Student 1 Name: Student 1 ID last 3 digits:
Student 2 Name: Student 2 ID last 3 digits:

ESS331F Sedimentation and Stratigraphy
Lab Exercise 4: Sedimentation Provenance

Background:

A succession of nonmarine sandstones with shales and thin conglomerates occupies an elongate basin. This succession rests unconformably on older rocks to the south and west, is faulted against other rocks to the north, and is overlain by younger sediments to the east. Exposure in the basin is very poor, but from what is seen the predominantly sandy basin fill is disturbed by broad, gentle folds. Traps for petroleum may be present, and the basin has potential for oil and gas. The basin is undergoing seismic surveying to test this possibility in detail. Oil seeps have been found along the faulted margins, so it is known that there is at least some petroleum present.

In order to gain an understanding of the potential reservoir rocks you have been asked to research the source of the sediments exposed at the surface. One method of doing this, in poorly exposed sediments, is to examine their detrital petrography and search for spatial trends, which could yield information on dispersal patterns.

What has been done for you:

Field work yielded thirty-six samples, the locations of which are shown on the accompanying maps. Thin-section examination of these samples yielded the data shown on the attached tables on P.4, in which twelve major detrital species have been identified. Values given in the table are percentage distributions of these species, determined from counts of 400 grains in each thin section.

Your tasks:

It is useful to plot dispersal trends of key detrital grain types. Resistant grains (i.e. quartz) increase in proportion downstream, as easily-weathered grains are destroyed in the transport process. Sediment input areas for such easily-weathered grains are indicated by areas of high concentration close to the basin margin. Answer questions a to f.

a. Draw isopleths lines (contours) of percentage values for 1) mono-crystal quartz (student 1) and 2) mica (student 2) on the basin maps using the marked sample locations.

b. Which mineral detrital grain in the data table on P.3 will you choose to best indicate the dispersal pattern of granite? _____
Now contour the number of lithic fragments: 1.1) basalt (student 1), 1.2) granite (student 1), 2.1) quartz arenite (student 2) and 2.2) limestone (student 2).

c. Calculate the percentage of each group of components in the QFR diagram. Plot samples 1-4 together on the triangular QFR diagram on P. 4.

For each sample provided, normalize the counts for QFR components (i.e. consider all the components below, the sum of their percentages = 100% for each sample.)
Q- mono-crystal quartz
F- K-feldspar + Plagioclase
R- rock fragments (limestone, quartz arenite, basalt, chert), poly-crystal quartz

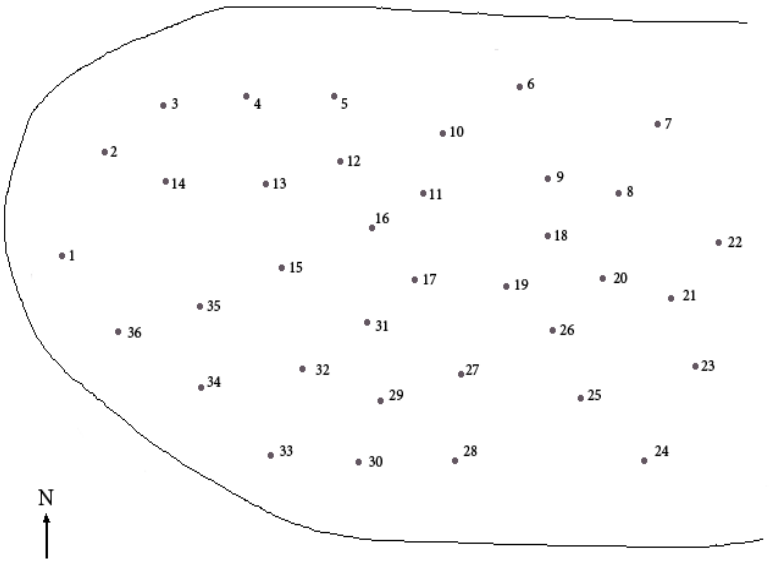
d. Plot compositions of sample 5-20 (student 1) and sample 21-36 (student 2) on P. 4. Please use a different colour or symbol from your partner to plot.
Tip: the data table and a QFR plot for rough work are also available in your individual answer sheets. Rough work will not be marked. You must put together your data points on P.4 for interpretation.

Look at the graphs that you and your partner draw:

e. This basin is filled by a longitudinal drainage system. Based on your contour maps, was this basin filled from the west to the east, or was it filled from the east to the west?

_____

f. Where are the source-area rock types (basalt, granite, quartz arenite & limestone) located around the basin? Label them outside the basin below:



g. Look at the QFR diagram you plot on P.4. Write a brief note summarizing the classification of the sandstones that can be interpreted from this diagram and how they evolve with respect to their locations in the basin. You may refer to chapter 5 of your textbook.

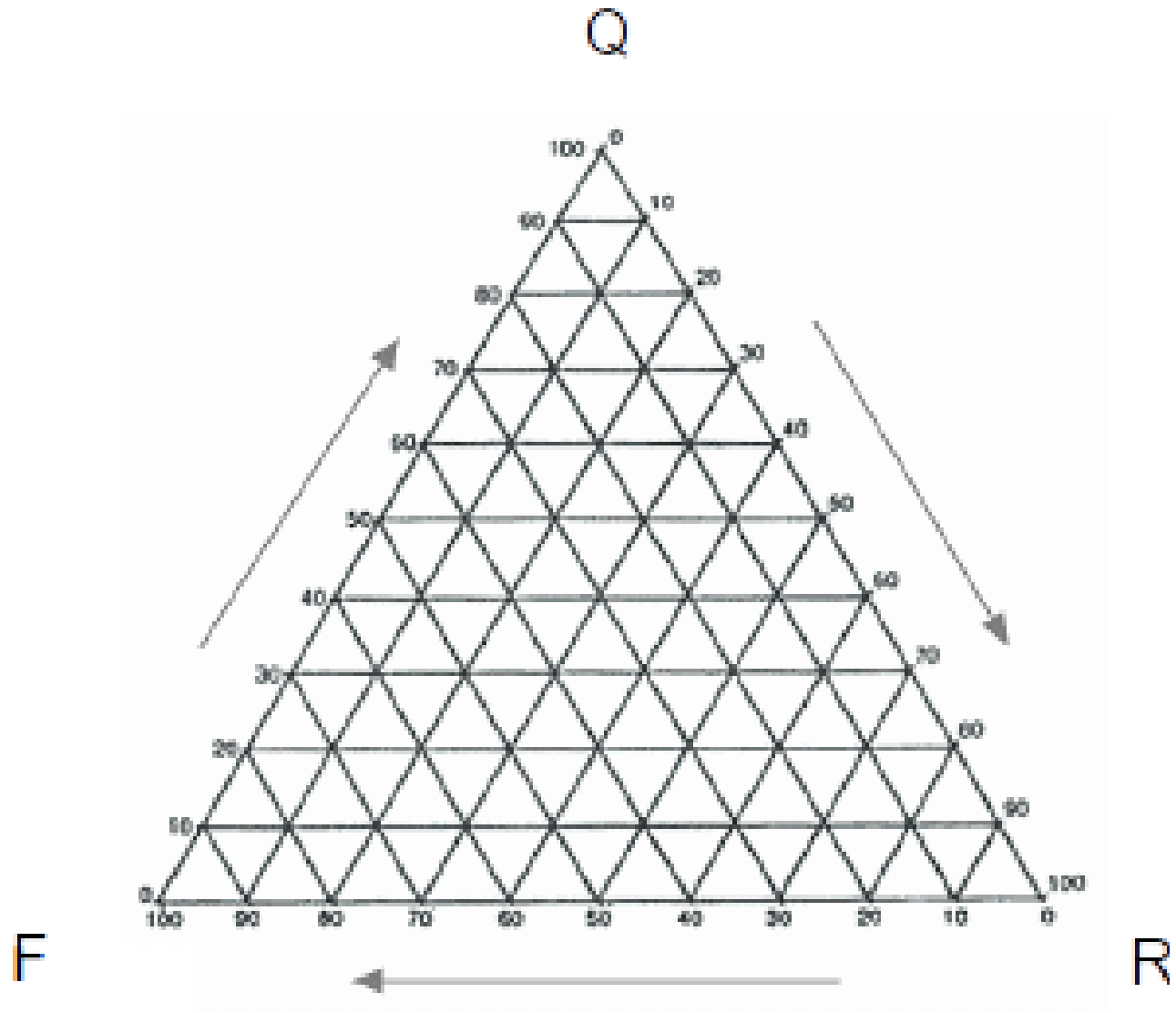
_____
_____
_____

Data:
(Available as Excel file)

Location	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
monoX quartz	20	40	36	60	44	58	77	78	77	54	58	50	65	40	45	58	66	81
polyX quartz	-	-	3	15	20	18	10	9	9	17	14	17	13	t	13	10	8	5
K-feldspar	-	-	3	15	18	17	7	5	6	16	15	17	13	t	3	7	8	4
plagioclase	10	8	10	2	3	1	1	2	1	1	t	2	1	9	4	3	1	t
mica	-	-	-	2	4	t	-	1	1	2	2	4	1	-	1	2	1	-
hornblende	-	-	-	1	2	1	-	1	t	1	1	2	1	-	t	1	t	-
pyroxene	-	-	-	1	1	2	t	t	-	1	1	t	-	-	t	t	t	-
limestone	10	4	-	-	-	-	-	-	-	-	-	-	-	3	6	7	8	5
quartz arenite	3	-	-	-	-	-	-	-	-	-	-	-	-	-	5	3	2	2
chert	2	t	-	-	-	-	-	-	-	-	-	-	-	1	2	1	1	1
basalt	45	40	38	-	-	-	-	-	-	-	-	-	1	36	16	4	1	-
iron oxides	10	8	10	4	8	3	5	4	6	8	9	8	5	11	5	4	4	2

Location	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
monoX quartz	78	83	89	98	95	92	92	94	91	88	82	80	80	74	74	70	39	18
polyX quartz	6	4	2	t	-	1	-	-	-	-	-	-	-	-	1	-	-	-
K-feldspar	6	4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
plagioclase	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	8
mica	t	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
hornblende	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pyroxene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
limestone	4	4	2	1	-	2	4	2	4	6	12	11	14	18	18	20	14	19
quartz arenite	2	2	4	1	5	5	4	3	4	5	5	6	4	2	2	2	1	1
chert	t	1	t	-	t	t	t	1	1	1	1	3	2	6	5	8	4	6
basalt	t	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	38
iron oxides	3	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	8	10

Notes:
t=trace (<4 grains in a count of 400)
PolyX quartz = poly crystalline quartz
MonoX quartz= single crystalline quartz



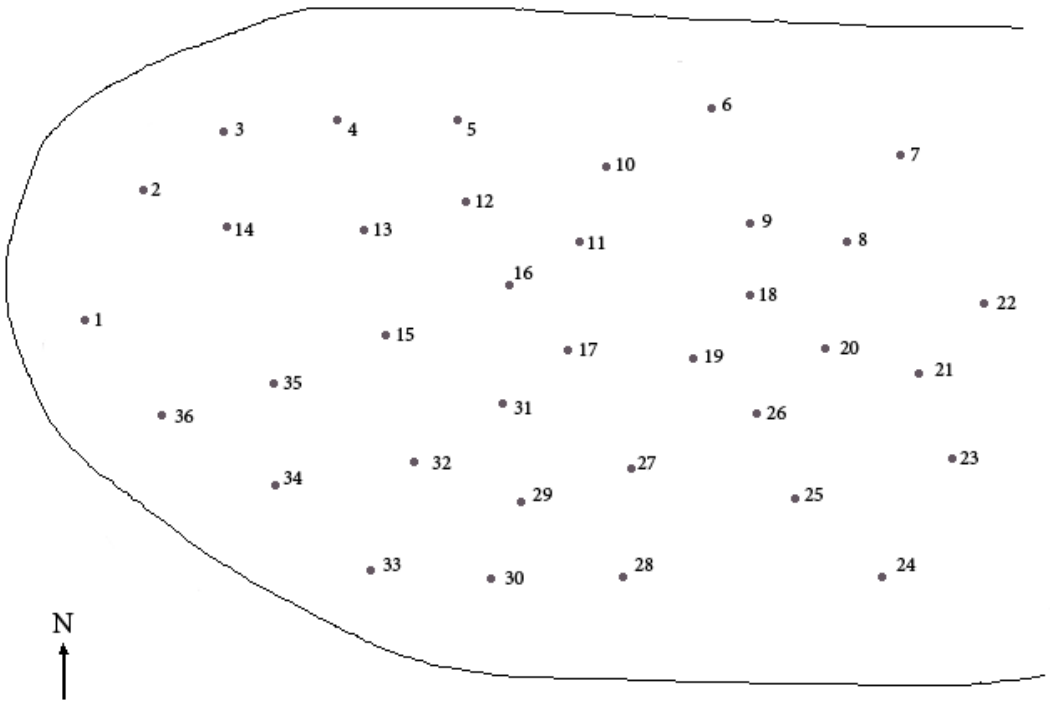
Reminder:
For each sample provided, normalize the counts for QFR components (i.e. consider all the components below, the sum of their percentages = 100% for each sample.)
Q- mono-crystal quartz
F- K-feldspar + Plagioclase
R- rock fragments (limestone, quartz arenite, basalt, chert), poly-crystal quartz

Individual answer sheets for student 1

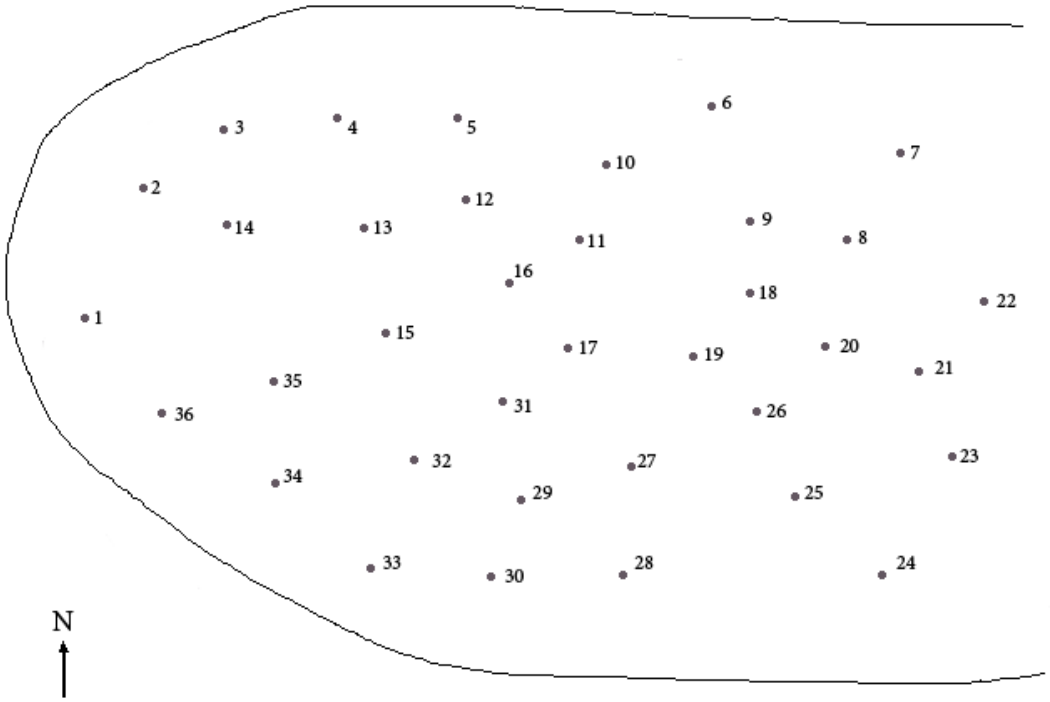
Student 1 Name: Last 3 digits of student 1 ID:

Name of partner student 2:

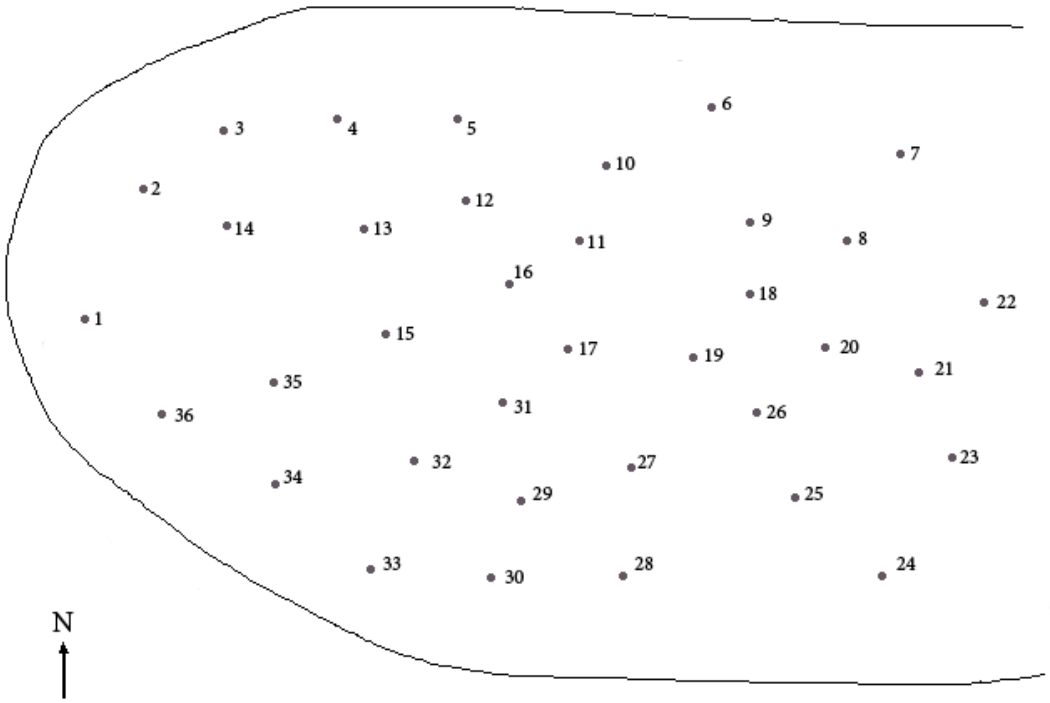
a1) Contours of percentage values for mono-crystal quartz



b1.1) Contours of the number of lithic fragments of basalt



b1.2) Contours of the number of the representative mineral of granite



Data:
(Available as Excel file.)

Location	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
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polyX quartz	-	-	3	15	20	18	10	9	9	17	14	17	13	t	13	10	8	5
K-feldspar	-	-	3	15	18	17	7	5	6	16	15	17	13	t	3	7	8	4
plagioclase	10	8	10	2	3	1	1	2	1	1	t	2	1	9	4	3	1	t
mica	-	-	-	2	4	t	-	1	1	2	2	4	1	-	1	2	1	-
hornblende	-	-	-	1	2	1	-	1	t	1	1	2	1	-	t	1	t	-
pyroxene	-	-	-	1	1	2	t	t	-	1	1	t	-	-	t	t	t	-
limestone	10	4	-	-	-	-	-	-	-	-	-	-	-	3	6	7	8	5
quartz arenite	3	-	-	-	-	-	-	-	-	-	-	-	-	-	5	3	2	2
chert	2	t	-	-	-	-	-	-	-	-	-	-	-	1	2	1	1	1
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iron oxides	10	8	10	4	8	3	5	4	6	8	9	8	5	11	5	4	4	2

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K-feldspar	6	4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
plagioclase	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	8
mica	t	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
hornblende	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pyroxene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
limestone	4	4	2	1	-	2	4	2	4	6	12	11	14	18	18	20	14	19
quartz arenite	2	2	4	1	5	5	4	3	4	5	5	6	4	2	2	2	1	1
chert	t	1	t	-	t	t	t	1	1	1	1	3	2	6	5	8	4	6
basalt	t	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	38
iron oxides	3	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	8	10

Notes:
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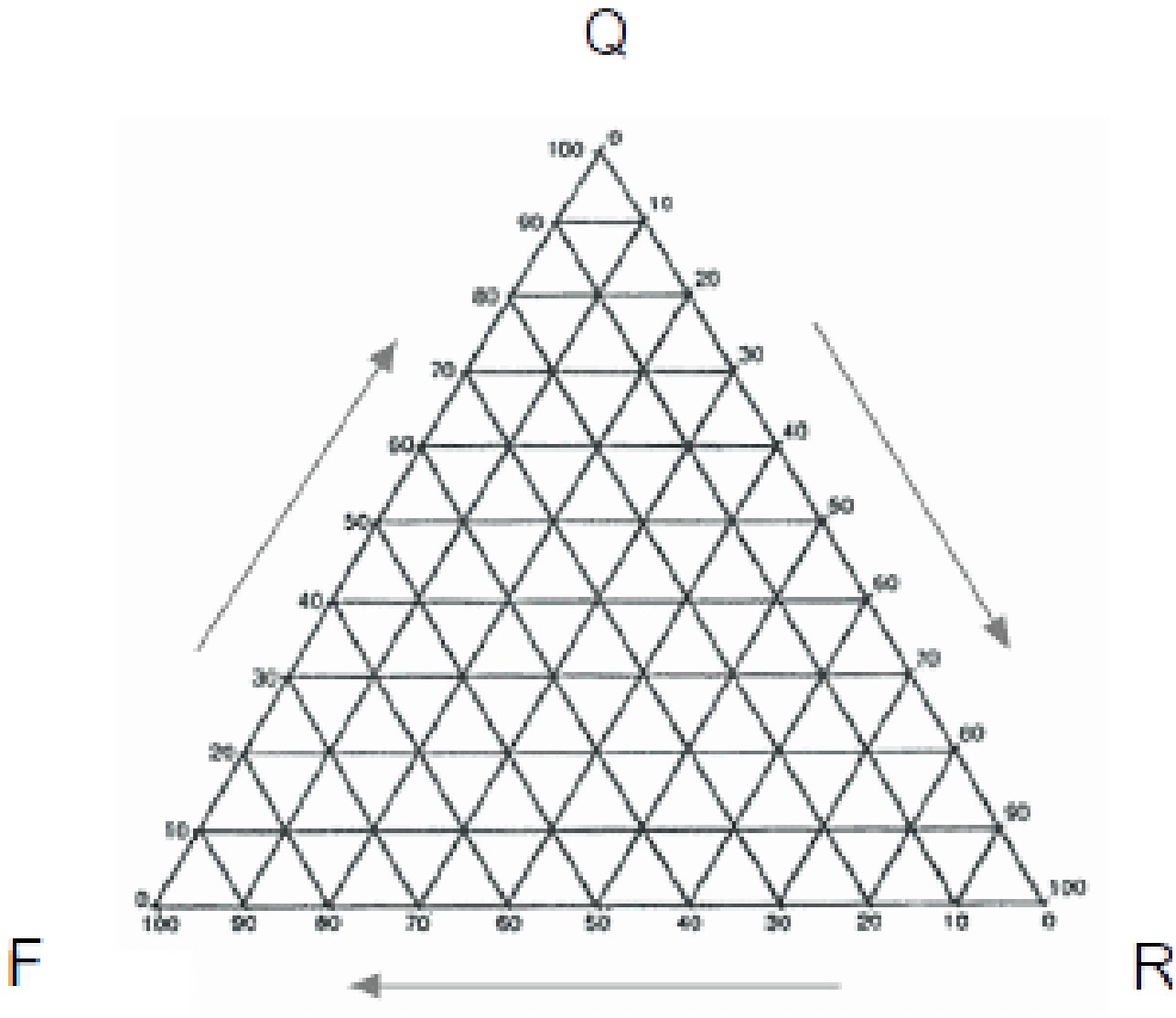

This graph is for rough work only. Only the QFR diagram on P.4 will be marked.

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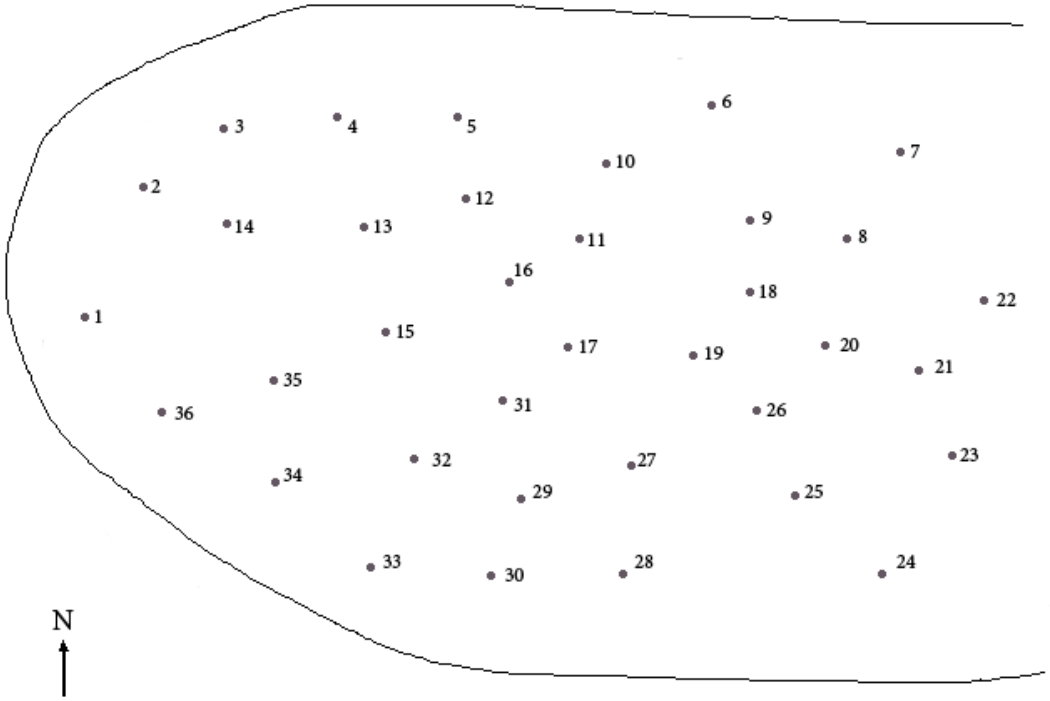
Individual answer sheets of student 2

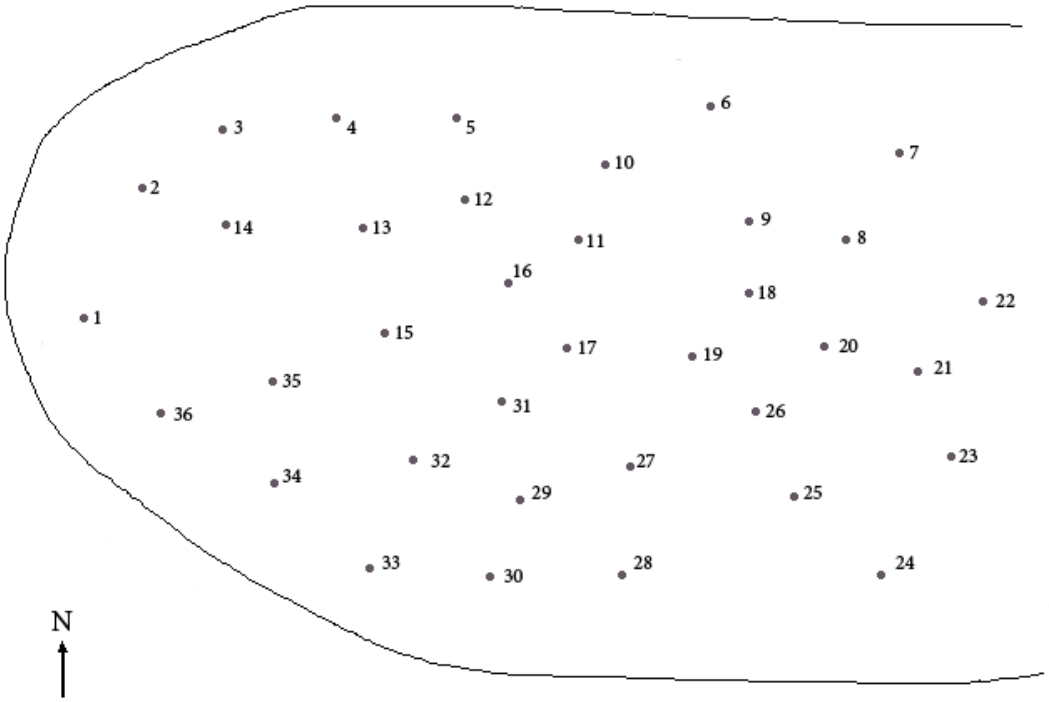
Student 2 Name: Last 3 digits of student 2 ID:

Name of partner student 1:

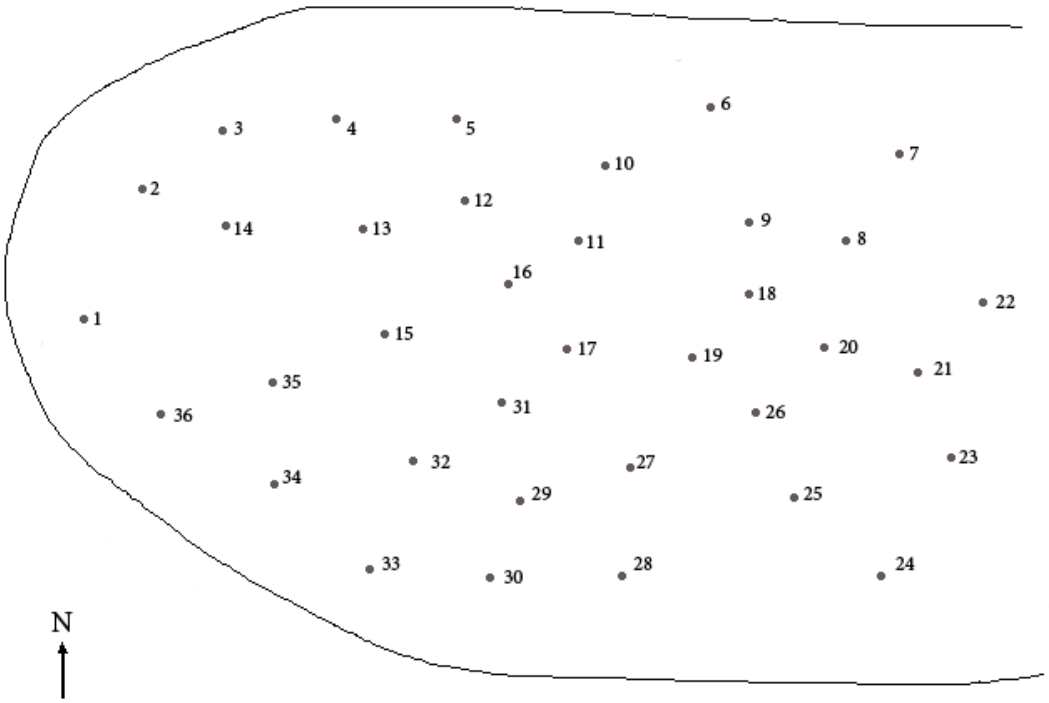
a2) Contours of percentage values for mica



b2.1) Contours of the number of lithic fragments of quartz arenite



b2.2) Contours the number of lithic fragments of limestone



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plagioclase	10	8	10	2	3	1	1	2	1	1	t	2	1	9	4	3	1	t
mica	-	-	-	2	4	t	-	1	1	2	2	4	1	-	1	2	1	-
hornblende	-	-	-	1	2	1	-	1	t	1	1	2	1	-	t	1	t	-
pyroxene	-	-	-	1	1	2	t	t	-	1	1	t	-	-	t	t	t	-
limestone	10	4	-	-	-	-	-	-	-	-	-	-	-	3	6	7	8	5
quartz arenite	3	-	-	-	-	-	-	-	-	-	-	-	-	-	5	3	2	2
chert	2	t	-	-	-	-	-	-	-	-	-	-	-	1	2	1	1	1
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K-feldspar	6	4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
plagioclase	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	8
mica	t	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
hornblende	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pyroxene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
limestone	4	4	2	1	-	2	4	2	4	6	12	11	14	18	18	20	14	19
quartz arenite	2	2	4	1	5	5	4	3	4	5	5	6	4	2	2	2	1	1
chert	t	1	t	-	t	t	t	1	1	1	1	3	2	6	5	8	4	6
basalt	t	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	38
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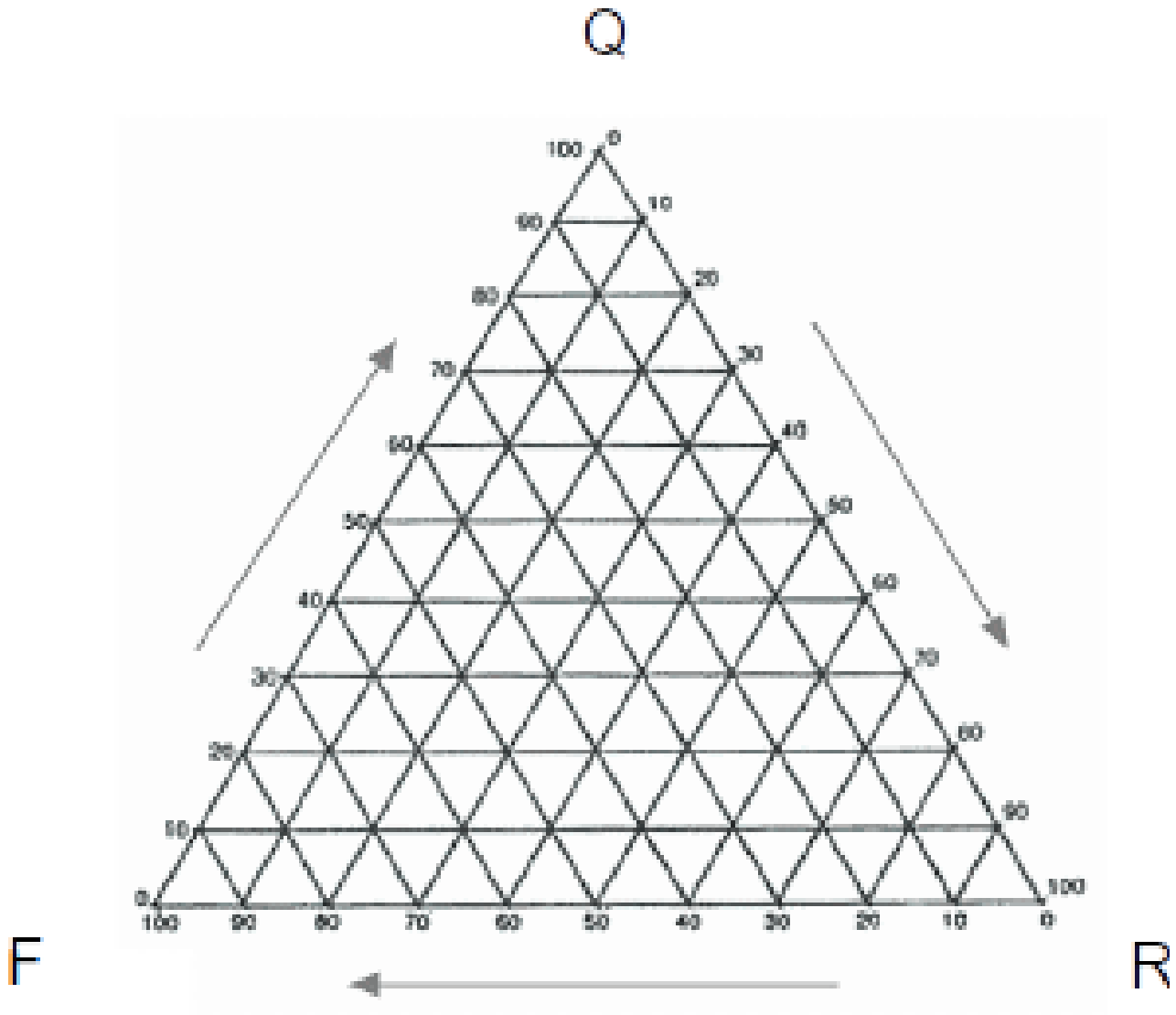

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