	1.3	88	18	127	51	0.1	30	724	0	69	41	0.1	110	23	2	85
1073	12145	99565	39.3	8.2	4.5	22.6	3.6	0.80	0.4	0.1	3	382	1.4	77	11	90	109	0.1	23	615	0	51	48	0.1	92	21	2	114
1074	12200	99610	39.3	7.7	5.1	22.4	3.8	1.02	0.4	0.1	2	393	1.2	78	10	105	46	0.1	31	650	0	53	37	0.1	100	25	3	84
1075	12245	99600	48.4	8.2	5.9	16.9	3.8	1.16	0.2	0.1	2	377	1.3	85	17	154	38	0.1	32	698	0	71	36	0.1	112	22	2	81
1076	12275	99585	46.8	7.1	3.8	19.0	3.5	0.85	0.2	0.1	2	360	1.1	77	12	87	29	0.1	26	498	0	36	45	0.1	81	22	2	67
1077	12330	99580	61.3	8.1	8.8	7.8	3.8	2.02	0.2	0.1	2	314	1.2	50	167	0	68	0.1	30	950	0	90	30	0.1	142	25	3	100
1078	12555	99595	49.6	7.7	3.1	19.0	3.0	0.83	0.2	0.1	3	356	1.1	82	10	72	63	0.1	23	470	0	31	49	0.1	80	20	2	84
1079	12405	99605	46.2	8.8	3.8	18.2	3.2	0.88	0.2	0.1	2	346	1.2	85	10	80	32	0.1	25	517	0	43	52	0.1	89	21	2	79
1080	12425	99610	42.1	7.4	3.4	22.4	3.7	0.55	0.2	0.1	3	343	1.3	85	9	58	26	0.1	21	500	0	35	53	0.1	80	19	1	82
1081	12150	99650	48.0	6.2	3.4	20.3	3.1	0.67	0.2	0.1	2	345	0.9	78	10	73	19	0.1	20	520	0	35	41	0.1	76	21	2	72
1082	12460	99860	30.5	23.7	21.6	0.1	1.0	3.12	0.3	0.1	1	35	4.7	28	74	185	44	0.1	13	528	0	276	74	0.1	223	14	3	116
1083	12460	99860	9.6	1.2	2.1	47.1	4.3	0.05	0.1	0.1	0	120	0.3	46	12	6	5	0.1	10	4320	0	70	0	0.1	30	15	0	20
1084	12460	99860	7.2	1.3	3.3	47.6	2.3	0.05	0.1	0.1	0	160	0.5	58	9	27	9	0.1	19	6360	0	37	12	0.1	47	22	1	21
1085	12520	99805	98.9	0.1	0.7	1.3	0.5	0.04	0.1	0.1	1	53	0.1	0	6	534	4	0.1	0	48	5	25	0	0.1	10	1	0	10
1086	12530	99840	74.1	2.3	22.3	0.1	0.6	0.47	0.1	0.1	4	39	3.3	46	13	128	22	0.1	22	470	0	25	0	0.1	96	20	3	100
1087	12590	99800	90.0	2.3	0.7	1.6	0.5	0.07	0.1	2.1	4	176	0.1	15	3	230	8	0.1	7	16	0	6	0	0.1	6	3	0	24
1088	12610	99845	89.1	0.2	13.5	0.1	0.5	0.02	0.1	0.1	1	97	0.2	5	7	255	7	0.1	4	41	0	25	0	0.1	10	1	1	45
1089	14255	860	63.0	4.2	2.6	11.3	2.1	0.75	0.3	0.1	1	284	0.8	36	8	69	22	0.1	23	233	0	25	29	0.1	46	22	2	51
1090	14240	840	68.2	4.0	3.0	10.7	1.9	0.87	0.3	0.1	1	277	0.9	35	9	83	23	0.1	24	305	0	25	26	0.1	47	22	2	53
1091	14250	820	50.5	5.1	2.5	17.4	2.7	0.68	0.3	0.1	1	300	1.0	38	8	66	25	0.5	19	338	0	21	27	0.1	50	21	2	60
1092	14250	770	66.3	7.9	1.9	8.8	1.8	1.12	0.2	0.1	0	195	1.0	45	6	87	17	0.3	27	200	0	20	36	0.1	48	28	3	45

S	E	N	S	A	F	C	M	T	P	S	A	B	B	C	C	C	C	E	L	M	M	N	P	S	V	Y	Y	Z
A	A	O	I	L	E	A	G	I	2	O	S	A	E	E	O	R	U	U	A	N	O	I	B	B				
M	S	R	O	2	2	O	O	O	O	3																		
P	T	T	2	O	O			2	5																			
L		H		3	3																							
E																												
1093	14240	725	62.6	5.7	3.0	9.8	1.0	1.10	0.2	0.1	1	330	1.2	60	9	68	22	0.7	30	244	0	25	25	0.1	56	28	3	49
1094	14245	615	59.8	6.3	3.7	11.3	2.1	1.60	0.3	0.1	1	315	1.3	104	11	124	23	0.1	70	330	0	31	35	0.1	69	54	6	68
1095	14245	415	57.5	6.9	3.5	12.1	2.5	1.12	0.3	0.1	1	334	1.3	45	224	85	90	0.5	23	352	0	143	35	0.1	69	25	2	84
1096	14200	400	51.8	7.1	4.4	15.5	3.1	1.22	0.4	0.1	1	367	1.4	46	16	109	55	0.1	23	459	6	41	38	0.1	85	24	2	82
1097	14465	330	74.3	5.1	3.0	6.3	2.0	3.20	0.2	0.1	0	382	1.1	51	13	97	26	0.1	28	277	5	25	28	0.1	58	27	3	52
1098	14560	270	61.2	10.7	3.5	7.4	2.5	1.15	0.3	0.1	1	263	2.0	64	11	75	24	0.1	38	290	3	31	46	0.1	64	34	3	48
1099	14600	230	51.1	13.2	6.3	8.4	2.6	1.90	0.4	0.1	2	308	2.4	85	19	152	34	0.1	49	370	6	63	60	0.1	105	38	3	63
1100	14570	200	47.1	5.9	3.5	18.4	4.3	1.23	0.3	1.1	2	515	1.3	84	24	93	21	0.1	42	470	4	39	30	0.1	73	34	3	64
1101	14660	305	70.0	6.5	2.5	7.1	1.7	1.20	0.2	0.1	1	300	1.1	89	12	117	20	0.6	54	229	0	22	35	0.1	63	37	3	42
1102	14760	375	74.1	4.6	2.5	6.2	1.7	0.84	0.2	0.1	1	300	0.8	72	6	70	16	0.2	45	143	0	21	25	0.1	51	28	2	38
1103	14755	385	68.8	6.1	3.8	7.6	1.9	1.27	0.3	0.1	1	360	1.1	55	9	110	19	0.1	38	194	5	29	37	0.1	69	32	3	45
1104	14770	340	68.5	5.4	3.2	8.4	1.8	1.34	0.3	0.1	1	360	1.0	100	9	128	19	0.1	60	232	0	25	38	0.1	69	44	4	46
1105	14760	305	69.6	6.3	3.1	6.6	1.8	1.43	0.3	0.1	1	327	1.1	104	10	106	19	0.1	64	180	7	25	36	0.1	70	39	4	48
1106	14776	300	64.3	6.7	2.7	10.9	2.2	1.29	0.4	0.1	1	280	1.0	51	8	104	21	0.1	30	238	5	29	42	0.1	66	38	3	49
1107	14960	320	90.4	2.5	0.9	2.7	1.5	0.63	0.2	0.1	0	166	0.4	51	6	40	9	0.1	28	79	0	8	23	0.1	33	24	2	32
1108	14390	95	49.0	5.6	3.8	17.7	3.8	0.88	0.3	0.1	1	272	1.2	40	17	74	25	0.2	21	414	0	39	30	0.1	67	21	1	55
1109	14395	35	26.8	4.3	2.0	33.4	3.3	0.46	0.5	0.1	1	392	0.9	24	5	52	21	0.1	15	292	0	17	13	0.1	48	20	1	53
1110	14490	150	20.0	5.4	2.7	27.4	7.1	0.58	0.3	8.2	2	234	1.2	40	5	44	19	0.1	16	382	10	20	31	0.1	43	18	1	56
2354	13978	34	42.0	7.3	4.5	19.9	4.8	1.07	0.1	0.3	5	285	1.3	51	35	59	22	0.6	24	600	0	45	22	0.5	88	38	2	60
2355	13956	54	31.0	5.0	2.3	22.6	8.8	0.43	0.1	0.9	4	330	0.8	61	25	40	17	0.4	18	400	0	40	15	0.5	46	30	2	29
2363	14005	82	36.0	5.3	2.4	22.8	7.2	0.46	0.1	0.5	3	335	1.0	49	28	44	25	0.4	19	410	0	35	17	0.6	49	31	2	37
2375	13948	99998	48.0	6.7	3.3	22.0	2.9	0.67	0.1	0.1	5	330	1.2	45	32	63	18	0.6	26	605	0	45	27	0.5	60	43	2	73
2379	13926	45	42.5	8.0	3.3	20.8	4.1	0.60	0.1	0.8	6	355	1.6	56	30	60	22	0.9	30	535	0	85	27	0.5	57	42	2	63
2380	13907	30	39.5	6.6	3.3	26.3	2.9	0.60	0.1	0.1	9	330	1.2	44	30	64	22	0.6	25	525	0	35	22	0.5	71	38	2	58
2390	13876	56	36.5	6.0	2.9	25.4	4.7	0.56	0.1	1.2	6	325	1.0	42	37	50	18	0.6	22	440	0	40	17	0.5	60	35	2	55
2391	13830	23	40.0	7.4	3.6	23.3	3.7	0.60	0.1	1.1	5	255	1.4	47	31	53	20	0.6	25	5000	0	50	23	0.4	60	40	2	61
2403	13724	2	40.0	5.6	3.0	23.4	5.2	0.50	0.1	0.1	5	335	0.9	39	29	52	17	0.6	21	454	0	35	20	0.4	55	33	2	37
2407	13741	28	33.5	5.6	2.9	24.7	4.1	0.51	0.1	5.4	4	290	0.9	40	28	45	17	0.5	20	420	0	25	20	0.4	55	32	1	25
2408	13752	99984	48.0	6.4	3.2	21.0	2.5	0.58	0.2	0.1	5	340	1.1	42	34	58	41	0.6	25	675	0	25	23	0.3	56	40	2	40
2410	13780	11	47.0	6.3	3.1	22.6	2.5	0.60	0.1	0.1	4	345	1.0	45	31	66	36	0.5	24	490	0	20	30	0.3	62	36	2	38
2414	13745	57	42.5	6.3	3.2	23.9	3.9	0.68	0.1	0.1	5	350	1.1	48	30	68	24	0.7	25	480	0	25	21	0.3	67	37	2	38
2419	13739	78	43.5	6.4	3.1	25.7	2.0	0.62	0.1	0.1	5	300	1.1	45	28	61	22	0.6	25	415	0	40	15	0.4	65	37	2	29
2426	13894	8	44.0	6.9	3.3	24.0	2.1	0.59	0.2	0.1	6	310	1.2	45	30	64	32	0.7	26	540	0	25	20	0.4	60	44	2	38
2427	13774	99967	57.5	10.1	5.0	13.5	1.6	0.85	0.3	0.1	7	310	2.0	65	40	62	25	1.1	38	1100	0	45	38	0.3	70	60	3	82
2436	13755	99932	51.0	7.1	3.3	23.5	1.9	0.61	0.1	0.1	5	325	1.3	45	40	65	25	0.7	27	590	0	25	24	0.4	60	40	2	30
2438	13826	99854	40.0	4.4	2.1	29.2	0.7	0.05	0.1	0.1	3	290	0.6	28	28	46	15	0.5	17	380	0	25	13	0.3	45	30	1	44
2444	13664	21	37.0	7.2	3.3	26.3	1.7	0.61	0.1	0.1	5	310	1.4	57	29	59	225	0.9	37	415	0	30	28	0.4	61	47	3	53
2449	13582	99955	40.5	6.4	3.3	24.8	3.3	0.65	0.1	1.8	4	310	1.1	45	29	61	23	0.6	23	495	0	30	21	0.4	68	38	2	35
2464	13587	99930	32.5	5.0	2.6	24.3	3.6	0.54	0.1	8.9	4	405	0.9	60	45	40	20	0.5	20	410	0	40	17	0.3	54	35	2	21
2465	13599	99887	32.5	5.8	2.4	22.8	4.7	0.46	0.1	9.2	5	220	1.1	65	31	48	20	0.4	24	350	0	35	22	0.4	52	34	2	14
2472	13984	99956	42.0	7.0	3.5	25.5	2.5	0.66	0.1	0.1	5	265	1.3	48	29	58	25	0.8	25	550	0	20	26	0.4	63	40	2	40
2504	13955	99973	37.0	4.4	2.2	25.2	3.3	0.51	0.1	7.5	4	385	0.7	46	28	57	16	0.4	19	395	0	15	17	0.4	46	31	2	18
2505	13925	99954	48.0	7.4	3.5	21.7	2.2	0.66	0.1	0.1	6	305	1.3	51	31	73	25	0.7	29	580	0	40	25	0.6	64	44	2	38
2510	13894	99974	49.5	7.3	3.5	16.2	1.6	0.66	0.2	0.1	4	290	1.3	50	32	55	19	0.8	29	665	0	20	26	0.3	53	46	2	32
2516	13856	99959	53.0	12.5	5.5	11.																						

S	E	N	S	A	F	C	H	T	P	S	A	B	B	C	C	C	C	E	L	M	M	N	P	S	V	Y	Y	Z
A	A	O	I	L	E	A	G	I	2	O	S	A	E	E	O	R	U	U	A	N	O	I	B	B			B	N
M	S	R	O	2	2	O	O	O	O	3																		
P	T	T	2	O	O			2	5																			
L		H		3	3																							
E																												
2521	13825	99947	54.0	9.6	4.4	14.2	1.5	0.80	0.2	1.2	4	305	1.8	66	35	59	43	0.9	38	970	0	25	37	0.5	65	57	3	42
2524	14022	99986	48.0	8.3	3.9	17.6	1.6	0.67	0.2	0.1	4	290	1.6	58	33	60	22	0.8	33	750	0	25	30	0.3	64	50	3	37
2542	14008	99997	38.0	6.9	3.0	21.4	4.2	0.58	0.1	0.1	3	285	1.3	42	30	52	24	0.5	25	455	0	30	28	0.3	54	37	2	26
2545	14021	10	36.0	7.0	3.5	23.0	3.7	0.77	0.1	0.1	4	300	1.2	45	31	62	24	0.3	25	520	0	66	25	0.4	67	40	2	37
2546	14026	17	37.0	5.9	2.8	26.8	3.6	0.64	0.1	0.1	4	300	0.9	44	30	60	16	0.4	23	480	0	30	28	0.3	59	34	2	22
2547	14073	20	35.0	8.1	5.5	23.1	3.5	1.37	0.2	0.3	4	275	1.3	55	36	51	25	0.7	25	610	0	40	30	0.2	110	40	2	56
2561	14097	3	40.5	6.4	3.2	23.9	3.5	0.79	0.2	0.1	4	355	1.1	42	31	63	22	0.5	22	500	0	35	30	0.4	67	38	2	32
2572	14148	26	41.5	6.3	3.2	25.4	3.0	0.63	0.4	0.1	4	265	1.2	47	31	53	22	0.6	27	600	0	20	30	0.4	55	50	2	38
2590	14147	40	72.0	3.2	1.6	12.8	2.5	0.51	0.1	0.1	4	245	0.4	42	28	39	11	0.4	21	260	0	15	19	0.2	34	45	3	3
2592	14193	40	35.5	6.7	2.9	20.1	5.8	0.54	0.1	0.4	3	385	1.3	65	33	46	20	0.5	26	485	0	45	32	0.4	55	38	2	20
2599	14092	67	64.5	3.7	2.1	10.0	2.5	0.54	0.1	0.1	4	185	0.5	34	30	42	13	0.1	17	200	0	40	21	0.3	42	23	1	0
2603	14156	136	41.5	6.9	3.8	21.9	3.5	1.00	0.1	0.1	2	305	1.0	42	33	55	23	0.3	20	510	0	45	29	0.2	75	33	2	35
2616	14188	128	41.5	8.1	6.8	17.3	3.5	1.92	0.2	0.1	3	330	1.3	50	37	52	21	0.8	24	700	0	45	35	0.3	134	40	2	73
2618	14212	116	41.0	8.5	7.6	18.0	4.0	2.29	0.2	0.1	3	285	1.4	48	41	65	27	1.0	23	765	0	30	30	0.2	160	40	2	86
2620	14234	124	42.0	8.1	6.2	19.1	4.0	1.71	0.2	0.1	3	285	1.3	47	38	55	25	0.5	23	655	0	35	37	0.3	124	37	2	63
2622	14147	87	39.5	8.8	4.6	21.3	4.3	1.02	0.2	0.1	4	275	1.4	48	39	57	29	0.5	25	540	0	30	40	0.4	87	40	2	46
2636	14124	54	46.5	6.6	3.9	22.5	3.2	1.08	0.2	0.1	4	335	1.0	47	32	83	17	0.6	24	545	0	30	32	0.5	80	42	2	38
2642	14168	65	44.5	6.9	3.1	21.8	3.3	0.83	0.1	0.1	4	310	1.0	42	20	65	16	0.5	24	475	7	40	18	0.4	66	30	2	33
2646	14241	43	38.5	6.8	3.1	22.7	5.3	0.68	0.2	0.1	3	345	1.1	52	30	62	22	0.2	23	475	0	30	32	0.4	63	40	2	33
2649	13729	99897	53.5	5.6	2.5	19.5	3.9	0.55	0.1	0.1	3	400	1.0	44	30	49	20	0.4	22	405	9	40	30	0.4	50	35	2	17
2652	13694	99850	39.0	7.6	4.2	23.8	3.6	0.83	0.2	0.1	4	290	1.6	50	34	52	34	0.5	25	590	0	20	34	0.4	80	40	2	61
2655	13671	99878	59.0	4.0	2.2	18.6	3.6	0.55	0.1	0.1	3	335	0.7	44	35	44	22	0.4	24	370	0	20	32	0.3	46	35	2	26
2668	13663	99905	42.5	9.1	4.7	18.3	2.7	0.96	0.2	0.9	4	365	1.7	62	20	42	16	1.1	34	735	0	25	15	0.2	58	40	2	90
2670	13643	99987	45.5	6.4	3.5	22.3	3.1	0.73	0.1	0.1	5	340	1.0	46	20	50	22	0.5	24	555	7	30	14	0.3	64	25	2	50
2678	13638	99953	32.0	6.8	4.4	26.1	4.2	0.62	0.2	1.2	5	340	1.3	56	100	60	30	0.5	25	430	0	70	30	0.3	66	38	2	58
2680	13550	99865	30.5	5.9	3.1	26.6	4.0	0.55	0.2	6.0	3	315	1.0	50	28	50	22	0.3	23	450	0	25	30	0.3	60	34	2	33
2681	13510	99858	32.5	6.1	3.2	22.3	4.5	0.62	0.1	4.7	6	400	1.1	46	18	37	20	0.5	22	560	9	25	20	0.3	55	23	2	112
2697	14021	117	46.5	7.3	3.9	18.5	2.5	0.66	0.1	0.1	4	340	1.7	86	20	55	40	0.8	55	550	13	25	13	0.5	60	45	3	83
2706	14012	54	36.0	7.1	3.6	21.6	4.6	0.83	0.1	0.1	5	330	1.1	45	22	86	25	0.4	23	490	8	25	19	0.3	74	27	2	42
2713	13986	10	39.0	6.7	3.1	23.0	3.7	0.77	0.1	0.1	4	330	1.0	39	20	62	20	0.3	21	480	8	40	14	0.5	65	27	2	34
2724	13976	30	42.5	9.7	9.6	14.3	4.1	3.10	0.1	0.1	4	240	1.5	45	40	105	23	0.9	23	945	0	50	12	0.3	216	30	2	107
2726	14028	144	27.0	5.7	2.8	24.6	8.3	0.44	0.1	0.2	4	300	1.0	55	30	44	26	0.3	23	450	0	15	27	0.4	52	32	1	30
2731	14067	135	36.0	10.3	4.8	20.8	4.5	1.11	0.2	0.1	5	280	1.6	50	37	90	32	0.5	24	540	0	60	42	0.4	95	41	2	40
2735	14059	115	36.5	6.7	7.0	18.6	4.9	2.90	0.1	0.5	5	345	1.2	44	25	110	19	0.1	24	730	11	50	20	0.3	180	30	2	65
2736	14060	101	36.0	7.4	3.8	21.6	4.3	1.13	0.1	2.8	4	275	1.0	40	22	65	15	0.6	21	465	0	55	0	0.2	84	28	2	26
2740	14068	160	39.5	6.2	3.2	20.2	4.7	0.69	0.1	0.1	4	325	1.0	42	18	66	16	0.7	23	510	0	35	20	0.3	63	28	2	35
2743	14085	194	41.5	9.5	7.0	16.6	4.1	2.24	0.1	0.1	4	265	1.4	44	50	76	30	0.7	24	720	0	70	16	0.3	150	30	2	80
2750	13996	194	41.5	7.0	3.0	19.8	4.5	0.71	0.1	0.1	5	325	1.1	40	18	63	14	0.8	23	445	0	20	0	0.3	60	26	2	23
2760	14173	182	44.5	13.0	9.7	12.1	5.6	2.60	0.2	0.1	4	240	1.6	41	50	133	27	0.5	24	895	0	155	30	0.2	168	35	2	73
2766	14194	150	42.5	7.0	4.3	20.5	3.7	1.14	0.1	0.2	4	310	1.0	40	20	68	14	0.8	22	530	0	0	0	0.2	90	30	2	39
2772	14132	219	42.0	7.1	3.2	24.3	3.6	0.80	0.2	0.1	4	340	1.2	50	32	67	30	0.5	24	485	0	20	33	0.5	70	44	2	38
2785	14183	291	34.0	7.7	3.2	20.2	3.9	0.71	0.1	7.1	4	275	1.2	52	20	53	14	0.5	23	375	0	25	15	0.3	66	27	2	27
2788	14149	273	26.0	6.9	5.1	11.1	3.8	0.90	0.1	9.9	5	325	1.3	71	25	65	16	0.4	25	400	0	35	14	0.4	93	25	2	24
2790	14129	253	32.0	6.1	3.8	21.3	5.1	1.00	0.1	6.4	4	385	1.1	68	23	50	14	0.5	23	600	0	30	14	0.5	75	25	2	30
2792	14089	250	34.0	15.0	5.9	14.1	4.2	1.70	0.1	6.1	6	230	2.0	67	25	100	15	0.4	26	440	12	55	36	0.2	122	37	3	30
3535	13861	353	55.0																									

S A M P L E	E A S T	N O R T H	S I D E	A L O N G	F E E D	C A R B	H A R D	T I M E	P R O D	S O I L	A S H	B A S E	B E N E F I T	C O O R D	C O O R D	C O O R D	E N E R G Y	L A N D	M A T E R I A L	N O N I N F O R M A T I O N	P R O D U C T	S O I L	V E G E T A T I O N	Y E A R	Y E A R	Z O N E		
2798	14216	348	38.5	8.1	4.8	18.6	5.3	1.65	0.1	1.9	4	330	1.1	40	25	83	17	0.4	21	585	0	55	13	0.3	110	28	2	35
2802	14321	310	43.5	4.5	2.5	14.8	3.5	0.48	0.1	0.3	3	250	0.7	42	20	36	17	0.3	21	370	0	45	0	0.1	46	22	1	11
2804	14307	257	45.5	13.5	6.0	13.0	3.5	1.17	0.1	0.3	5	270	2.8	90	36	96	19	0.7	44	375	0	45	50	0.5	100	68	4	7
2807	14348	244	47.5	7.0	4.7	18.0	3.2	0.92	0.1	0.4	4	630	1.6	76	35	92	19	0.3	30	475	0	45	35	0.4	83	55	3	20
2808	14383	205	43.0	14.4	6.5	13.3	3.2	1.24	0.1	0.1	6	275	3.1	95	33	104	23	1.2	48	400	0	45	56	0.6	110	73	4	9
2812	14357	174	25.0	4.1	2.7	29.5	7.8	0.34	0.1	0.2	4	270	0.8	57	30	33	20	0.1	22	420	0	15	25	0.5	42	27	1	17
2819	14403	175	30.5	3.8	3.6	25.5	7.5	0.62	0.1	0.1	3	245	0.7	40	27	63	18	0.1	20	425	0	30	22	0.5	52	37	2	45
2837	14472	180	25.0	4.8	2.6	21.2	8.5	0.48	0.1	0.8	4	240	0.8	50	18	27	14	0.3	18	410	0	40	0	0.3	52	17	1	22
2840	14494	222	27.0	4.3	2.3	20.8	6.3	0.42	0.1	7.6	4	305	0.7	51	20	26	12	0.1	18	355	13	25	14	0.2	45	14	1	15
2847	14469	296	33.0	6.1	3.4	18.7	6.9	0.60	0.1	1.6	3	390	1.2	66	20	40	15	0.4	24	455	0	40	0	0.3	62	23	1	26
2850	13485	99820	40.0	5.7	3.0	21.8	5.2	0.62	0.2	0.2	4	300	1.0	52	30	52	18	0.3	23	315	0	15	23	0.4	60	33	2	23
2852	13455	99777	15.0	2.3	1.6	30.4	6.9	0.20	0.1	9.9	2	145	0.3	35	24	21	12	0.1	10	255	0	10	21	0.4	30	17	0	1
2857	13506	99745	74.5	7.3	4.0	7.8	1.5	1.08	0.1	0.1	3	350	1.7	62	36	76	28	0.7	34	375	0	50	37	0.4	70	52	3	23
2860	13483	99728	51.5	6.4	3.6	21.5	1.9	0.59	0.2	0.1	4	375	1.6	74	33	60	20	0.3	35	590	0	45	38	0.4	58	50	2	55
2864	13439	99746	27.0	3.6	1.9	40.4	2.7	0.38	5.0	0.1	4	425	0.7	40	29	77	52	0.5	27	350	0	50	28	0.5	58	70	2	88
2867	13393	99766	66.0	2.7	1.7	13.4	2.6	0.38	0.1	0.1	3	260	0.3	36	20	51	17	0.3	21	210	0	70	0	0.1	34	16	1	17
2870	13375	99733	49.0	3.9	2.4	15.9	2.6	0.50	0.1	0.1	3	300	0.5	42	20	38	21	0.3	22	275	0	40	0	0.4	48	16	1	23
2871	13371	99789	60.5	5.4	3.5	16.8	2.8	0.81	0.1	0.1	4	280	0.8	51	31	80	22	0.5	26	320	0	25	34	0.6	67	40	2	28
2875	13268	99949	60.0	6.0	5.7	10.6	2.4	1.39	0.1	0.3	3	420	1.2	58	46	84	34	0.5	30	375	0	70	0	0.3	107	35	2	44
2879	13252	99899	56.5	7.3	4.2	15.0	3.6	0.85	0.1	0.2	3	310	1.5	65	36	65	16	0.4	34	480	0	40	44	0.5	72	51	2	25
2881	13190	99908	46.5	6.0	3.6	17.5	3.1	0.85	0.1	1.0	3	340	1.0	52	12	68	20	0.6	27	420	0	50	0	0.2	70	30	2	26
2883	13298	99921	40.5	13.2	5.8	13.2	3.2	0.96	0.1	0.2	5	370	2.9	105	35	84	18	1.3	60	580	0	55	55	0.4	92	76	4	15
2885	13331	99927	47.5	4.3	2.5	19.5	2.7	0.60	0.1	0.1	3	365	0.6	37	20	49	12	0.2	21	445	0	25	0	0.2	52	25	1	25
2888	13328	99937	44.0	10.6	5.0	14.5	2.2	1.27	0.1	0.1	4	365	2.7	95	28	97	24	1.1	49	385	0	65	13	0.4	102	60	4	17
2892	13375	99896	24.5	19.8	44.4	0.1	0.5	1.08	0.1	0.1	26	45	7.0	200	52	165	12	0.1	17	285	12	85	95	2.4	620	52	5	0
2893	13408	99881	43.5	10.2	5.0	20.3	2.9	0.83	0.1	0.1	4	375	1.9	67	33	79	23	0.5	36	435	0	35	50	0.7	92	60	3	20
2898	13366	99839	39.9	5.7	3.2	25.2	4.0	0.64	0.2	9.9	3	390	1.1	57	55	46	26	0.4	22	460	0	35	38	0.4	68	33	1	34
2901	13373	99818	30.0	3.5	2.2	23.5	4.0	0.53	0.1	9.9	3	455	0.6	55	25	42	15	0.2	16	360	0	25	0	0.1	46	16	1	19
2905	13303	99809	27.5	2.9	1.7	24.9	4.5	0.40	0.1	9.9	3	330	0.4	42	15	34	8	0.2	14	290	0	0	0	0.1	40	13	1	7
2907	13328	99753	33.0	4.3	2.5	23.6	4.4	0.52	0.1	7.8	4	370	0.7	48	18	44	15	0.3	18	410	0	10	0	0.1	55	20	1	25
2912	13261	99843	68.5	4.5	5.5	10.4	2.4	1.72	0.2	0.2	3	475	1.0	53	30	122	33	0.5	28	520	0	30	0	0.1	100	30	2	50
2915	13225	99877	55.0	10.8	7.3	11.3	2.7	1.50	0.4	0.1	3	280	1.6	72	46	173	34	0.9	40	410	0	100	54	0.4	111	55	3	64
2920	13228	99795	43.0	6.9	7.5	19.7	4.3	2.44	0.5	1.0	3	415	1.5	63	42	60	35	0.7	29	1000	0	10	38	0.4	147	45	2	110
2922	13278	99790	34.0	6.7	3.4	23.1	3.5	0.60	0.1	5.0	0	410	1.3	51	30	130	60	0.5	26	400	0	0	22	0.1	62	36	2	30
2923	13281	99874	44.0	14.5	5.4	12.6	2.5	0.98	0.2	0.4	0	375	2.2	85	18	75	18	0.9	51	468	10	24	40	0.1	100	63	4	40
2930	13202	99766	63.0	6.3	3.5	11.0	2.1	0.85	0.1	0.3	0	240	1.3	45	33	105	173	0.4	25	290	7	15	23	0.1	71	38	2	81
2933	13198	99726	38.5	6.9	6.5	18.3	3.6	2.20	0.6	4.1	0	330	1.6	64	42	112	23	0.9	34	780	8	15	22	0.1	126	48	2	60
2937	13236	99751	38.0	7.2	3.4	21.0	3.0	0.60	0.2	0.7	0	320	1.3	56	18	65	42	0.6	33	388	9	32	17	0.1	72	36	2	60
2939	13186	99792	55.0	7.2	4.5	12.2	2.2	0.95	0.2	0.2	0	345	1.3	47	20	90	25	0.4	30	300	0	37	20	0.1	90	28	2	46
2942	13151	99803	63.5	5.3	4.1	11.0	1.8	0.92	0.2	0.1	0	260	0.8	41	20	85	25	0.1	26	241	6	26	18	0.1	85	28	2	45
2945	13099	99822	73.0	5.0	1.9	8.2	1.0	0.87	0.2	0.1	0	260	0.8	32	14	60	21	0.1	20	187	0	7	22	0.1	65	28	2	38
2948	13087	99869	39.5	7.2	4.1	23.7	2.8	0.66	0.1	0.1	0	350	1.6	46	33	93	21	0.4	30	445	9	30	33	0.1	77	44	2	20
2950	13077	99846	44.0	9.9	3.8	18.1	2.8	0.84	0.1	0.1	0	340	2.0	57	34	103	138	0.7	35	400	0	35	37	0.1	73	52	3	64
2955	13091	99838	49.5	8.9	3.4	17.6	2.7	0.77	0.1	0.1	0	360	1.9	60	32	92	81	0.8	37	400	0	25	27	0.1	65	48	2	44
3561	13731	214	75.0	5.5	2.3	8.8	0.9	1.10	0.2	0.1	0	260	0.9	38	32	94	20	0.3	24	280	7	0	32	0.1	64	40	2	30
3566	13626	116	55.0	6.8	3.1	17.1	2.1	1.08	0.2	0.1	0	400	1.2	43	31	88	17	0.6	26	475	0	0	23	0.1	72	46	3	40

S	E	N	S	A	F	C	M	T	P	S	A	B	B	C	C	C	C	E	L	M	M	N	P	S	V	Y	Y	Z
A	A	O	I	L	E	A	G	I	2	O	S	A	E	E	O	R	U	U	A	N	O	I	B	B				
M	S	R	O	2	2	O	O	O	0	0	3																	
P	T	T	2	0	0			2	5																			
L		H		3	3																							
E																												
2956	13107	99755	52.0	7.0	3.3	14.9	2.1	0.72	0.2	0.1	0	420	1.4	50	15	55	26	0.8	30	310	0	7	14	0.1	66	35	2	46
2957	13608	99838	54.0	8.5	4.0	12.0	2.2	0.78	0.1	0.1	0	410	1.9	57	16	60	23	0.6	34	304	0	20	20	0.1	72	42	3	44
2958	13156	99725	51.5	10.2	4.4	11.4	2.6	0.80	0.2	0.1	0	460	2.6	68	16	65	19	0.6	39	394	6	13	30	0.1	73	50	3	36
2960	13152	99698	62.0	5.8	5.3	10.5	1.9	1.06	0.2	1.0	0	340	1.1	50	23	100	28	0.4	28	310	7	38	15	0.1	98	30	2	51
2964	13132	99700	63.0	8.7	2.8	9.0	1.2	1.24	0.2	0.2	0	375	1.5	68	17	100	55	0.5	40	298	8	21	35	0.1	85	65	4	100
2965	13113	99716	62.5	8.0	6.7	9.2	1.3	1.40	0.2	0.1	0	290	1.4	52	45	162	30	0.6	35	300	8	80	34	0.1	107	37	2	35
2967	13126	99660	59.5	4.5	1.9	16.6	2.8	0.50	0.1	0.1	0	200	0.7	30	30	92	18	0.2	18	250	0	40	28	0.1	40	28	1	12
2969	13113	99682	54.0	6.5	2.5	18.6	2.2	0.85	0.1	0.1	0	330	1.0	38	31	98	35	0.5	24	350	8	30	31	0.1	62	38	2	35
2970	14240	60	62.0	5.0	2.7	13.4	2.0	0.70	0.1	0.1	0	330	0.8	34	27	50	36	0.6	23	242	0	28	15	0.1	65	25	2	53
2975	14258	78	53.0	4.5	2.0	18.0	2.9	0.43	0.2	0.1	0	265	0.7	34	15	45	20	0.5	20	260	0	0	10	0.1	57	20	1	43
2976	14289	111	59.0	4.8	3.5	14.2	2.4	0.68	0.2	0.1	0	255	0.7	38	16	70	14	0.5	22	217	0	28	0	0.1	74	17	1	32
3002	14341	125	41.5	11.0	5.8	15.6	3.3	0.93	0.2	0.1	0	435	2.0	91	20	95	67	1.4	58	388	0	41	25	0.1	110	50	3	68
3017	14396	109	39.5	6.9	3.4	20.1	4.6	0.68	0.2	0.1	0	370	1.3	41	18	75	23	0.4	23	440	0	27	20	0.1	80	26	2	52
3018	14531	177	39.0	6.6	3.0	21.0	3.9	0.60	0.2	0.1	0	360	1.2	38	15	70	29	0.4	22	404	0	17	15	0.1	75	24	2	60
3028	14405	157	37.0	7.6	3.9	20.7	3.2	0.73	0.2	0.9	0	275	1.4	50	20	60	22	0.6	25	470	0	17	20	0.1	80	25	2	57
3035	14439	140	51.0	7.0	3.6	15.0	1.9	0.84	0.3	0.4	0	335	1.4	56	20	60	17	0.6	32	545	0	18	16	0.1	75	38	2	48
3038	14490	143	44.5	7.9	4.0	18.0	2.9	0.76	0.3	0.7	0	345	1.6	53	20	65	18	0.2	29	562	0	20	30	0.1	75	40	2	75
3045	14547	161	31.5	5.1	2.6	22.0	7.1	0.50	0.2	1.0	0	280	0.9	51	24	55	12	0.4	20	364	7	10	0	0.1	60	20	2	40
3047	14556	221	42.0	5.8	3.0	22.2	2.4	0.62	0.2	0.1	0	310	0.9	35	15	70	15	0.4	20	400	0	16	0	0.1	68	23	2	52
3051	12995	99682	37.5	6.8	3.3	23.5	3.1	0.60	0.3	0.1	0	330	1.1	45	15	75	18	0.5	23	430	0	28	0	0.1	75	26	2	63
3054	13012	99711	65.0	5.1	3.0	13.4	1.7	0.89	0.2	0.1	0	295	0.9	48	16	75	20	0.6	26	228	0	14	0	0.1	70	33	3	34
3059	13033	99746	51.5	6.1	3.0	17.8	3.2	0.68	0.2	0.2	0	370	1.2	48	35	95	56	0.5	28	400	0	25	23	0.1	60	38	2	40
3068	13050	99939	53.5	7.7	3.3	20.5	1.9	0.70	0.2	0.1	0	375	1.4	58	33	57	43	0.9	43	480	0	0	25	0.1	60	53	2	25
3070	14534	275	51.0	11.5	5.5	12.8	1.4	0.97	0.3	0.1	0	825	2.5	94	16	15	18	2.0	56	890	0	26	17	0.1	41	52	3	125
3072	14565	256	47.5	11.5	4.2	16.4	1.9	0.92	0.3	0.1	0	555	2.1	80	32	70	53	1.6	55	620	8	30	40	0.1	44	60	3	140
3083	13407	30	63.0	5.9	2.6	15.2	1.5	0.88	0.1	0.1	0	410	1.2	37	32	94	22	0.5	25	353	0	30	24	0.1	55	45	3	28
3130	13442	55	70.5	6.8	3.3	6.2	0.9	2.16	0.2	0.1	0	900	1.6	84	15	100	20	0.8	44	331	0	70	14	0.1	84	67	5	49
3134	13395	99991	50.5	5.6	2.8	14.7	3.0	0.67	0.2	0.2	0	320	1.2	60	17	80	20	0.5	27	351	0	32	0	0.1	63	27	2	40
3204	13002	99883	64.5	9.8	3.9	11.0	1.7	1.25	0.3	0.1	0	400	2.2	75	35	123	42	1.0	51	440	7	20	38	0.1	71	88	5	19
3208	12989	99853	69.0	6.4	4.0	9.0	1.6	0.93	0.1	0.1	0	375	1.6	62	20	70	110	0.5	31	355	0	20	14	0.1	78	41	3	81
3214	13586	99996	38.5	14.0	5.9	15.5	2.1	1.00	0.1	0.1	0	365	3.3	75	46	114	73	0.9	50	363	0	70	43	0.1	108	62	3	17
3216	13490	85	49.5	5.5	2.9	20.9	2.3	0.62	0.2	0.1	0	390	0.9	47	24	60	13	0.4	23	422	0	33	0	0.1	65	23	1	46
3221	13501	32	70.0	5.9	2.6	10.4	0.9	1.02	0.2	0.1	0	555	1.2	48	20	60	90	0.4	25	318	0	25	0	0.1	74	33	2	100
3223	13504	99991	48.0	8.1	3.4	18.8	2.7	0.70	0.1	0.1	0	395	1.6	48	32	83	20	0.8	32	440	6	40	30	0.1	57	44	2	28
3226	13489	99964	27.0	6.4	2.9	24.0	2.5	0.52	0.2	9.9	0	310	1.0	52	15	75	35	0.1	20	353	11	80	0	0.1	65	18	1	72
3229	13485	99911	40.0	7.0	4.3	18.2	2.7	0.90	0.2	5.8	0	625	1.8	92	20	70	40	0.5	45	445	7	21	0	0.1	92	34	2	68
3230	13447	99982	54.0	6.1	2.7	16.5	2.6	0.60	0.1	0.1	0	340	1.2	40	30	75	12	0.5	25	390	6	15	22	0.1	50	35	2	11
3235	13018	99906	46.0	10.5	4.0	15.4	2.2	0.85	0.2	0.1	0	360	2.2	68	20	65	16	0.5	36	370	0	26	15	0.1	85	42	2	40
3239	12990	99942	34.5	6.4	3.6	23.2	3.1	0.70	0.1	8.3	0	335	1.6	60	30	75	120	0.5	30	490	6	0	17	0.1	65	33	2	84
3244	13001	99970	27.0	4.6	2.4	24.4	3.4	0.47	0.2	9.9	0	360	0.9	53	17	55	20	0.2	18	332	0	11	0	0.1	57	16	1	42
3249	13012	99991	36.0	7.8	3.9	21.9	2.7	0.66	0.2	0.1	0	340	1.6	60	20	65	22	0.7	30	407	0	30	10	0.1	82	33	2	55
3253	13060	5	38.5	8.2	3.3	20.6	2.6	0.72	0.2	0.1	0	330	1.8	55	33	94	40	0.7	31	445	7	0	34	0.1	76	45	2	42
3255	13120	16	61.0	7.8	3.4	11.1	1.3	1.47	0.2	0.1	0	350	1.5	73	22	170	34	0.8	38	373	0	30	12	0.1	103	67	4	60
3258	13189	99991	32.0	6.4	3.4	25.1	4.3	0.55	0.3	0.1	0	265	1.2	48	18	90	35	0.3	22	400								

S	E	N	S	A	F	C	H	T	P	S	A	B	B	C	C	C	C	E	L	M	M	N	P	S	V	Y	Y	Z	
A	A	O	I	L	E	A	G	I	2	O	S	A	E	E	O	R	U	U	A	N	O	I	B	B					
M	S	R	O	2	2	O	O	O	O	3																			
P	T	T	2	O	O			2	5																				
L		H		3	3																								
E																													
3266	13234		32	50.0	5.3	3.2	19.1	2.1	0.65	0.2	0.1	0	350	0.9	45	18	65	22	0.4	21	394	0	22	0	0.1	70	28	2	52
3270	13320		18	71.0	2.5	2.7	4.7	0.7	0.67	0.1	0.1	0	225	0.7	41	33	98	93	0.2	22	110	6	0	25	0.1	60	29	2	12
3275	13576	120	40.0	7.4	3.4	19.1	2.6	0.66	0.2	0.1	0	350	1.5	47	34	100	280	0.5	28	440	0	0	27	0.1	70	42	2	147	
3276	13552	92	62.5	6.5	7.8	10.5	2.4	2.80	0.2	0.1	0	300	1.7	48	46	266	36	0.5	30	870	9	15	37	0.1	166	55	3	78	
3280	13586	67	57.0	6.2	3.8	15.8	1.9	1.25	0.3	0.1	0	335	1.3	57	21	145	560	0.4	28	470	9	31	18	0.1	100	35	3	400	
3284	13591	47	58.5	5.7	4.0	17.0	2.0	0.84	0.2	0.1	0	355	1.4	61	25	90	29	0.4	30	447	0	27	13	0.1	92	30	2	58	
3286	13519	65	78.0	4.8	3.6	8.5	0.8	1.26	0.2	0.1	0	470	1.0	53	21	65	155	0.3	27	293	0	14	13	0.1	85	32	2	125	
3289	12965	99932	64.0	8.7	3.5	11.0	1.8	0.75	0.2	0.1	0	800	2.5	64	35	64	45	0.6	44	410	6	20	31	0.1	57	55	3	11	
3292	12987	99797	56.5	7.6	3.4	21.0	2.7	0.82	0.3	0.1	0	500	1.5	59	34	77	35	0.8	38	520	0	150	25	0.1	64	57	3	23	
3294	12974	99817	44.5	8.3	3.6	28.0	2.2	0.69	0.3	0.1	0	330	1.8	52	36	60	44	0.6	35	540	0	25	32	0.1	66	47	2	39	
3295	13038	99623	35.5	7.8	3.5	28.0	3.4	0.65	0.3	3.0	0	340	1.6	56	33	63	132	0.5	33	470	0	20	33	0.1	69	43	2	55	
3302	13035	99599	62.5	4.5	2.6	14.0	1.4	0.54	0.3	0.1	0	240	0.7	35	37	61	48	0.3	23	320	0	35	23	0.1	55	32	1	17	
3338	13088	99575	39.0	8.9	3.7	26.0	3.1	0.66	0.3	0.1	0	410	1.8	55	34	90	104	0.9	39	520	6	25	34	0.1	65	50	2	50	
3339	13158	99571	40.0	7.5	3.5	23.3	2.9	0.62	0.2	0.1	0	420	1.5	49	33	100	245	0.6	31	490	10	0	37	0.1	62	40	2	137	
3340	13909	82	25.0	5.0	2.3	40.0	3.6	0.39	0.3	0.1	0	230	0.7	26	29	51	32	0.1	17	380	5	15	30	0.1	52	25	1	14	
3343	13948	106	45.5	5.8	2.5	32.0	1.6	0.57	0.3	0.1	0	360	0.9	37	34	65	54	0.1	25	400	7	20	31	0.1	56	36	2	37	
3345	13961	130	11.0	3.0	1.1	45.0	0.8	0.22	0.7	0.1	0	300	0.3	19	27	77	433	0.1	17	150	7	0	12	0.1	56	30	1	140	
3352	13977	174	20.5	4.4	1.8	33.0	1.3	0.37	0.3	0.1	0	230	0.4	24	29	57	65	0.1	17	250	5	0	18	0.1	48	26	1	28	
3403	13939	159	33.0	6.8	3.9	20.0	3.2	0.95	0.3	8.9	0	330	1.0	49	43	58	78	0.4	24	550	5	40	23	0.1	85	37	2	52	
3407	13904	149	30.0	6.8	3.6	21.0	3.7	0.84	0.3	8.8	0	330	1.0	47	54	52	123	0.5	22	500	0	20	18	0.1	77	35	2	42	
3409	13848	132	45.0	7.3	4.2	20.0	3.4	1.05	0.3	6.5	0	335	1.1	47	36	60	117	0.5	23	555	5	0	32	0.1	90	35	2	61	
3414	13859	174	45.0	10.5	8.5	14.0	4.1	1.95	0.4	0.1	0	280	1.8	48	58	120	55	0.9	30	880	5	90	30	0.1	148	51	3	68	
3417	13909	184	48.0	8.2	13.8	11.0	6.4	3.70	0.4	0.1	0	240	2.0	42	72	194	213	0.8	24	1500	8	120	33	0.1	280	47	2	155	
3419	13999	224	36.0	7.2	23.3	7.0	5.4	9.95	0.4	0.1	0	200	2.9	44	13	300	47	0.3	22	2200	10	130	30	0.1	625	40	3	225	
3425	14000	266	41.5	8.3	7.0	17.1	5.4	1.60	0.3	3.8	0	275	0.9	44	52	66	48	0.4	26	730	0	65	23	0.1	100	39	2	50	
3428	14020	288	44.5	9.6	6.2	17.3	4.3	1.37	0.3	1.4	0	300	1.1	46	45	68	45	0.6	28	700	0	34	24	0.1	96	43	2	48	
3433	14057	309	45.0	10.5	8.3	16.7	3.6	2.20	0.4	0.1	0	280	1.8	49	51	123	50	0.5	30	870	16	50	38	0.1	140	45	2	68	
3444	14076	286	42.0	24.0	3.2	12.1	2.3	1.85	0.2	1.9	0	170	2.9	55	35	125	70	0.7	28	290	10	50	57	0.1	105	61	4	20	
3453	14094	336	40.0	31.0	2.8	6.9	1.1	1.95	0.2	0.7	0	130	3.9	49	36	195	22	0.2	25	150	13	35	100	0.1	123	65	5	0	
3461	14125	309	40.0	20.0	2.7	14.9	1.9	1.43	0.1	2.0	0	230	2.7	45	35	138	24	0.1	25	310	12	15	78	0.1	92	50	3	16	
3463	14169	332	42.0	24.0	3.5	13.0	2.5	1.80	0.2	2.0	0	200	2.8	55	25	125	70	0.7	28	300	10	70	55	0.1	125	50	4	50	
3465	13778	162	36.0	11.8	3.5	17.9	3.2	1.15	0.2	2.7	0	280	1.8	50	32	78	23	0.5	27	445	0	0	36	0.1	87	45	3	22	
3467	13800	203	32.5	10.7	6.0	18.3	3.8	2.50	0.2	6.4	0	250	1.7	44	35	90	58	0.5	23	610	0	0	35	0.1	153	40	2	54	
3472	14382	372	36.5	22.5	9.5	7.8	1.9	1.70	0.2	1.5	0	180	4.8	210	38	120	30	1.5	74	290	10	50	64	0.1	158	94	6	6	
3474	14450	356	29.5	11.0	5.9	18.3	3.7	1.20	0.2	0.1	0	290	2.0	88	37	84	172	0.9	38	420	11	0	37	0.1	115	50	3	50	
3476	14461	380	30.0	7.9	4.2	23.0	3.6	0.80	0.2	7.9	0	330	1.6	58	36	114	30	0.1	24	380	12	0	40	0.1	83	36	2	26	
3482	14485	421	36.5	8.8	3.4	23.5	3.0	0.72	0.2	1.0	0	280	1.7	50	32	61	115	0.6	27	300	0	0	33	0.1	70	42	2	70	
3485	14480	492	37.5	13.1	5.2	20.2	1.2	1.20	0.1	0.1	0	250	3.3	97	35	98	17	1.4	58	400	6	15	46	0.1	110	80	4	17	
3501	14414	454	81.5	6.3	3.6	7.8	0.9	1.35	0.1	0.1	0	640	1.7	70	37	113	28	0.8	46	360	0	0	35	0.1	70	85	5	14	
3506	14384	488	75.0	8.5	3.7	7.4	1.2	1.55	0.1	0.1	0	585	2.3	80	34	113	23	1.0	51	355	0	0	47	0.1	71	85	5	12	
3513	14320	408	84.0	6.6	2.2	8.3	0.7	1.39	0.1	0.1	0	250	1.0	40	32	100	17	0.4	24	245	0	0	37	0.1	67	46	3	11	
3516	14283	447	94.0	4.0	1.2	3.1	0.3	0.70	0.1	0.1	0	130	0.5	30	33	61	32	0.3	17	120	0	65	23	0.1	40	25	1	16	
3517	14293	497	97.0	2.7	0.6	2.2	0.3	0.62	0.1	0.1	0	140	0.4	51	31	30	10	0.5	30	70	0	0	25	0.1	30	40	2	0	
3524	14411	306	82.0	5.5	3.4	9.9	0.9	1.20	0.1	0.1	0	300	1.1	47	38	100	80	0.6	28	320									

