SRK Consulting
Engineers and Scientists

SRK Consulting (Canada) Inc.
Suite 800 – 1066 West Hastings Street
Vancouver, B.C. V6E 3X2
Canada

vancouver@srk.com
www.srk.com

Tel: 604.681.4196
Fax: 604.687.5532

Memo

To:	Loretta Ford, Northern Dynasty	**Date:**	November 22, 2006
cc:		**From:**	Stephen Day
Subject:	Status of Kinetic Tests Pebble Project	**Project #:**	1CN007.000

Loretta

As requested, and in response to a question I received verbally from Steve McGroarty (Alaska Department of Natural Resources), this memorandum describes the status of geochemical kinetic testing for the Pebble Project.

1 Introduction and Background

Kinetic tests are a component of the overall ML/ARD characterization of the project. The two main objectives of characterization are, as indicated in the ML/ARD SAP:

- Waste management planning (for example, is the rock./tailings acid-generating and/or metal-leaching?); and
- Impact management (what concentrations of metals and other components might leach from rock/tailings and what measures are required to manage this?).

Kinetic tests provide specific data to answer the questions of whether rock/tailings could generate ARD (depending on how the material is managed), when ARD would be generated, and how rates of metal leaching is related to factors such as mineralogy, sulfur, metal content, leachate chemistry and disposal conditions. Each test provides information on these aspects and is usually continued until the test results no longer add significant new information to the understanding of ML/ARD aspects of the project.

Thorough review of the test data has occurred at various times and decisions made to stop or continue tests as a result of trends in leachate chemistry. The duration of tests at completion is determined by the timing of these reviews and the date the tests started. There is no correlation of the actual termination date with short term effects observed in leachate chemistry trends.

The following sections describe the status of the waste rock and tailings programs.

2 Waste Rock

Twenty-seven waste rock humidity cell tests were started in February 2005. Three additional tests on Tertiary rock samples were started in November 2005. In September 2005, six subaqueous rock columns were started on samples of pre-Tertiary rock to evaluate leaching effects under flooded conditions. The status of testwork for each major rock type group is discussed below followed by the subaqueous columns.

Characteristics of the humidity cell and subaqueous column samples are shown in Tables 1 and 2, respectively.

2.1 Humidity Cells

2.1.1 Pre-Tertiary Metasedimentary Rocks

The main objective of testing the potentially acid generating pre-Tertiary rock types (both metasedimentary and plutonic) is to understand the rate of NP consumption leading to ARD release, and the rate of metal leaching under acidic and non-acidic conditions.

Graphs showing results are provided in Attachment A.

Eight samples of rock units designated as W and/or Y were tested. Tests on five samples were stopped when the data were reviewed in August 2005. Three tests were continued. All eight samples showed very stable leachate chemistry. The objectives of these tests have been met. They have demonstrated that samples with low NP (<0.4 kg $CaCO_3$/t) will generate acid almost immediately, whereas samples with higher NP produced pH neutral leachate. The tests have also shown which elements leach under acidic conditions and the trend in release rates. Rate of oxidation has been shown to correlate with sulfur content.

The three tests selected for continuation showed the same stable release trends, and the two samples with neutral pH (047-0350-0365 and 3115-0988-1008) are not expected to produce ARD for several years. These tests were stopped following review of data in June 2006.

Sample 3124-0188-0209 showed declining pH which then stabilized along stable metal release rates under acidic conditions. This test will be stopped in December 2006.

2.1.2 Pre-Tertiary Plutonic Rocks

Graphs showing results are provided in Attachment B.

Nine samples of plutonic igneous rocks were tested. Tests on two samples are continuing while tests on the other seven were stopped following review of data in August 2005. Results were very similar to the metasedimentary samples. Samples with relatively low NP (<10 kg $CaCO_3$/t) became acidic almost immediately whereas samples with higher NP have yielded consistently non-acidic leachates and were not expected to generate acid for several years. Once the initial trends were established, leachate chemistry showed decreasing concentrations of major ions with trace metals responding to changes in pH.

The overall objectives of these tests have been met in terms of indicating the rate at which NP is depleted and leaching of metals under various pH conditions. Two tests were selected to represent acidic and non-acidic conditions and were continued. The acidic test (3069-0927-0947) has shown a continuation of the slow decline in pH which also resulted in increases in metal leaching. This test is being continued. The non-acidic test (3124-0872-0887) continued along the same general trend. This test was stopped in June 2006.

2.1.3 Tertiary Rocks

The majority of Tertiary rock types are not expected to generate acid. A very small component contains elevated pyrite concentrations and may generate acid. The program is designed primarily to assess metal leaching under non-acidic conditions and relationships between sulfide content and metal leaching. Graphs showing results are provided in Attachment C.

Nine tertiary rock samples were tested, with two samples being tested as triplicates to assess reproducibility of results (total of 13 tests). Four tests of which three were part of a triplicate were stopped after the data were reviewed in August 2005. Testing of six samples of the samples started in February 2005 was continued to evaluate longer term trends. One of these tests was stopped when the data were reviewed in June 2006. All three tests started in November 2005 are continuing.

All samples generated leachates that were pH neutral or slightly alkaline. The six samples with relatively low sulfide content produced leachates with pHs between 8 and 9.3, but the three samples with higher sulfide content had leachate pHs between 7 and 8. The overall trend appeared to be for leachate pHs to stabilize between 7.5 and 8.2. All cells showed a general decrease in release rates, and the decrease generally lessened with time. In all cases, sodium was initially an important ion that gradually decreased and was replaced by calcium and magnesium as dominant ions. Release of metals and other potential contaminants generally decreased or was stable with a tendency toward flattening of the overall trend. The only parameter which showed increasing release was barium, the increase in which resulted from the decrease in sulfate.

The reasons for stopping testing on each of the four samples (six tests) are provided below. Generally, the focus on continuing tests has been on rock types with higher sulfur content that will have a stronger influence on water quality than the rocks with lower sulfur content. All four samples were not considered potentially acid generating (PAG) based on elevated NP/AP and low sulfur content. Continuation of the tests to observe onset of ARD was not a criterion.

- 115-0054-0066 (Siltstone). This sample was tested in triplicate. Reproducibility of the triplicate was very good. The tests were stopped because reproducibility was demonstrated, and the decreasing trend in release rates was sufficiently similar to other tests that continuation of other tests would provide the same information. Continuation of sample 115-1042-0163 of the same rock type with higher sulfur has confirmed the longer term trend.

- 117-1055-1071 (basalt dike intrusive into pre-Tertiary rock). This sample showed very similar trend as triplicate tests on 3102-0958-0978, which is the same rock type with a higher sulfur content. The test was stopped because results were very similar to this sample.

- 3129-0417-0435 (volcanic sediments). This sample contained very low sulfur (0.03%) and the release rate trends paralleled 3129-0253-0272, which was the same rock type with higher sulfur. The test was stopped because leachate concentrations were either stable or declining to low levels.

- 3129-0253-0272 (volcanic sediments). This sample showed stable release trends.

2.2 Subaqueous Columns

This program was designed to evaluate leaching of potentially acid generating pre-Tertiary waste rock under flooded conditions that might exist in a subaqueous disposal location or flooded pit walls at closure. Six samples were selected representing metasedimentary and plutonic waste rock with a range of sulfur content. Two of the samples were already acidic due to low NP at the time the test was started.

Graphs showing concentrations are provided in Attachment D.

The data were reviewed in June 2006, and two columns yielding pH neutral leachate and stable or decreasing trends in chemistry were stopped. The chemistry was also similar for two other neutral pH columns, which are being continued.

3 Tailings Tests

Four samples of tailings from processing of two ore composites were used as feed for four humidity cells started in February 2005. The samples were cleaner tailings and scavenger tailings which when combined

form the non-pyritic tailings. The scavenger tailings dominate the composite, but have lower sulfur concentrations. Characteristics of the four samples are provided in Table 3. All four samples had NP/AP greater than 2.4 and were not expected to generate acid.

Graphs for humidity cell results are provided in Attachment E.

Results for the two scavenger tailings samples showed that stable concentrations for most parameters developed within a few weeks of start-up. The tests were stopped after 34 weeks because trends were well-established.

The chemistry of leachates for the two cleaner tailings sample was less stable and showed long term increasing trends for copper leaching. The tests were therefore being continued to monitor the trends. The tests will be continued until stable or decreasing release trends become apparent.

Two leach columns containing the Scavenger Tailings sample shown in Table 3 are continuing.

TABLES

Table 1. Characteristics and Status of Rock Samples in Humidity Cells

Sample ID	Rock Type	NP kg $CaCO_3$/t	AP kg $CaCO_3$/t	NP/AP	Start Date	Stop Date	Duration Weeks	Time to Depletion of NP years	Leachate pH	Decisions	Reason for Decisions
Pre-Tertiary Meta-Sedimentary Rock											
019-0072-0090	WY	0.4	12.5	0.04	Feb-05	Aug-05	29	-	5<pH<6	Stopped	Stable leachate chemistry under acidic conditions
033-0137-0155	Y	26.5	68.4	0.39	Feb-05	Aug-05	29	23.8	pH Neutral	Stopped	Stable leachate chemistry. Not expected to generate acid in short term
047-0350-0365	WY	6.1	104.7	0.06	Feb-05	Jun-06	72	3.0	pH Neutral	Stopped	Stable leachate chemistry. Not expected to generate acid in short term
118-0520-0535	Y	30.9	92.5	0.33	Feb-05	Aug-05	29	8.6	pH Neutral	Stopped	Stable leachate chemistry. Not expected to generate acid in short term
118-1220-1238	WY	32.6	77.5	0.42	Feb-05	Aug-05	29	13.9	pH Neutral	Stopped	Stable leachate chemistry. Not expected to generate acid in short term
3102-0568-0588	Y	18.5	97.8	0.19	Feb-05	Aug-05	29	9.7	pH Neutral	Stopped	Stable leachate chemistry. Not expected to generate acid in short term
3115-0988-1008	Y	10.0	46.3	0.22	Feb-05	Jun-06	72	9.0	pH Neutral	Stopped	Stable leachate chemistry. Not expected to generate acid in short term
3124-0188-0209	Y	0.1	77.2	0.00	Feb-05	-	89	-	pH<5	Will be stopped	Stable leachate chemistry under acidic conditions
Pre-Tertiary Plutonic Rock											
025-0617-0637	D	9.8	105.3	0.09	Feb-05	Aug-05	29	-	pH<5	Stopped	Stable leachate chemistry under acidic conditions
046-0113-0133	N	6.1	53.4	0.11	Feb-05	Aug-05	29	-	5<pH<6	Stopped	Stable leachate chemistry under acidic conditions
046-0580-0600	G	8.0	45.0	0.18	Feb-05	Aug-05	29	7.2	pH Neutral	Stopped	Stable leachate chemistry. Not expected to generate acid in short term
112-0460-0480	X	5.6	91.6	0.06	Feb-05	Aug-05	29	4.4	pH Neutral	Stopped	Stable leachate chemistry. Not expected to generate acid in short term
117-0190-0210	N	5.6	58.1	0.10	Feb-05	Aug-05	29	3.7	pH Neutral	Stopped	Stable leachate chemistry. Not expected to generate acid in short term
118-0468-0488	M	37.5	36.6	1.03	Feb-05	Aug-05	29	23.4	pH Neutral	Stopped	Stable leachate chemistry. Not expected to generate acid in short term
3069-0927-0947	G	3.2	76.3	0.04	Feb-05	-	89	-	pH<5	Continuing	Continue to evaluate effect of declining pH
3123-0438-0458	D	41.8	152.5	0.27	Feb-05	Sep-05	29	38.2	pH Neutral	Stopped	Stable leachate chemistry. Not expected to generate acid in short term
3124-0872-0887	X	45.5	44.4	1.03	Feb-05	Jun-06	72	23.6	pH Neutral	Stopped	Stable leachate chemistry. Not expected to generate acid in short term
Tertiary											
115-0054-0066	TC siltstone	29.0	6.3	4.64	Feb-05	Aug-05	29	6.5	pH Neutral	Stopped	Decreasing trend shown. Sample 115-0142-0163 is continuing for same rock
115-0054-0066	TC siltstone	29.0	6.3	4.64	Feb-05	Aug-05	27	7.5	pH Neutral	Stopped	Reproducibility shown
115-0054-0066	TC siltstone	29.0	6.3	4.64	Feb-05	Aug-05	27	7.6	pH Neutral	Stopped	Reproducibility shown
115-0142-0163	TC arkose (higher S)	41.4	9.4	4.41	Feb-05	-	89	10.4	pH Neutral	Continuing	Continue as example of sed Tertiary with higher S
117-1055-1071	TBd (low S)	108.5	7.8	13.89	Feb-05	Aug-05	29	322.2	pH Neutral	Stopped	Similar results to sample 3102-0958-0978 on same rock type.
3102-0958-0978	TBd	103.3	21.3	4.86	Feb-05	-	89	153.7	pH Neutral	Continuing	Leachate chemistry stability not demonstrated.
3102-0958-0978	TBd	103.3	21.3	4.86	Feb-05	-	89	116.9	pH Neutral	Continuing	Continue to evaluate reproducibility
3102-0958-0978	TBd	103.3	21.3	4.86	Feb-05	-	89	202.8	pH Neutral	Continuing	Continue to evaluate reproducibility
3129-0253-0272	TC (and/vol cng)	83.8	3.1	26.80	Feb-05	Jun-06	72	110.5	pH Neutral	Stopped	Stable leachate chemistry
3129-0417-0435	TC (and/vol cng)	98.5	0.6	157.60	Feb-05	Sep-05	29	94.0	pH Neutral	Stopped	Release trends paralleled 3129-0253-0272 (same rock) which was continued.
4157 439-471	TF	21.9	116.9	0.19	Nov-05	-	52	5.3	pH Neutral	Continuing	Higher sulfur examples of Tertiary rock types
4292 415-430	TA/TD	17.2	27.2	0.63	Nov-05	-	52	10.4	pH Neutral	Continuing	Higher sulfur examples of Tertiary rock types
4292 685-695	TC	83.7	75.3	1.11	Nov-05	-	52	33.4	pH Neutral	Continuing	Higher sulfur examples of Tertiary rock types
Method Blank	Method Blank	-	-	-	Feb-05	Sep-05	29			Stopped	Blank effects demonstrated

EPA-7609-0005804-0006

Table 2. Characteristics and Status of Rock Samples in Subaqueous Columns

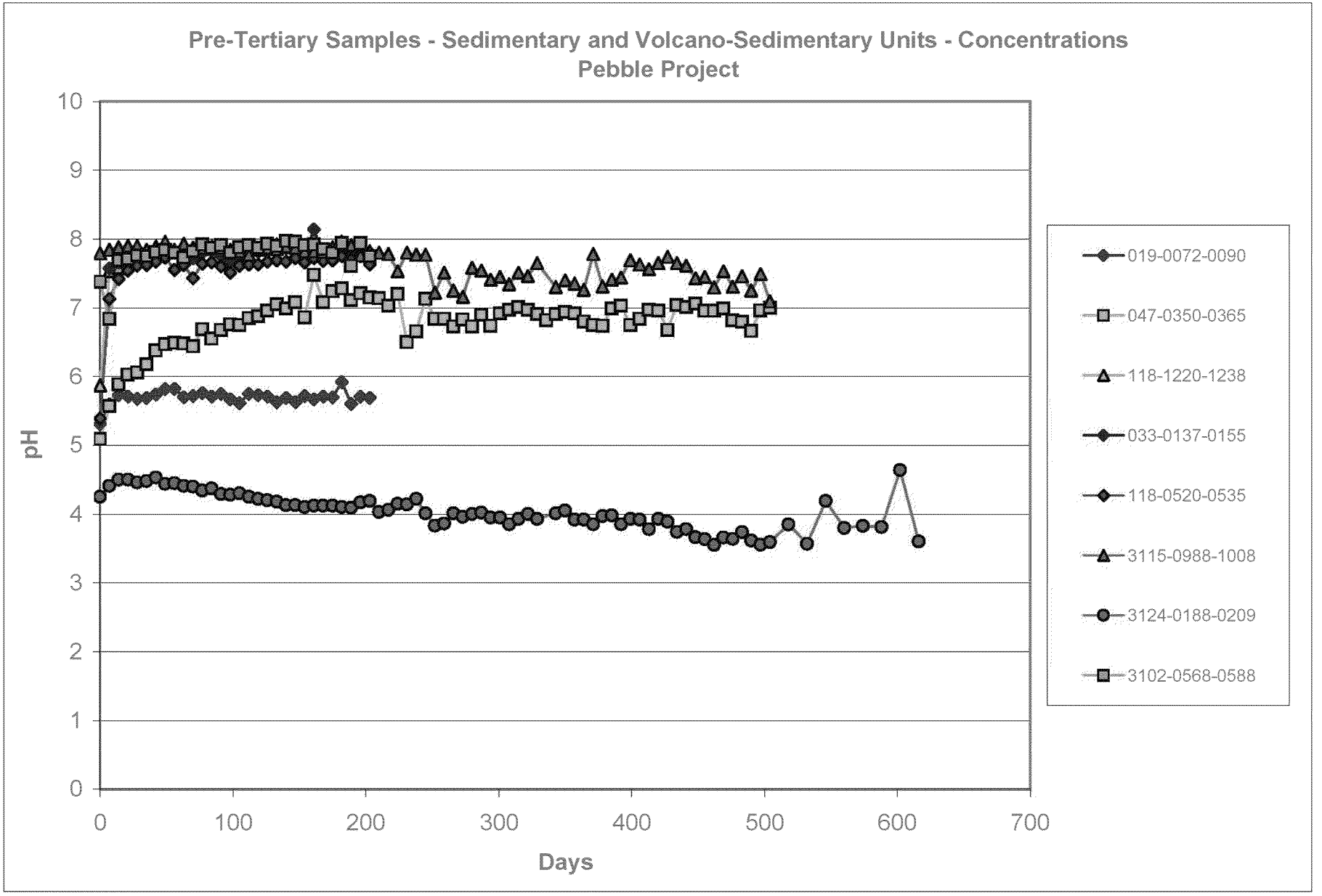
Sample ID	Rock Type	NP kg $CaCO_3$/t	AP kg $CaCO_3$/t	NP/AP	Start Date	Steop Date	Duration Weeks	Leachate pH	Decisions	Reason for Decisions
Pre-Tertiary Meta-Sedimentary Rock										
3102-0568-0588	Y	18.5	97.8	0.19	Feb-05	Aug-05	56	pH Neutral	Continuing	Monitoring of pH neutral leaching
3115-0988-1008	Y	10.0	46.3	0.22	Feb-05	Jun-06	39	pH Neutral	Stopped	Low concentrations, stable neutral pH chemistry
3124-0188-0209	Y	0.1	77.2	0.00	Feb-05	Oct-06	56	pH<5	Continuing	Monitoring of low pH leaching of acidic rock
Pre-Tertiary Plutonic Rock										
3069-0927-0947	G	3.2	76.3	0.04	Feb-05	Oct-06	56	pH<5	Continuing	Monitoring of low pH leaching of acidic ro ck
3123-0438-0458	D	41.8	152.5	0.27	Feb-05	Sep-05	39	pH Neutral	Stopped	Low concentrations, stable neutral pH chemistry
3124-0872-0887	X	45.5	44.4	1.03	Feb-05	Jun-06	52	pH Neutral	Continuing	Monitoring of pH neutral leaching

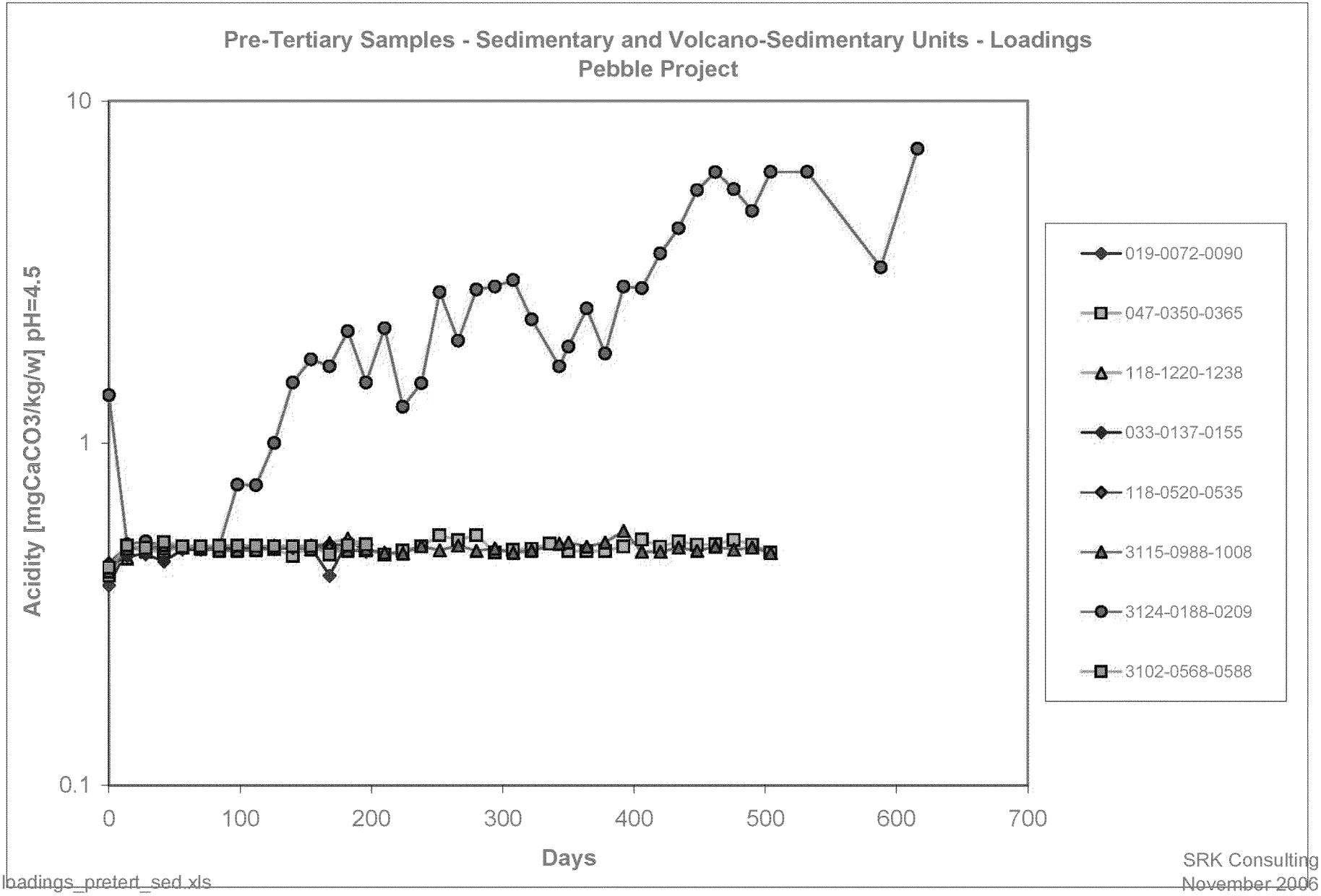
EPA-7609-0005804-0007

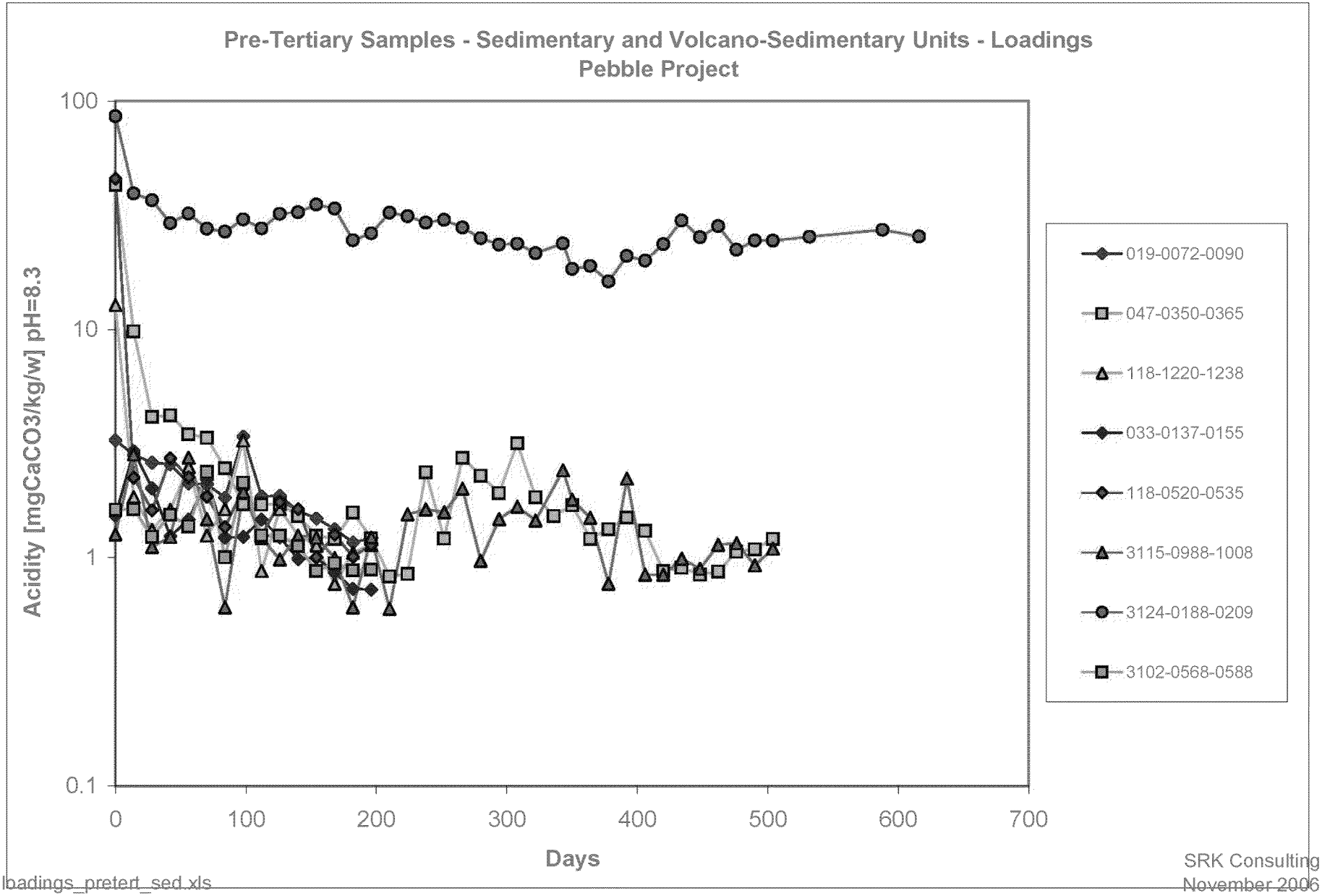
Table 3. Characteristics and Status of Tailings Samples

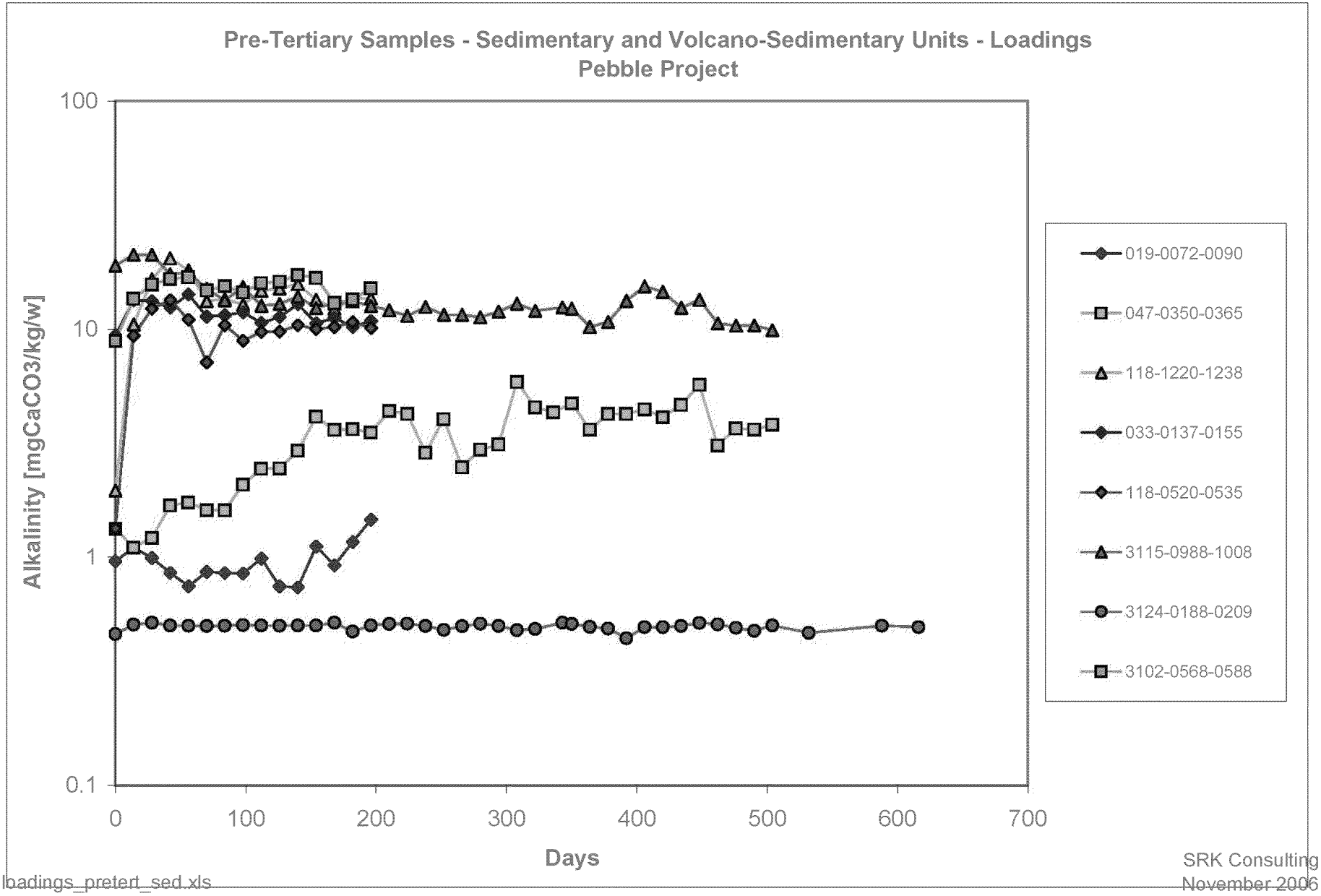
Sample ID	NP kg $CaCO_3$/t	AP kg $CaCO_3$/t	NP/AP	Start Date	Stop Date	Duration Weeks	Decision	Reason for Decision
S2-Scavenger Tails	24.4	5.3	4.6	11-Feb-05	07-Oct-05	34	Continuing	Evaluate longer term trend
S2-Bulk Cleaner Tails	23.3	9.7	2.4	11-Feb-05	-	89	Stopped	Well-defined stable or decreasing trends
S1-Scavenger Tails	19.9	4.7	4.2	11-Feb-05	07-Oct-05	34	Continuing	Evaluate longer term trend
S1-Bulk Cleaner Tails	19.6	6.9	2.9	11-Feb-05	-	89	Stopped	Well-defined stable or decreasing trends
Method Blank	-	-	-	11-Feb-05	-	89	Continuing	

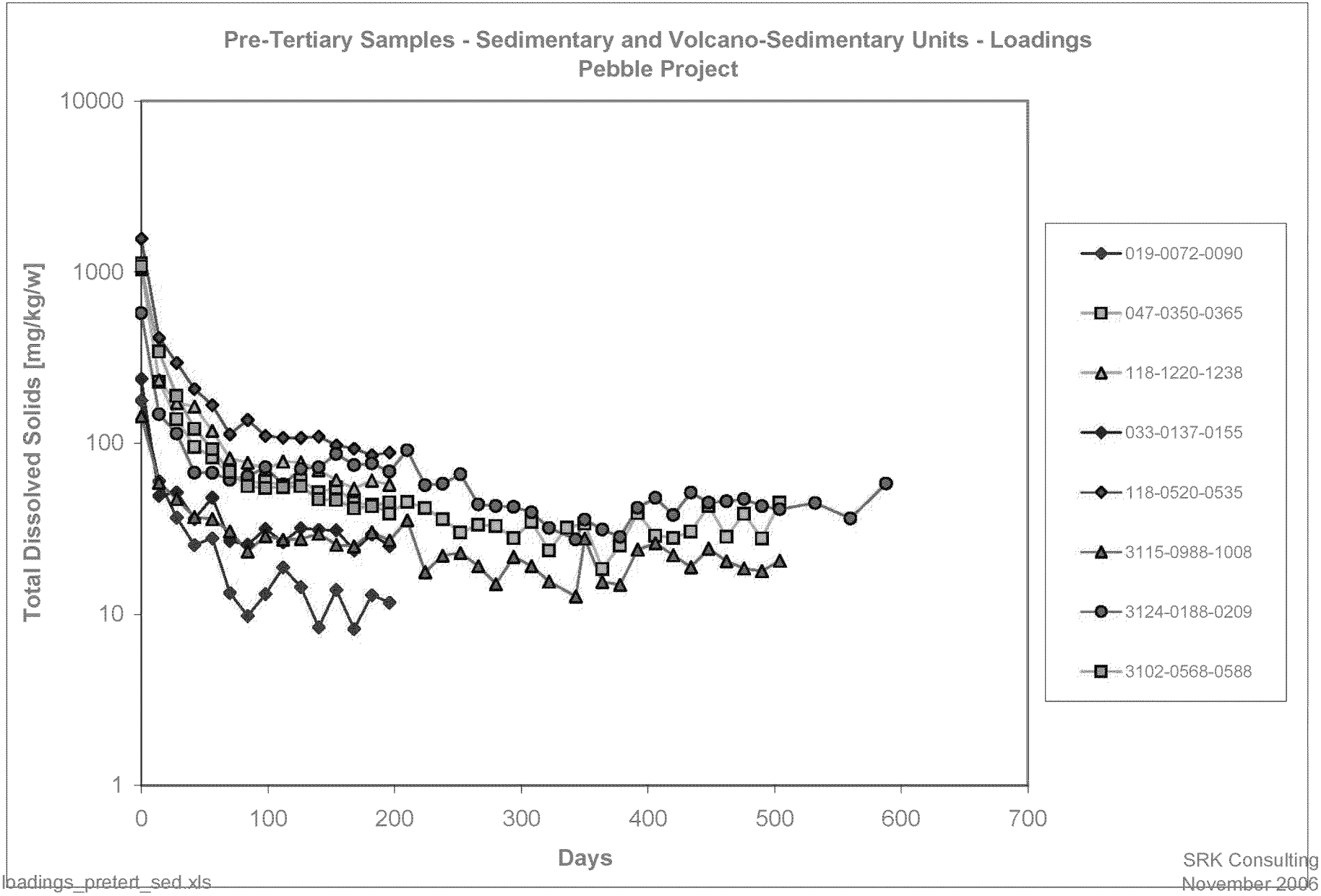
Attachment A
Graphs for Pre-Tertiary Metasedimentary Rock Humidity Cells

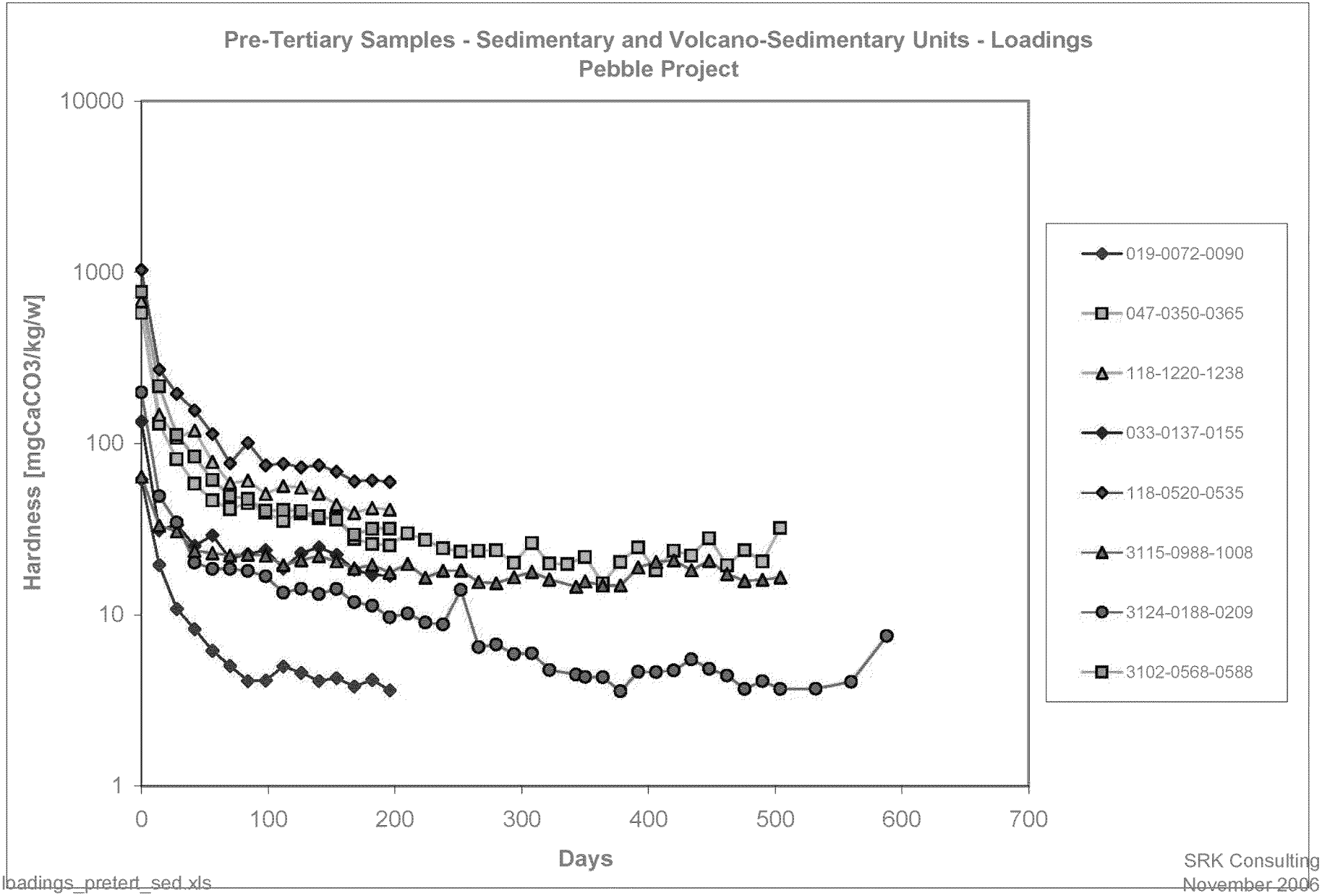

Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Concentrations
Pebble Project
pH
Days
0
1
2
3
4
5
6
7
8
9
10
0
100
200
300
400
500
600
700
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588

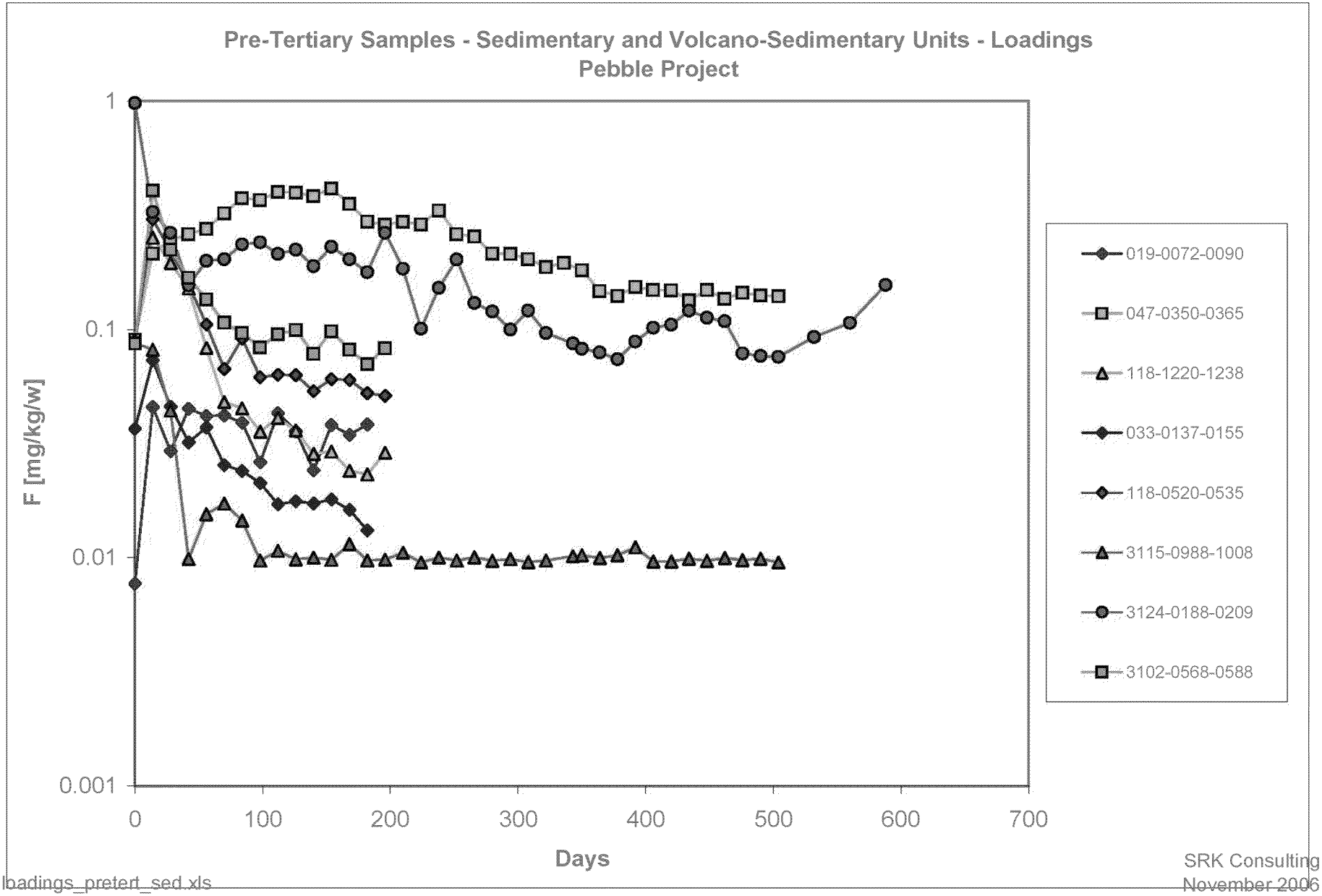

Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Loadings
Pebble Project
Acidity [mgCaCO3/kg/w] pH=4.5
10
1
0.1
0
100
200
300
400
500
600
700
Days
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588

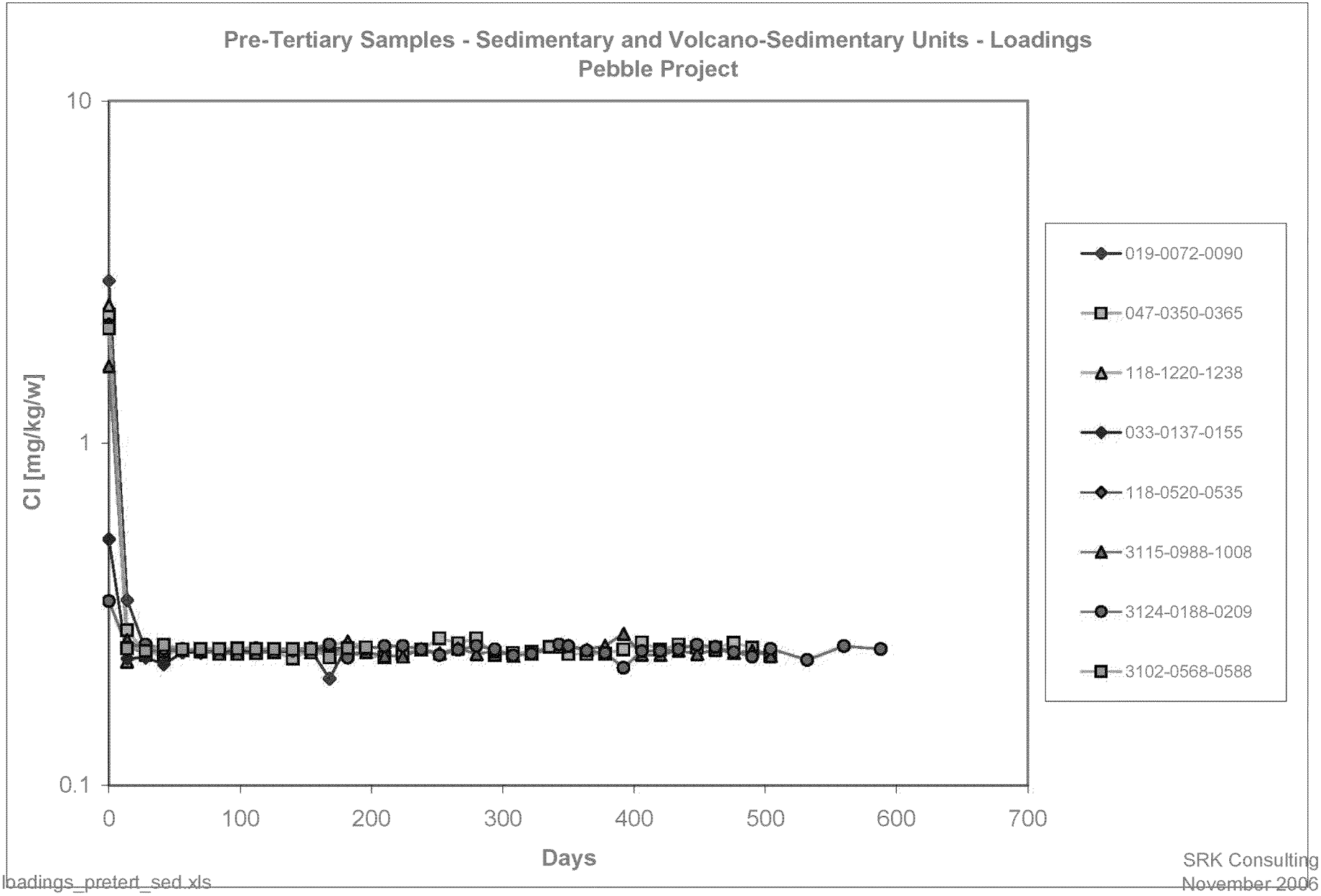

Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Loadings
Pebble Project
Acidity [mgCaCO3/kg/w] pH=8.3
100
10
1
0.1
0
100
200
300
400
500
600
700
Days
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588

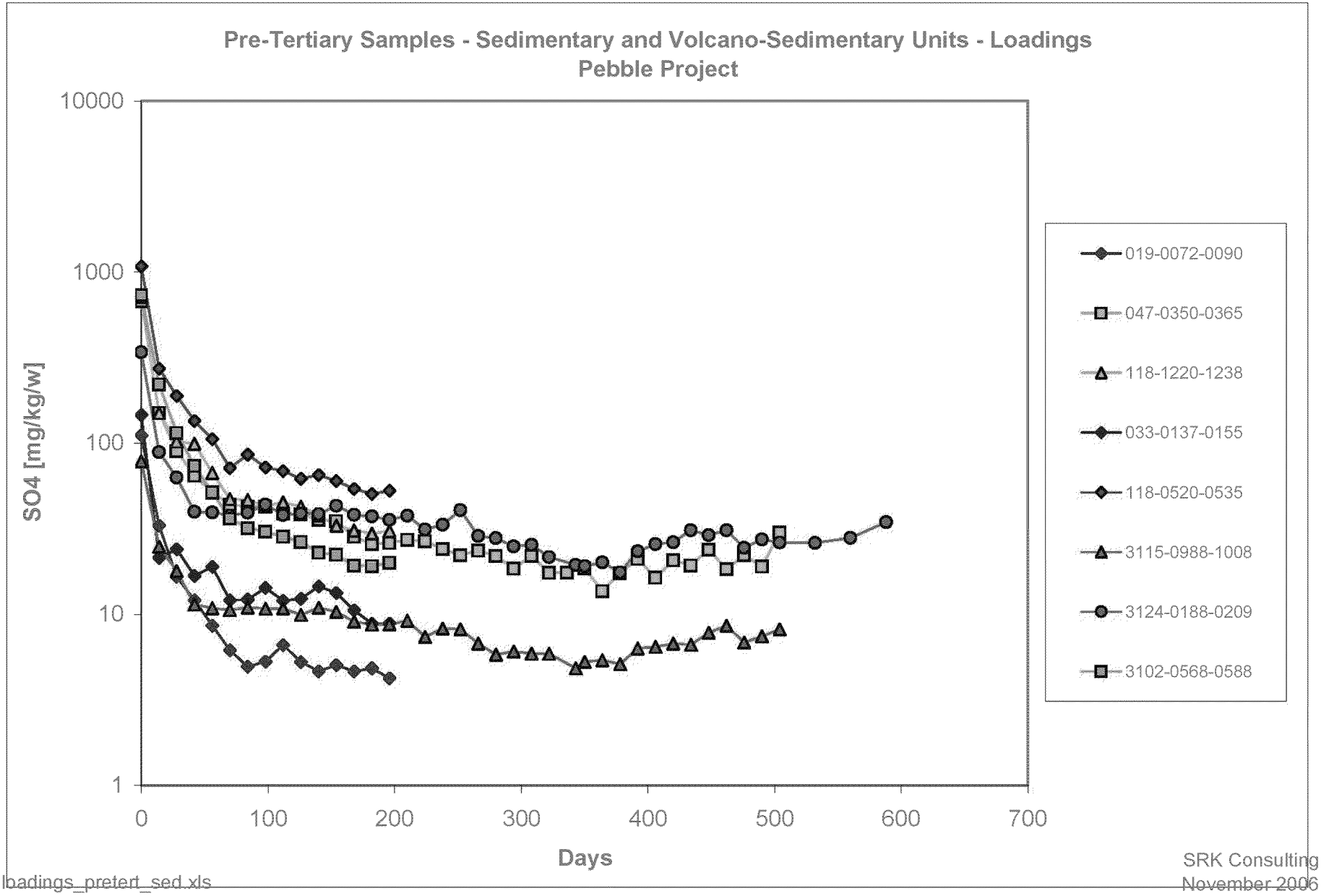

Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Loadings
Pebble Project
Alkalinity [mgCaCO3/kg/w]
100
10
1
0.1
0
100
200
300
400
500
600
700
Days
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588

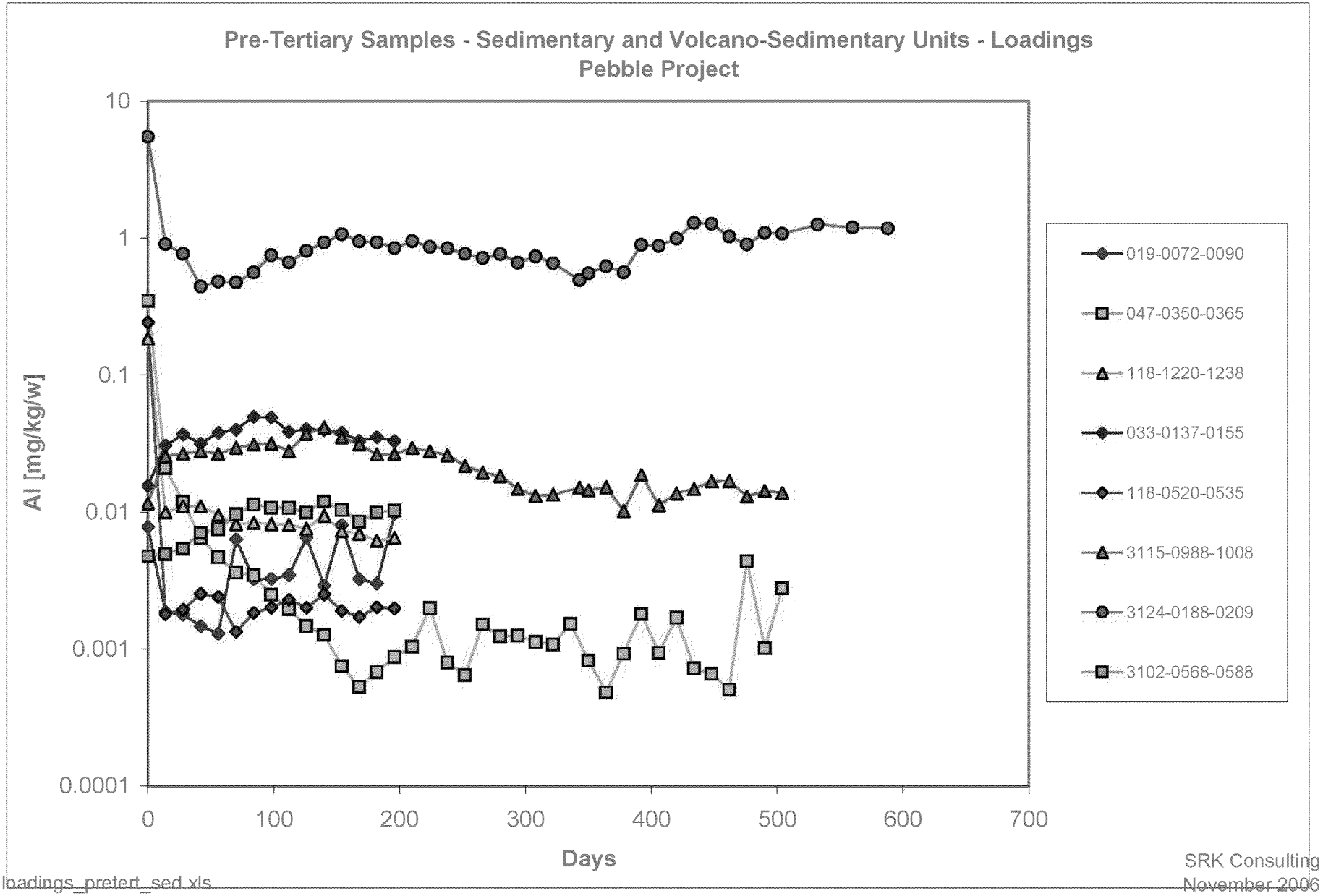

Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Loadings
Pebble Project
Total Dissolved Solids [mg/kg/w]
10000
1000
100
10
1
0
100
200
300
400
500
600
700
Days
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588

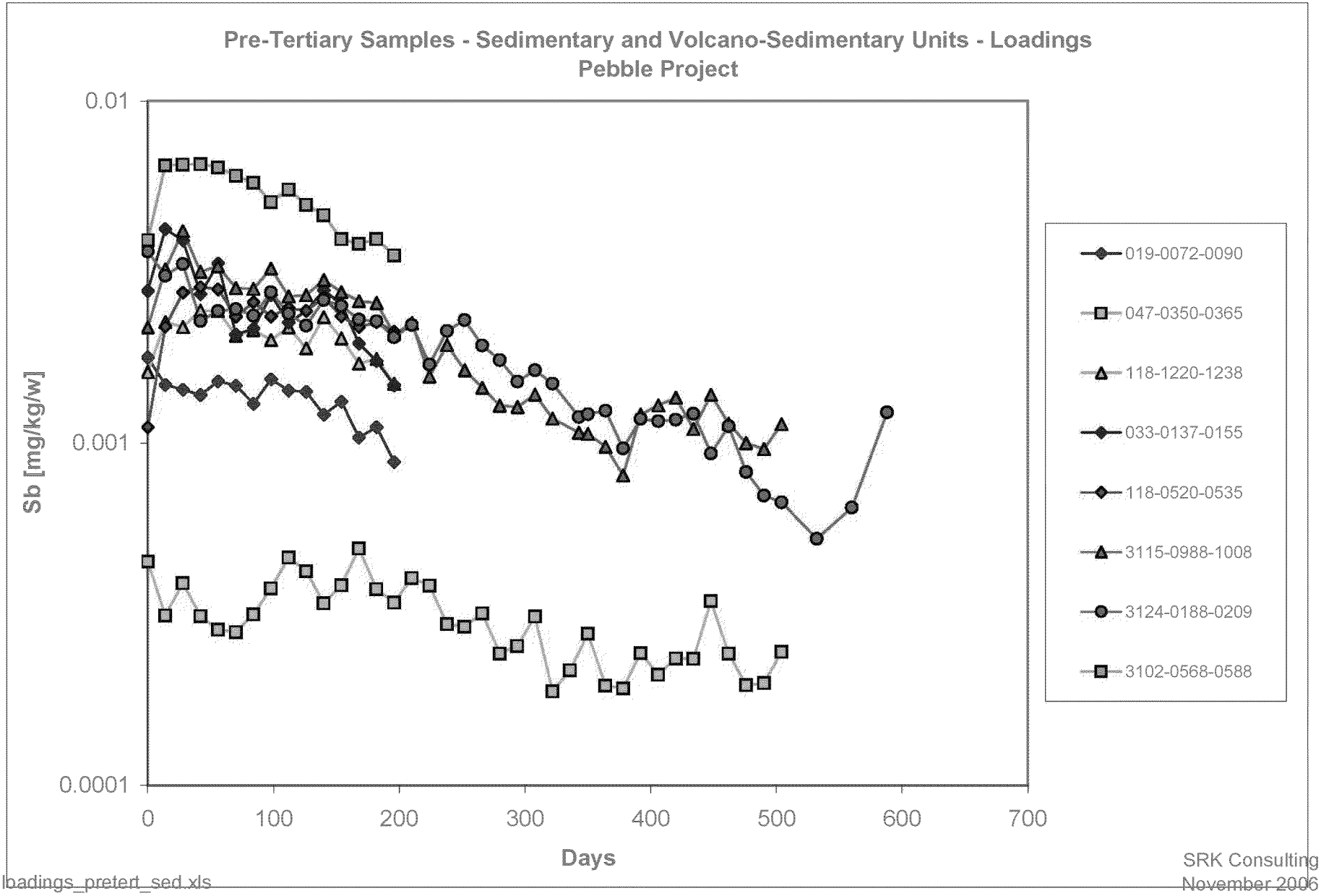

Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Loadings
Pebble Project
Hardness [mgCaCO3/kg/w]
10000
1000
100
10
1
0
100
200
300
400
500
600
700
Days
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588


Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Loadings
Pebble Project
F [mg/kg/w]
1
0.1
0.01
0.001
0
100
200
300
400
500
600
700
Days
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588

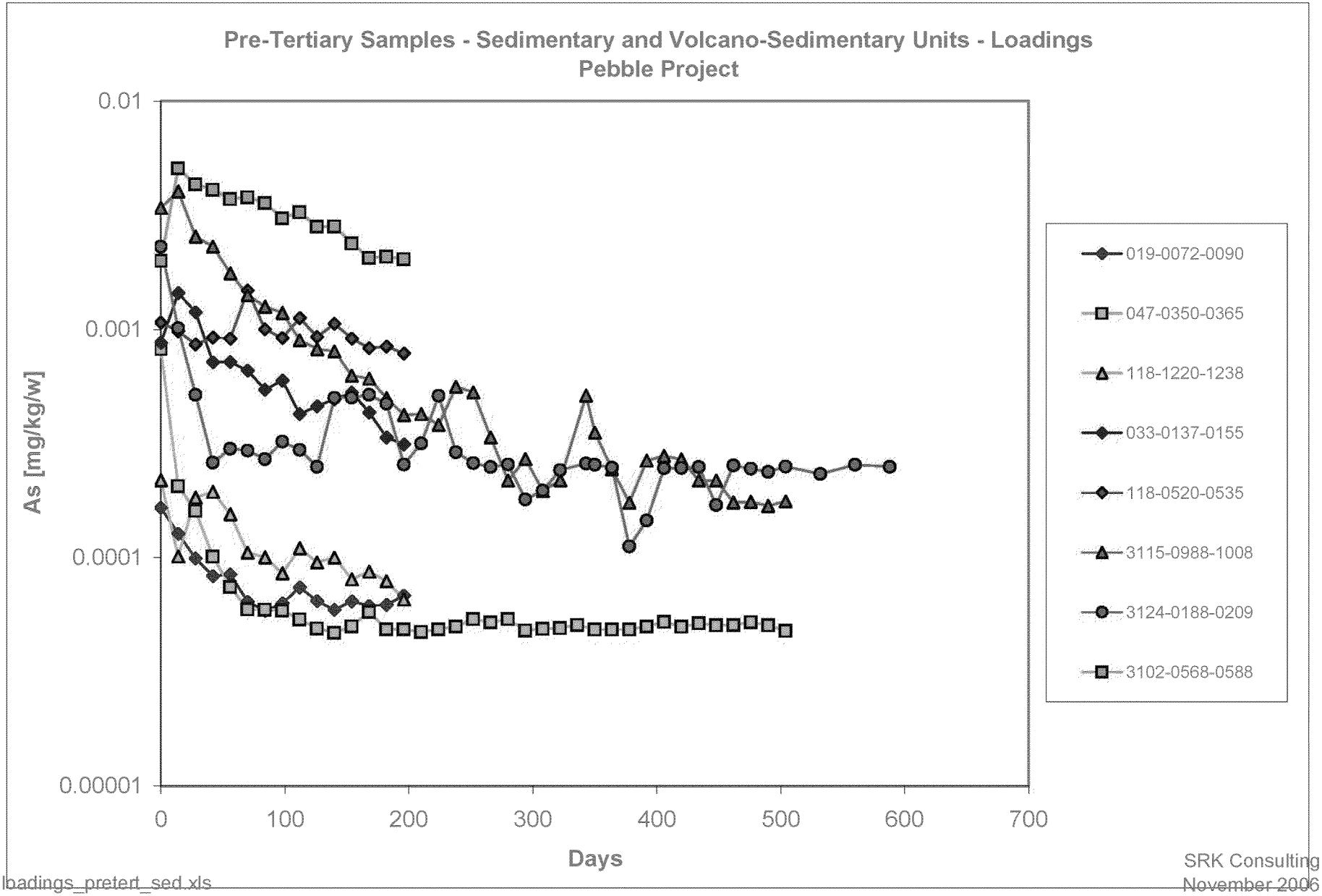

Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Loadings
Pebble Project
Cl [mg/kg/w]
10
1
0.1
0
100
200
300
400
500
600
700
Days
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588


Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Loadings
Pebble Project
SO4 [mg/kg/w]
10000
1000
100
10
1
0
100
200
300
400
500
600
700
Days
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588

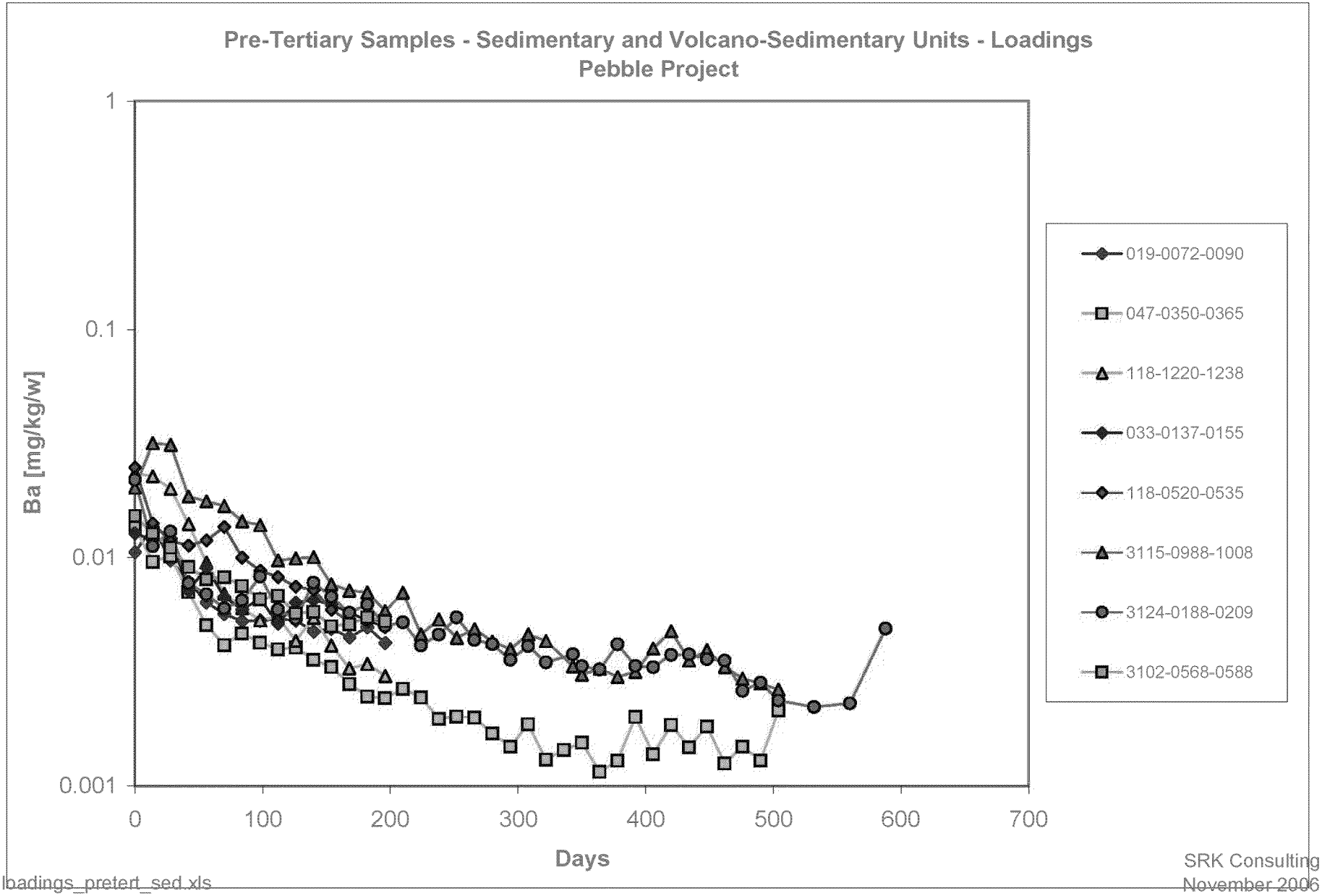

Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Loadings
Pebble Project
Al [mg/kg/w]
10
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588



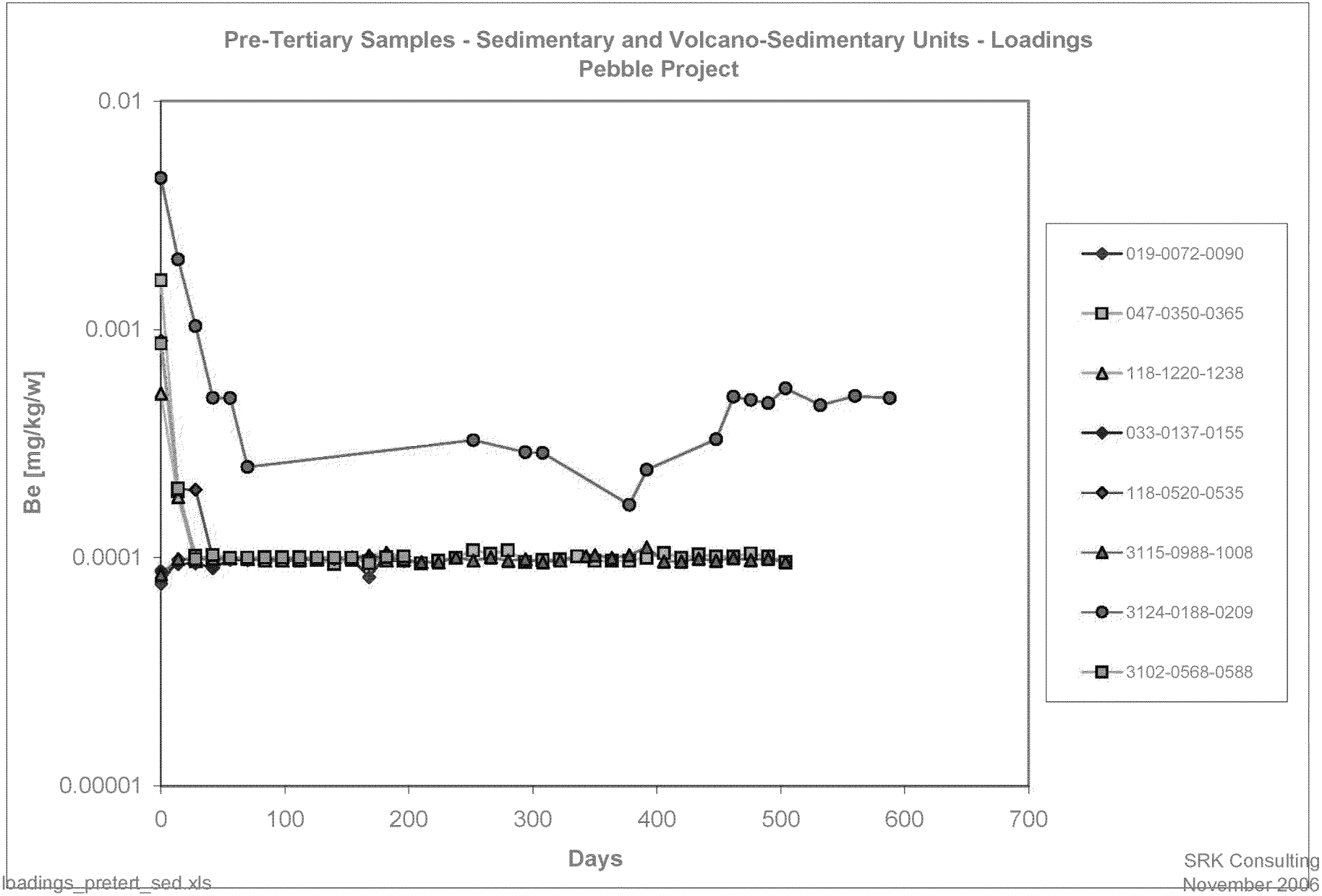
EPA-7609-0005804-0020
SOA 086783



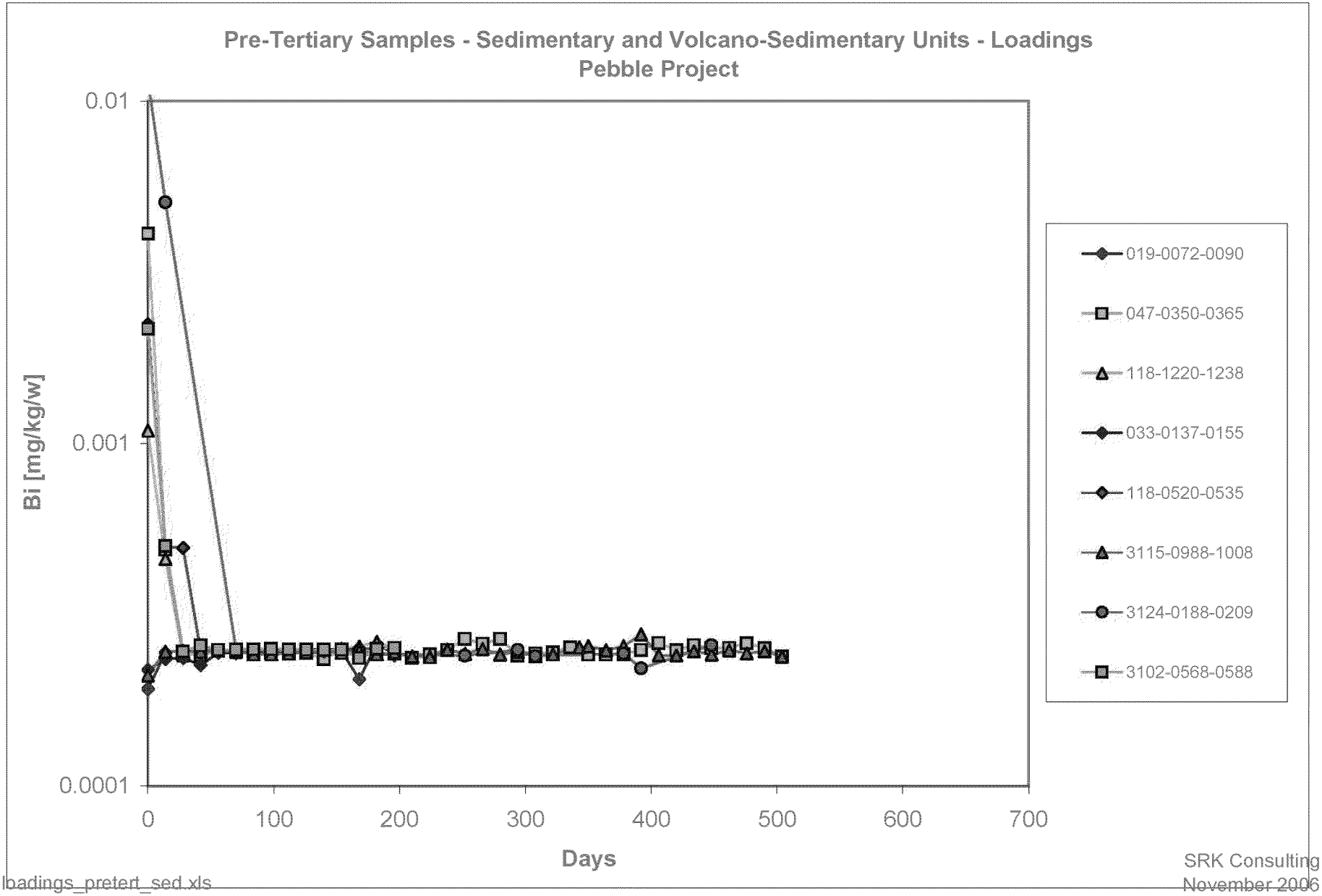
EPA-7609-0005804-0021
SOA 086784

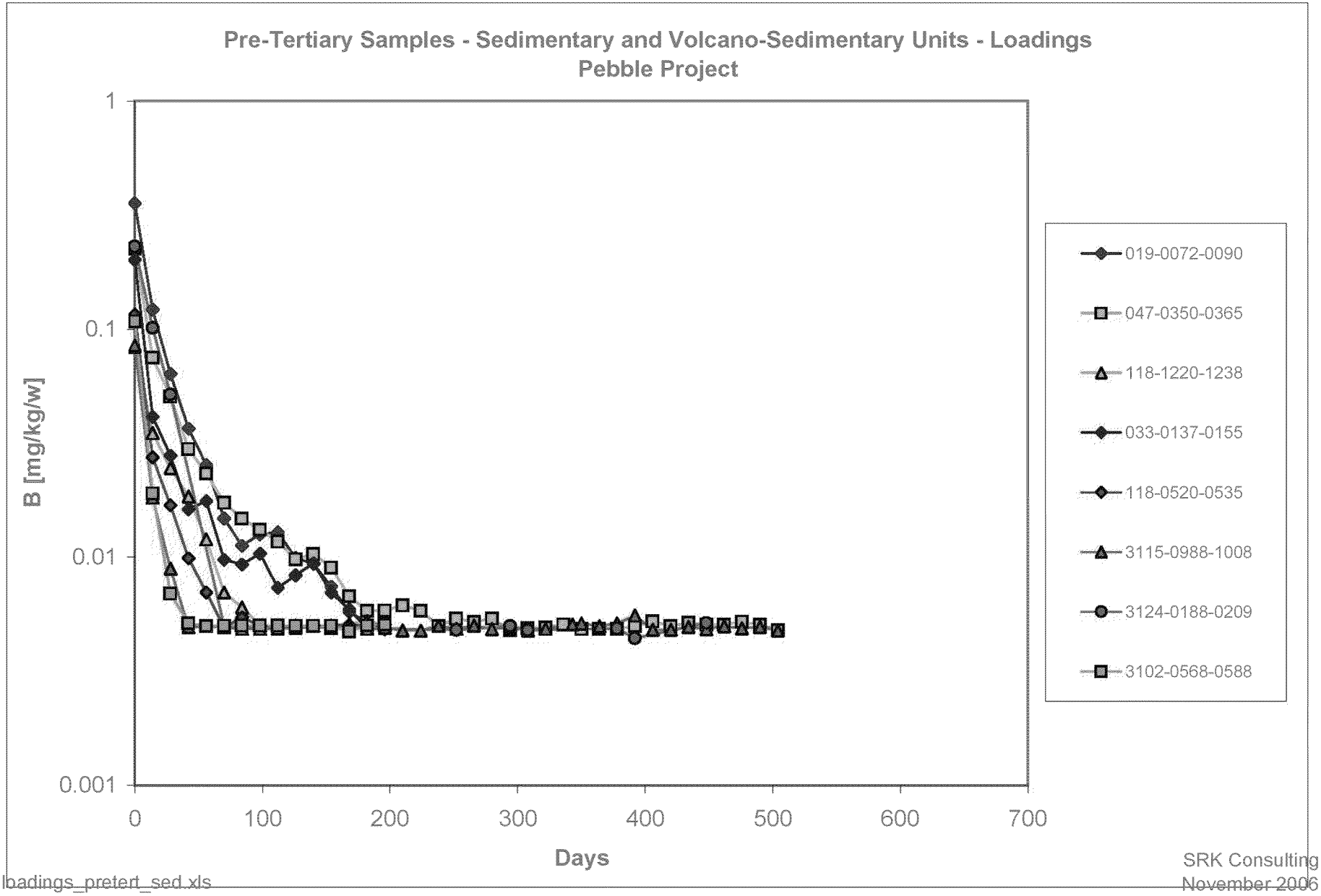


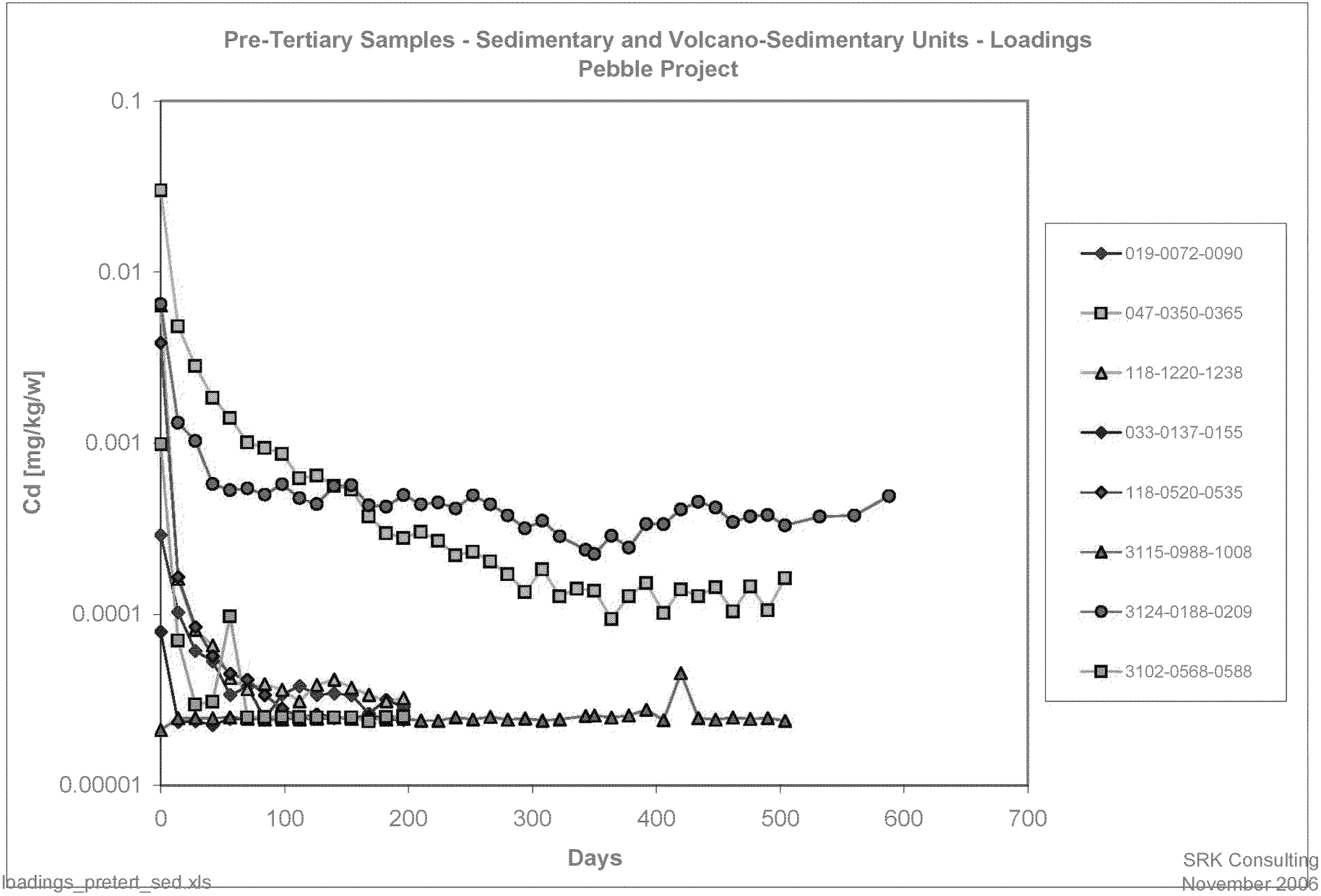
EPA-7609-0005804-0022
SOA 086785

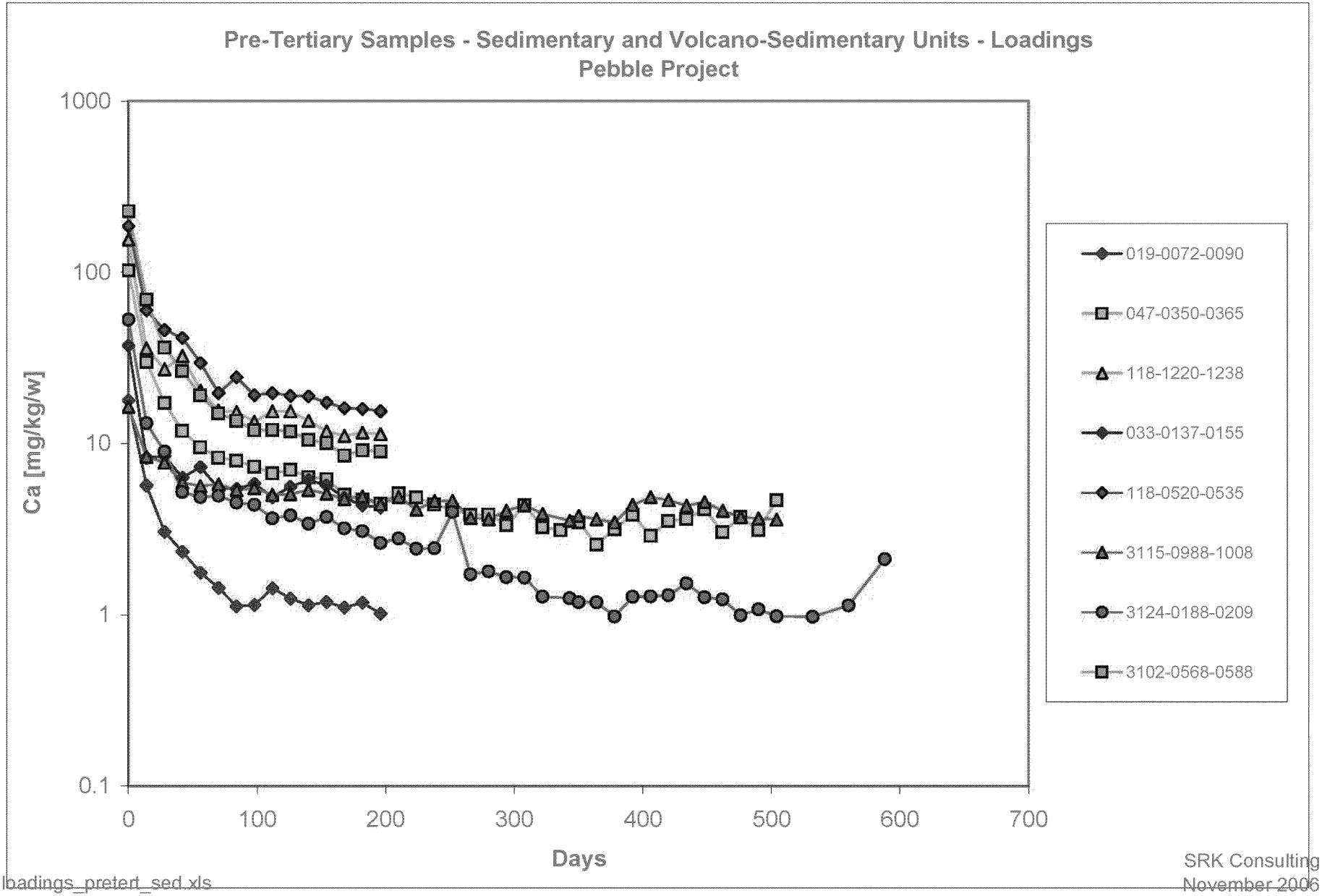


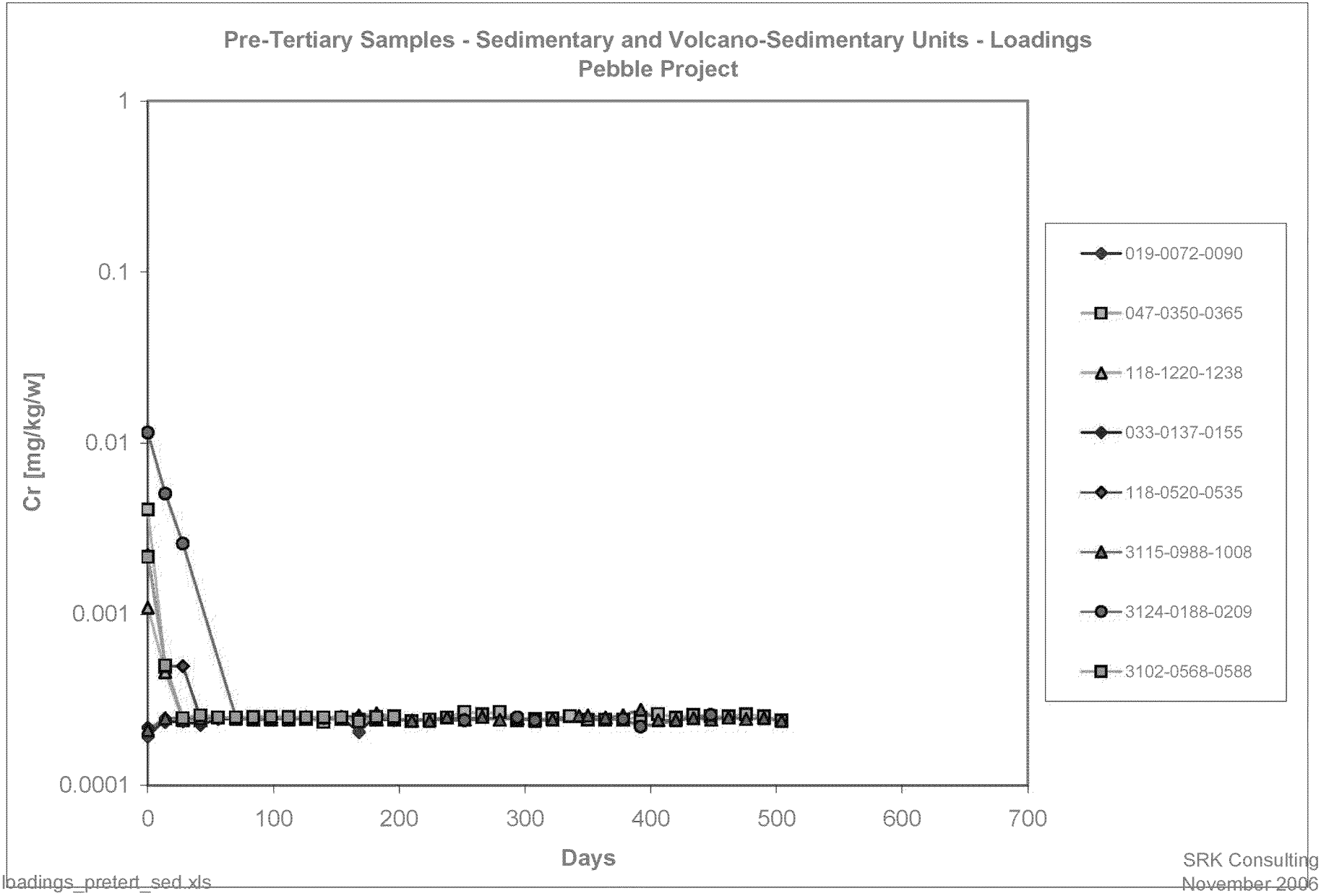
EPA-7609-0005804-0023
SOA 086786

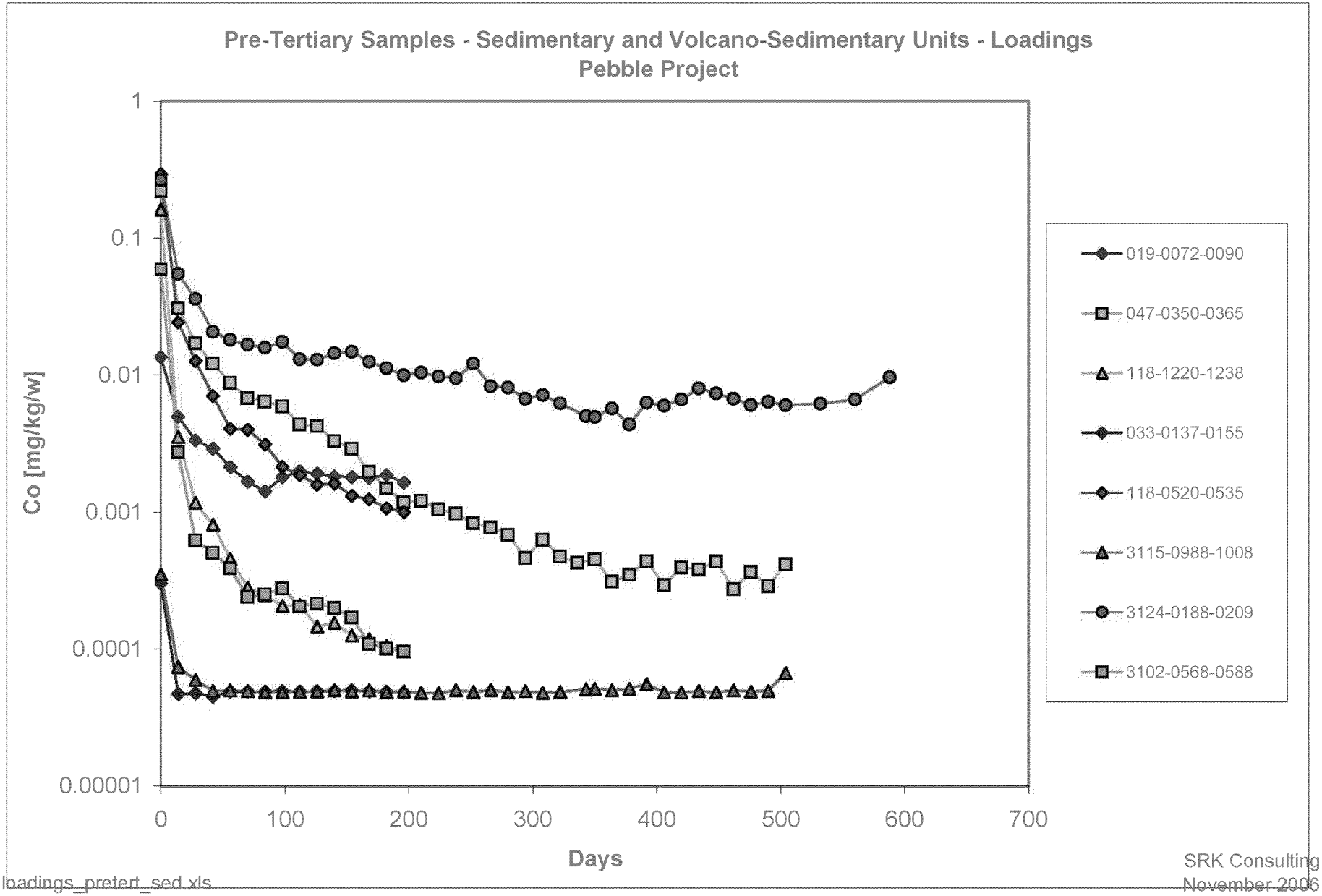

Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Loadings
Pebble Project
Bi [mg/kg/w]
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588

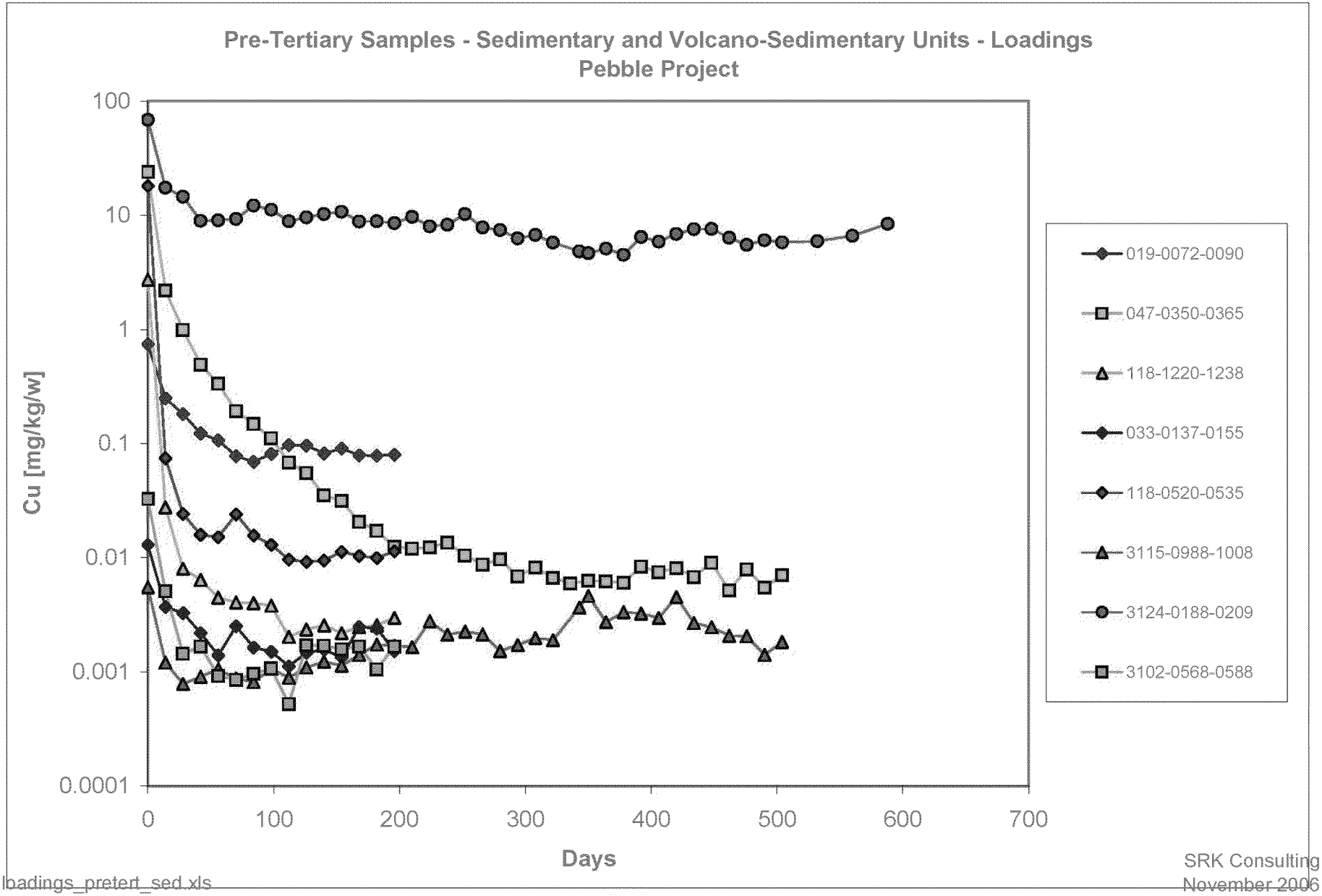

Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Loadings
Pebble Project
B [mg/kg/w]
1
0.1
0.01
0.001
0
100
200
300
400
500
600
700
Days
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588

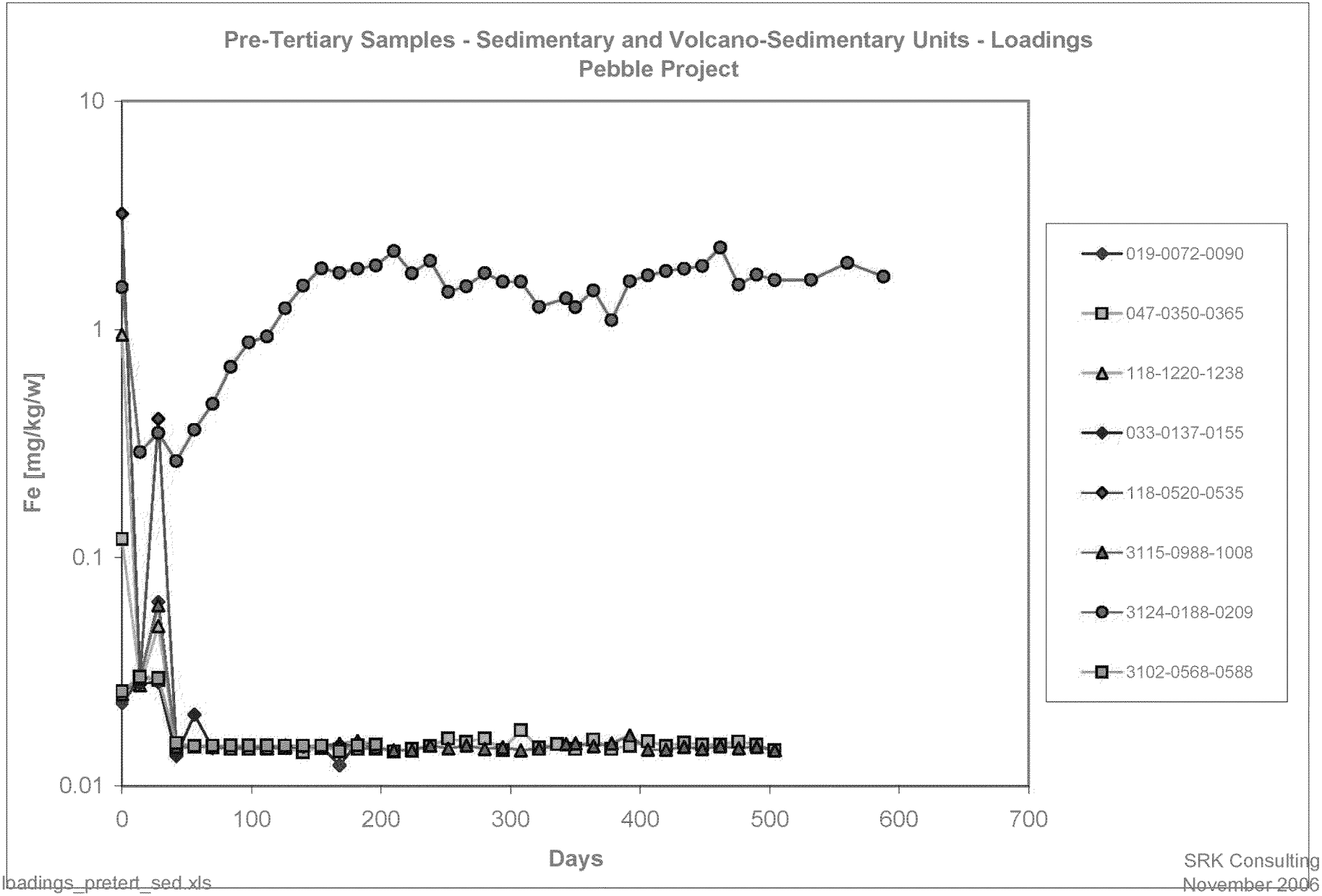

Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Loadings
Pebble Project
Cd [mg/kg/w]
0.1
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588


Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Loadings
Pebble Project
Ca [mg/kg/w]
1000
100
10
1
0.1
0
100
200
300
400
500
600
700
Days
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588

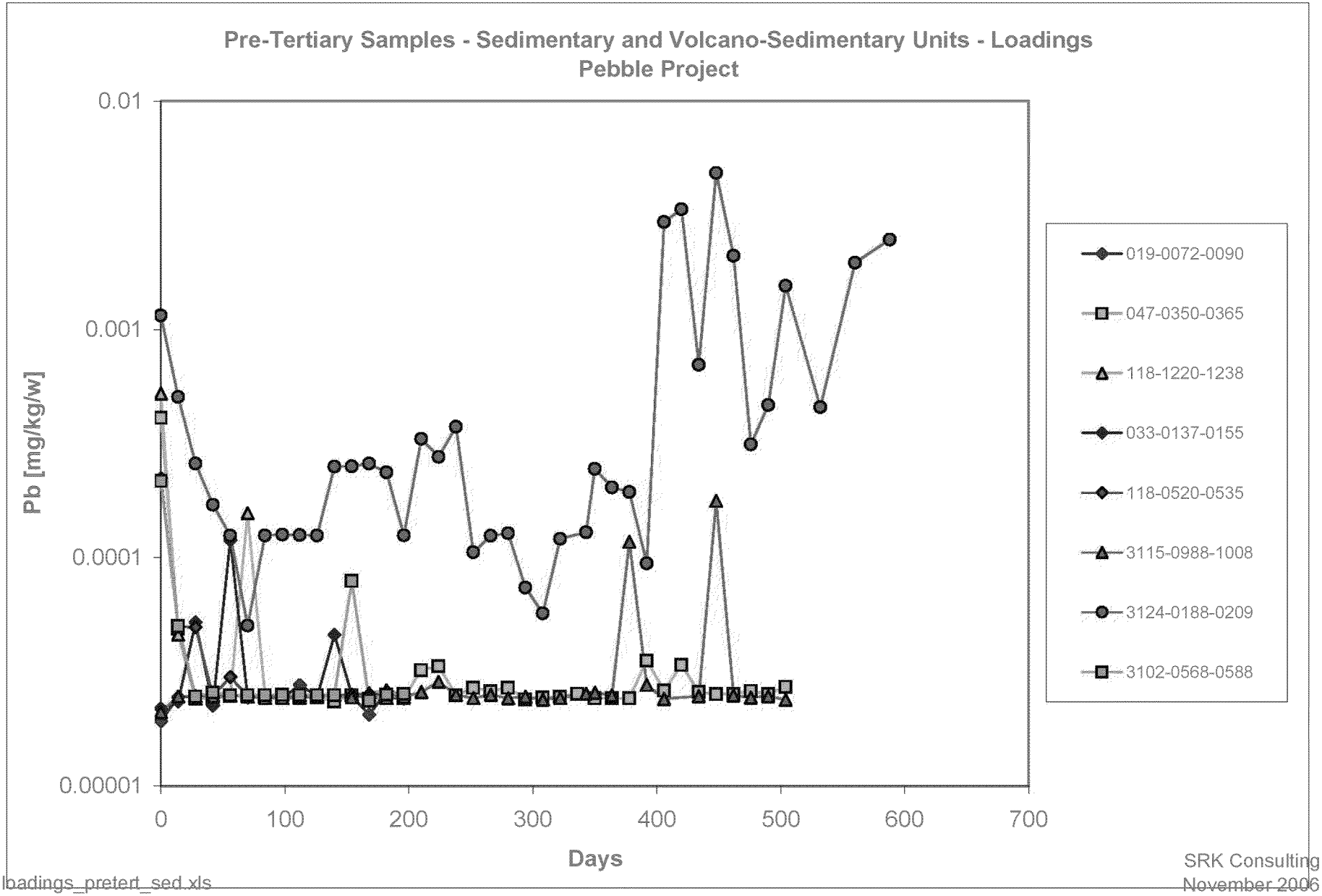

Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Loadings
Pebble Project
Cr [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588

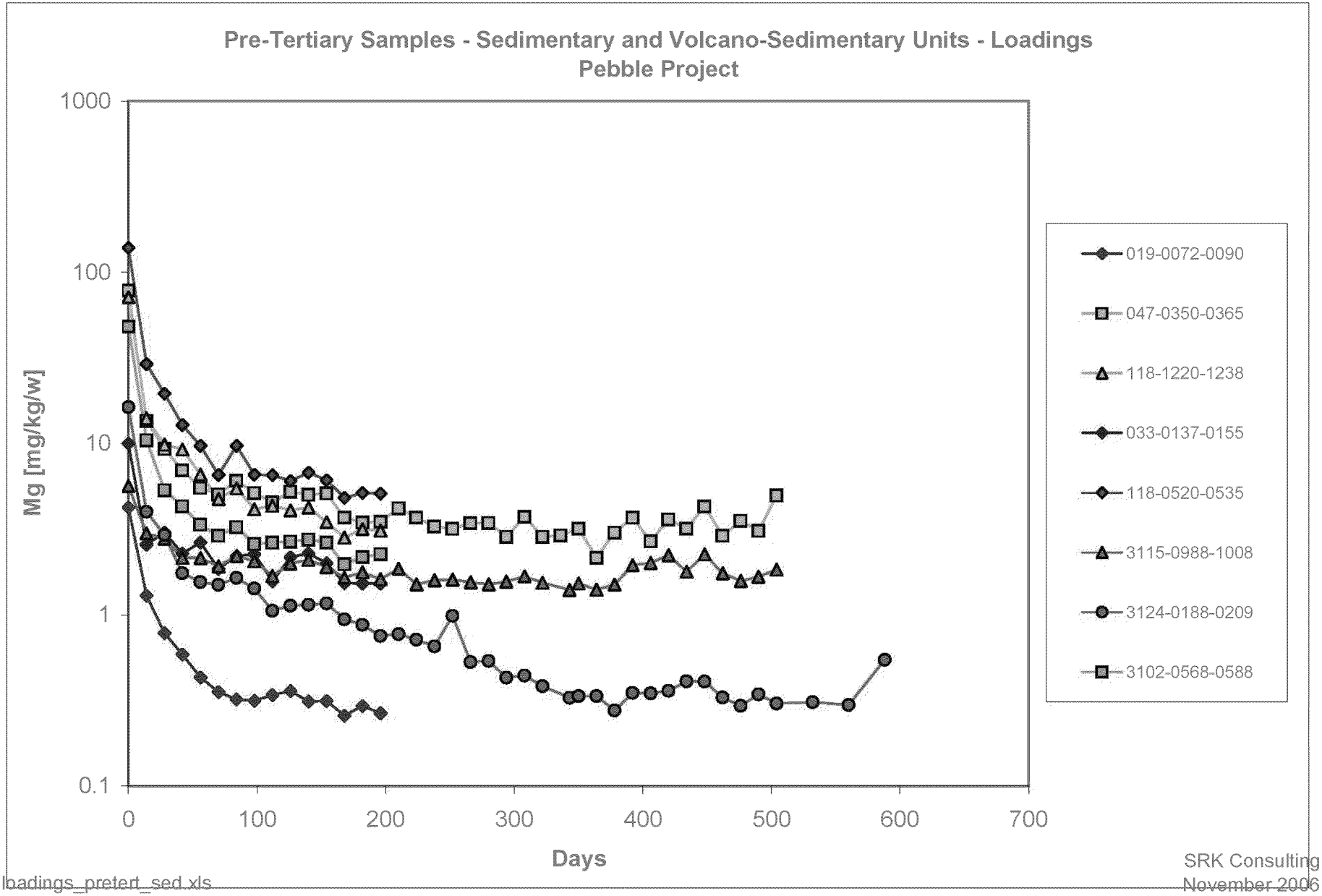

Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Loadings
Pebble Project
Co [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588

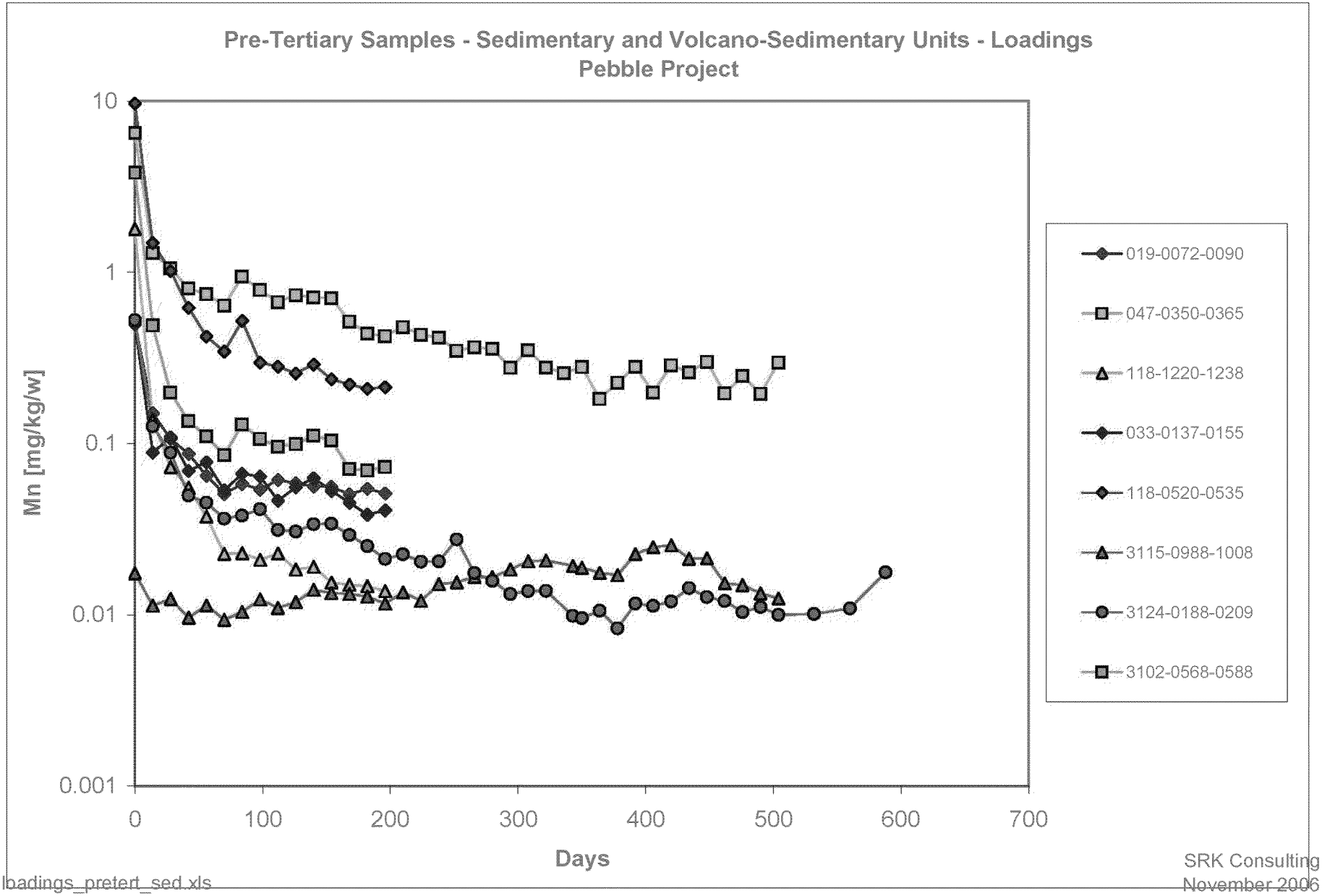

Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Loadings
Pebble Project
Cu [mg/kg/w]
100
10
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588



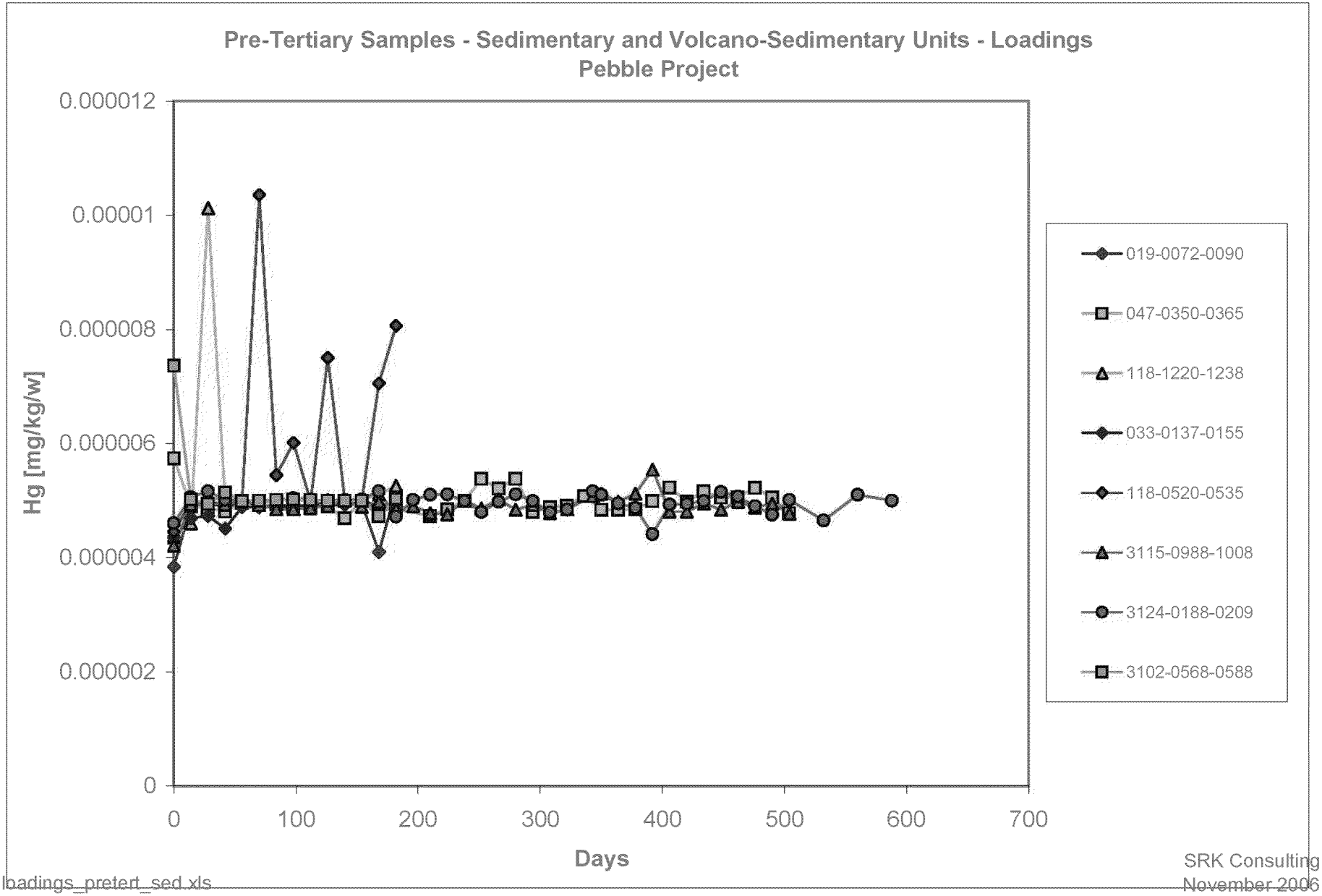
EPA-7609-0005804-0031
SOA 086794


Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Loadings
Pebble Project
Pb [mg/kg/w]
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588

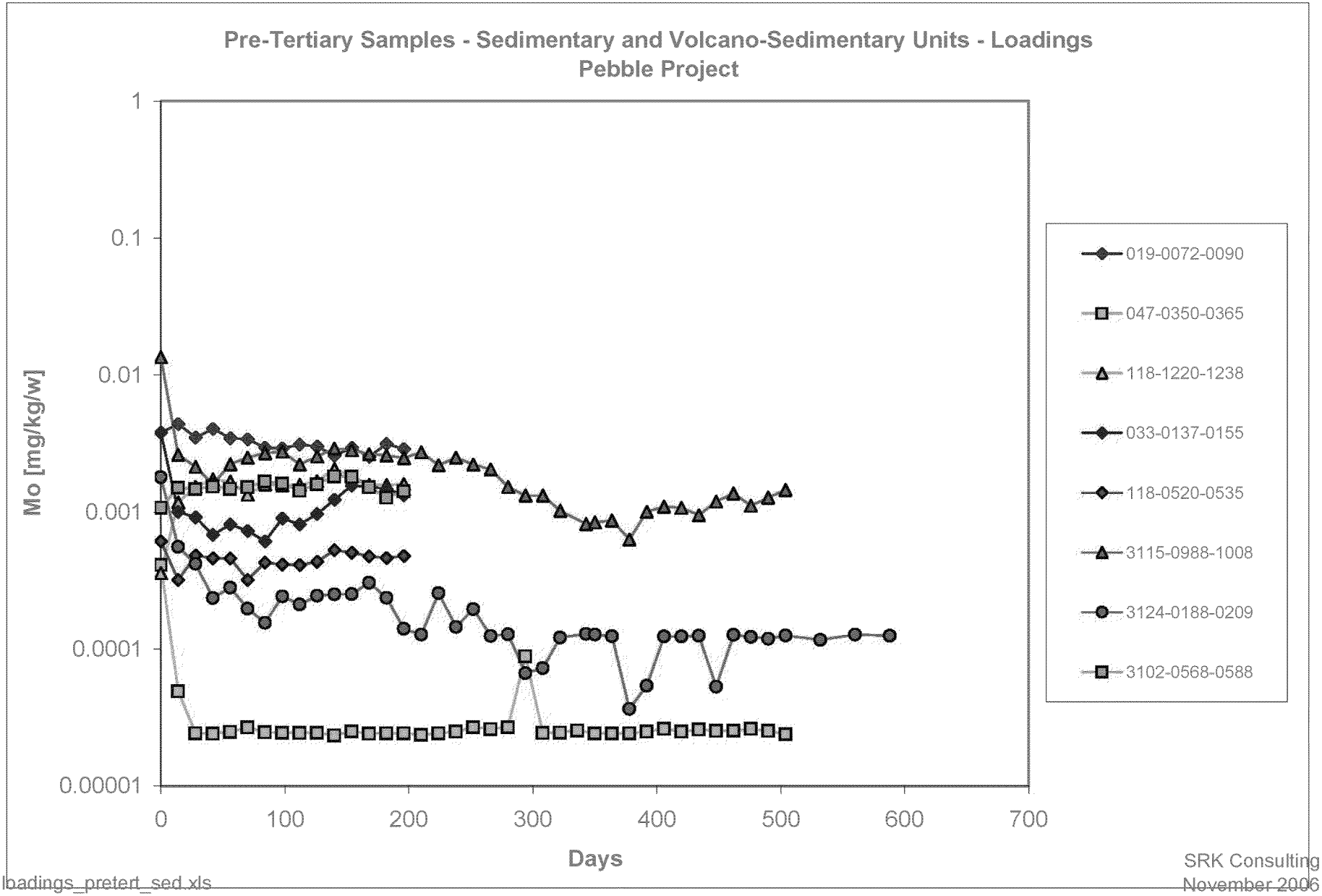

Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Loadings
Pebble Project
Mg [mg/kg/w]
1000
100
10
1
0.1
0
100
200
300
400
500
600
700
Days
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588



EPA-7609-0005804-0034
SOA 086797



EPA-7609-0005804-0035
SOA 086798

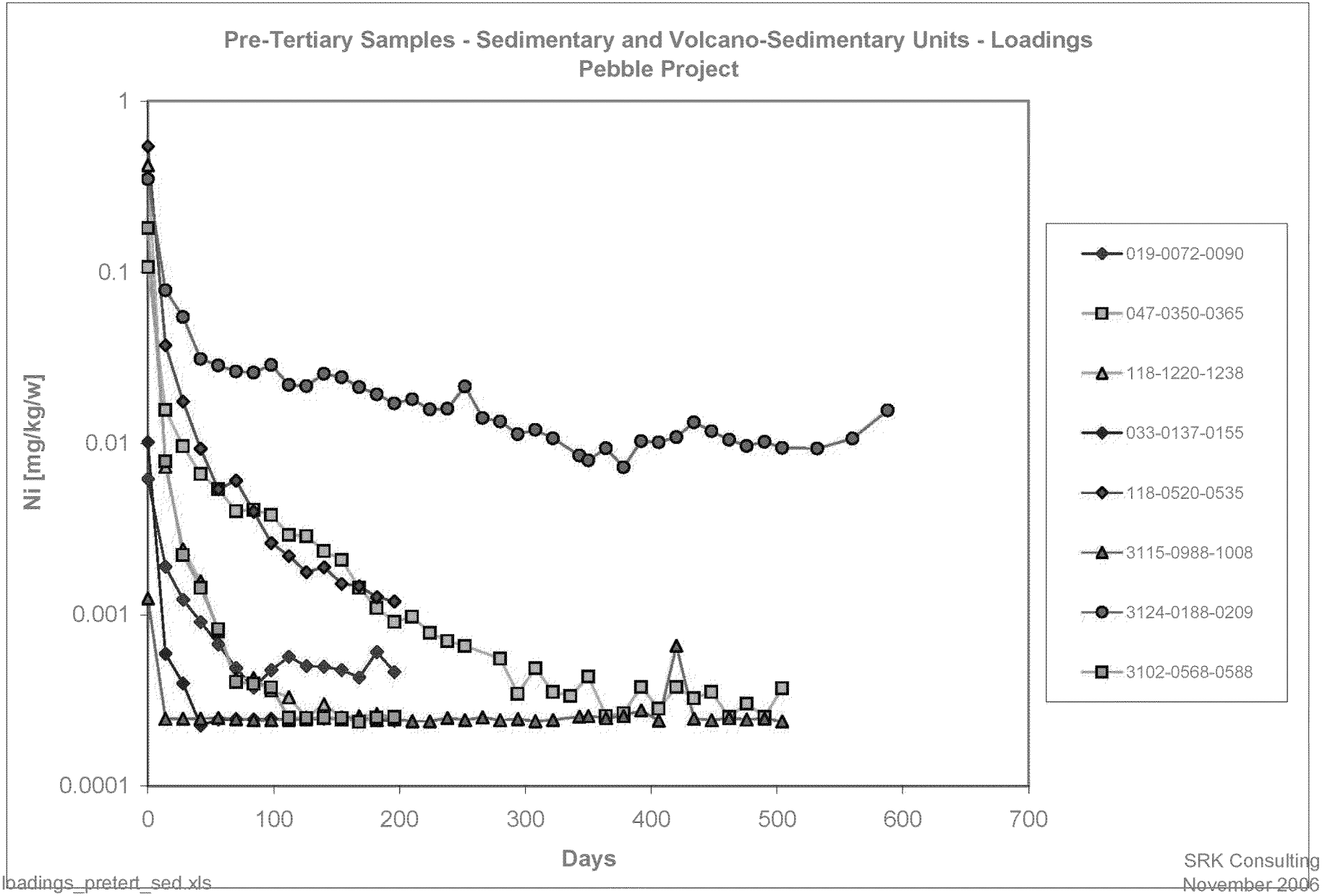


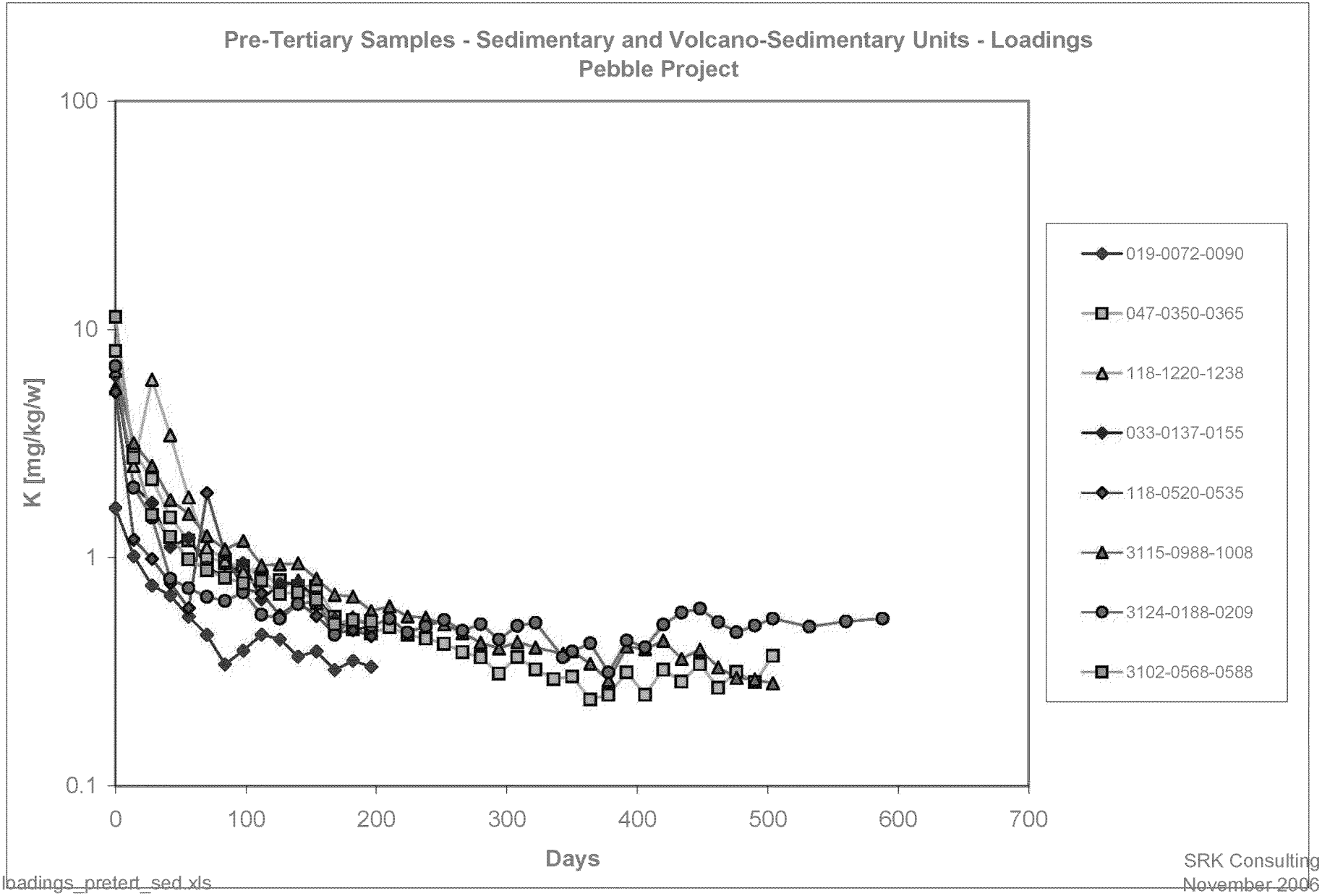
loadings_pretert_sed.xls

SRK Consulting
November 2006

EPA-7609-0005804-0036

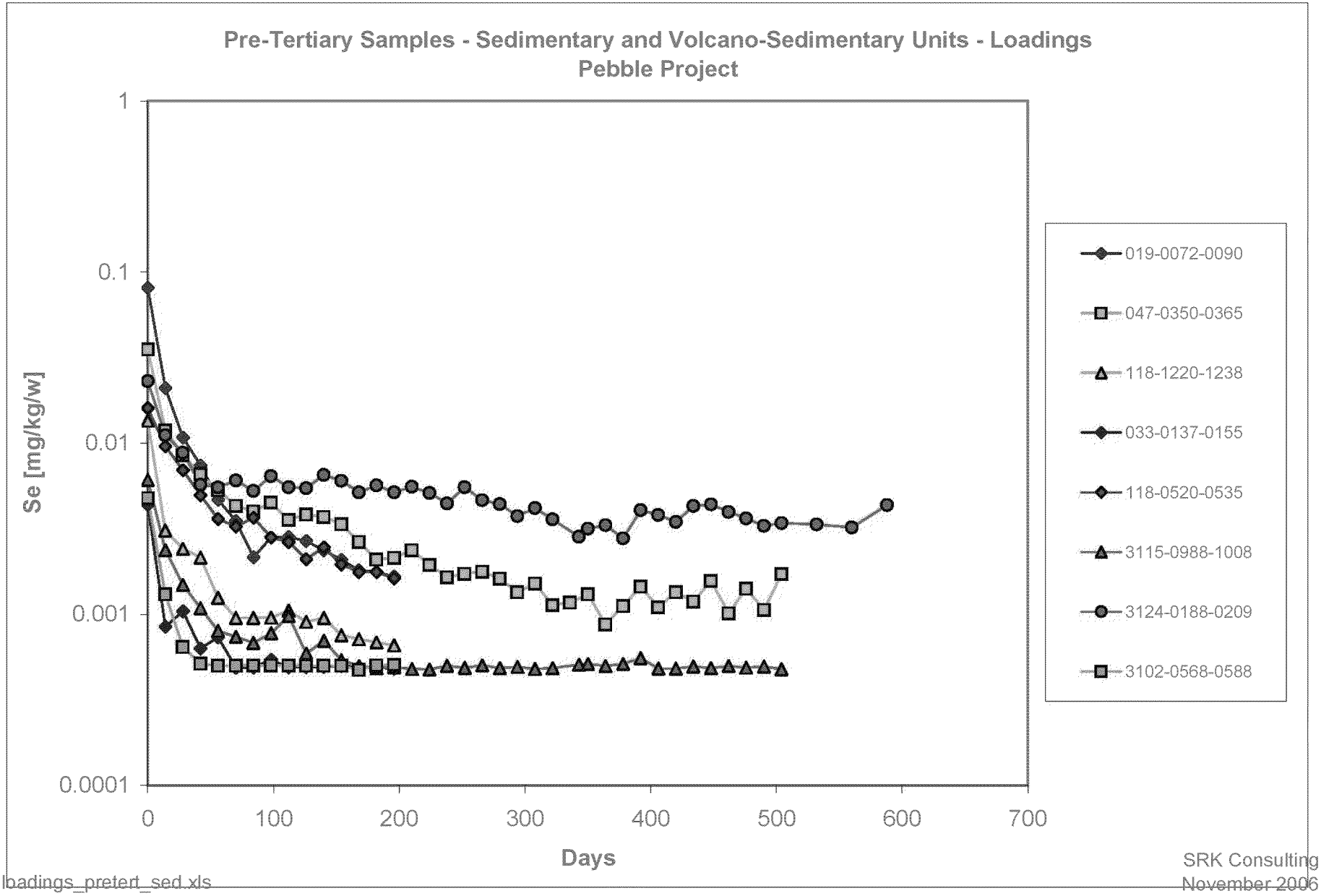
SOA 086799


Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Loadings
Pebble Project
Ni [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588

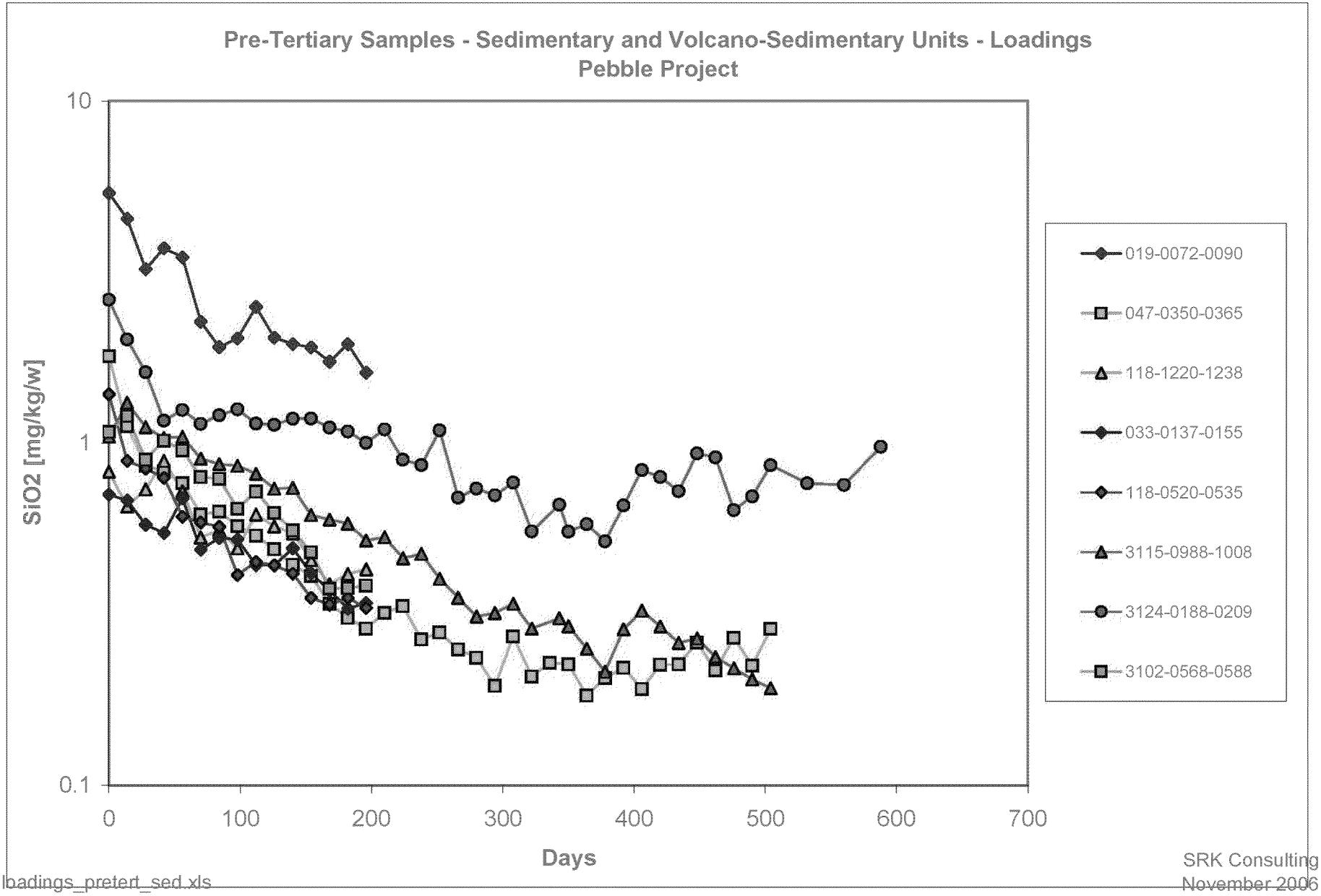


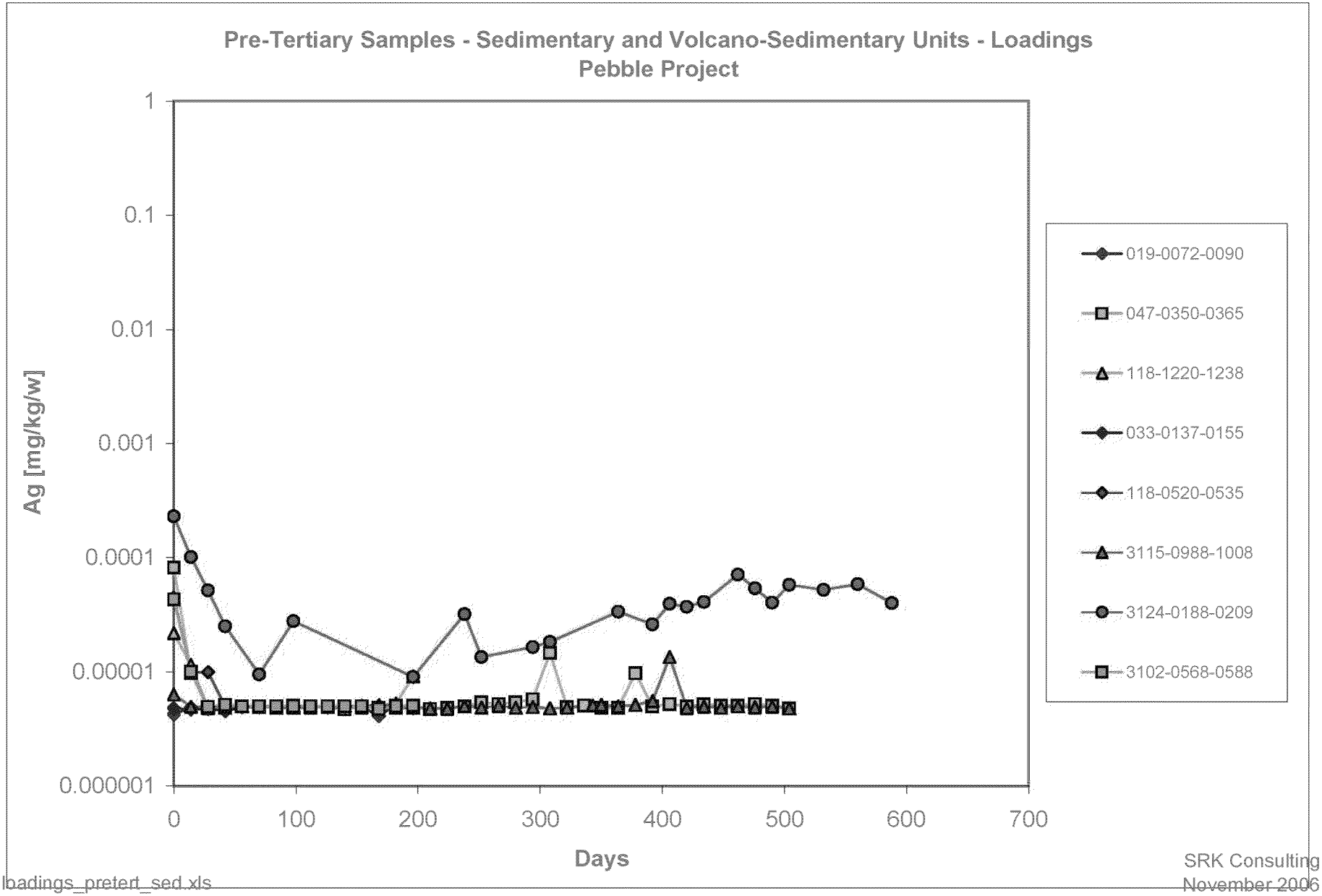
loadings_pretert_sed.xls

SRK Consulting
November 2006

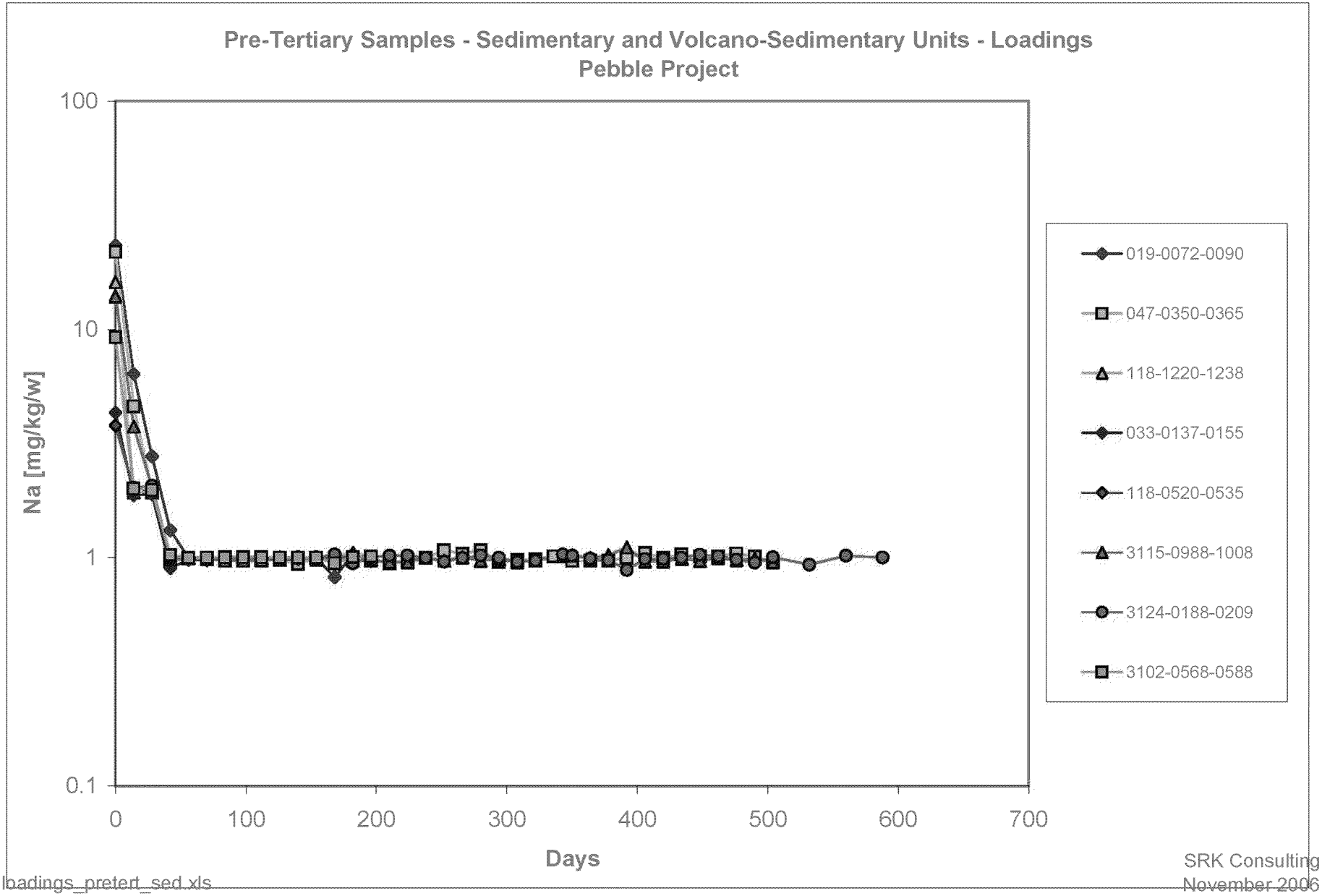


EPA-7609-0005804-0039
SOA 086802

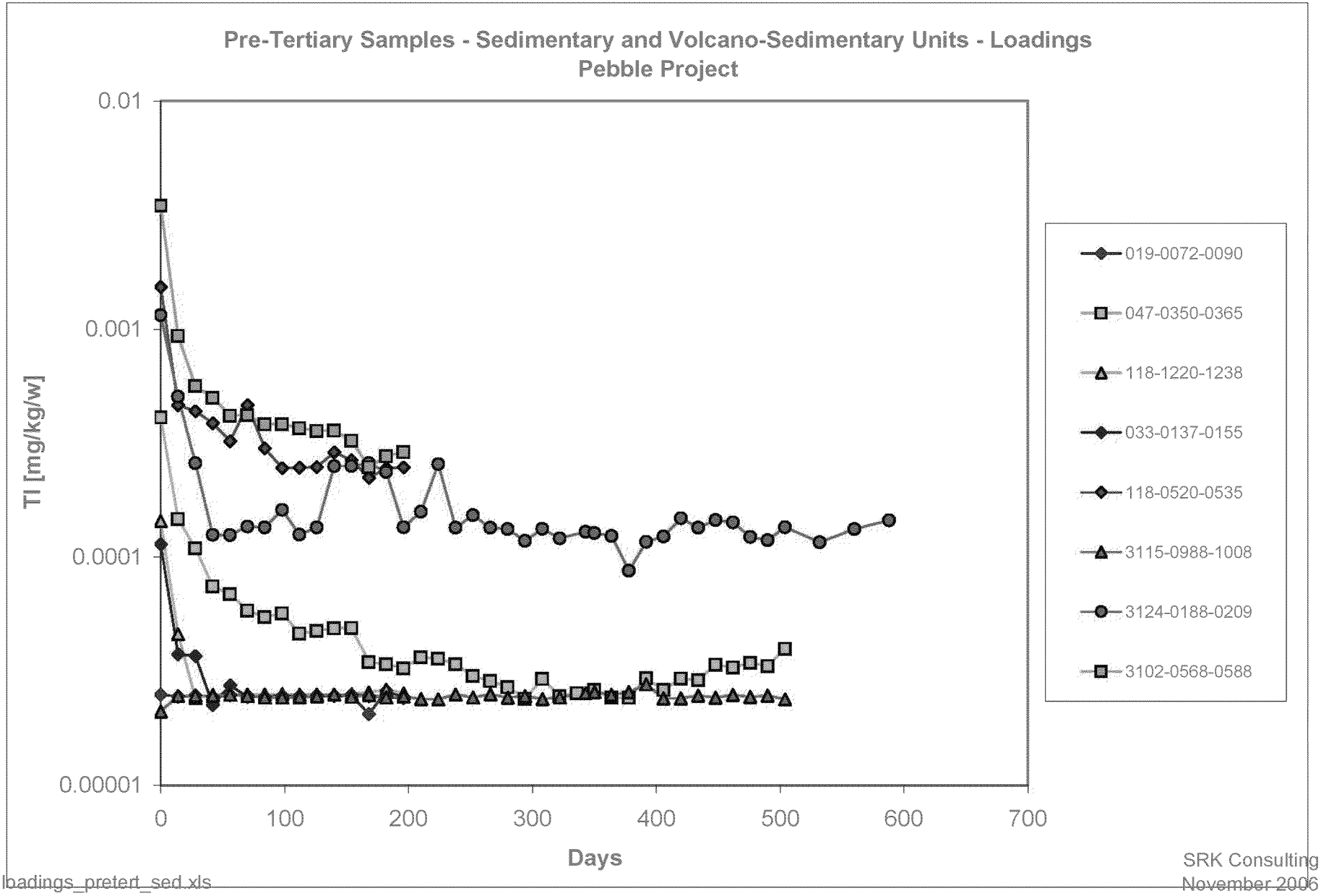

Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Loadings
Pebble Project
SiO2 [mg/kg/w]
10
1
0.1
0
100
200
300
400
500
600
700
Days
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588

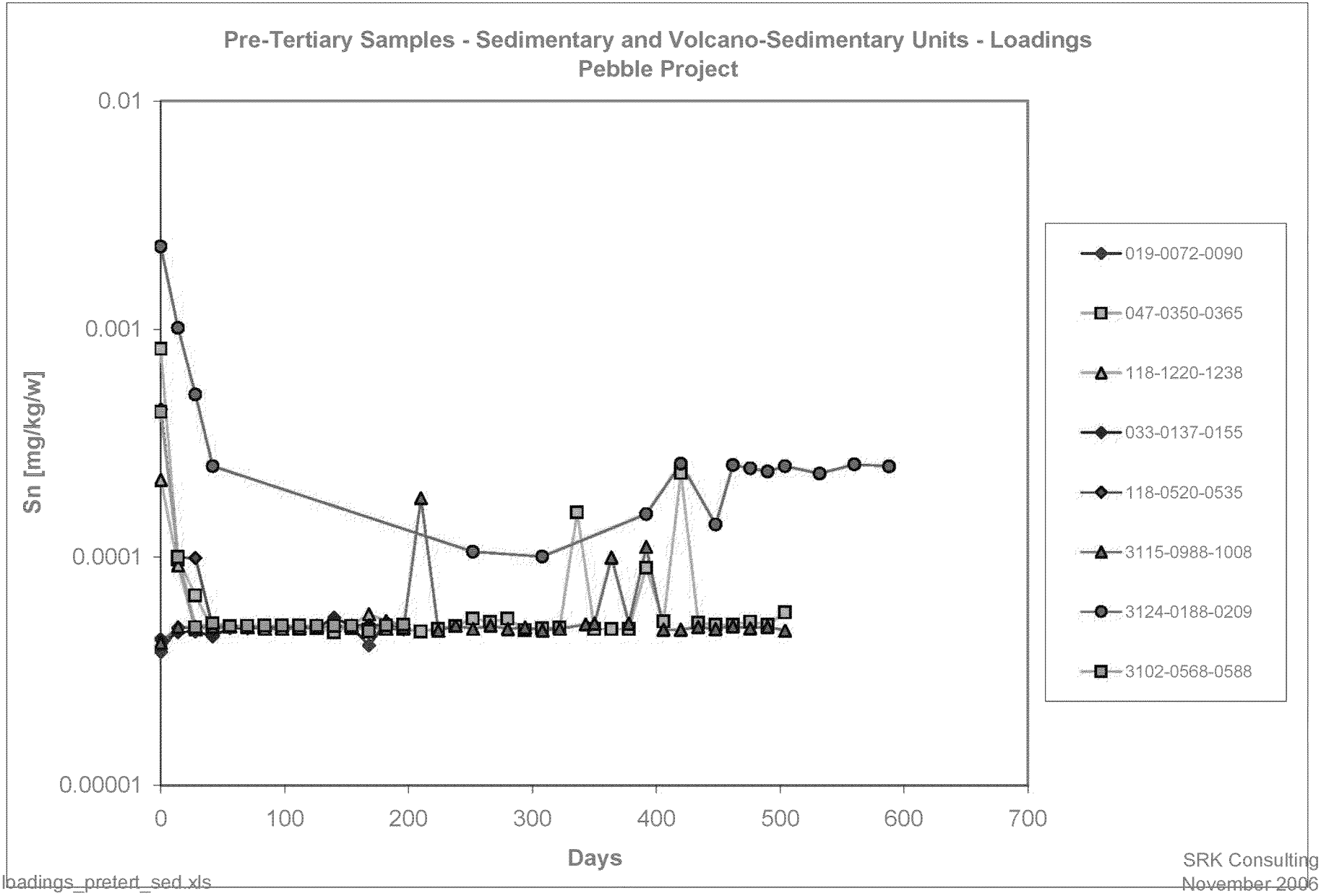


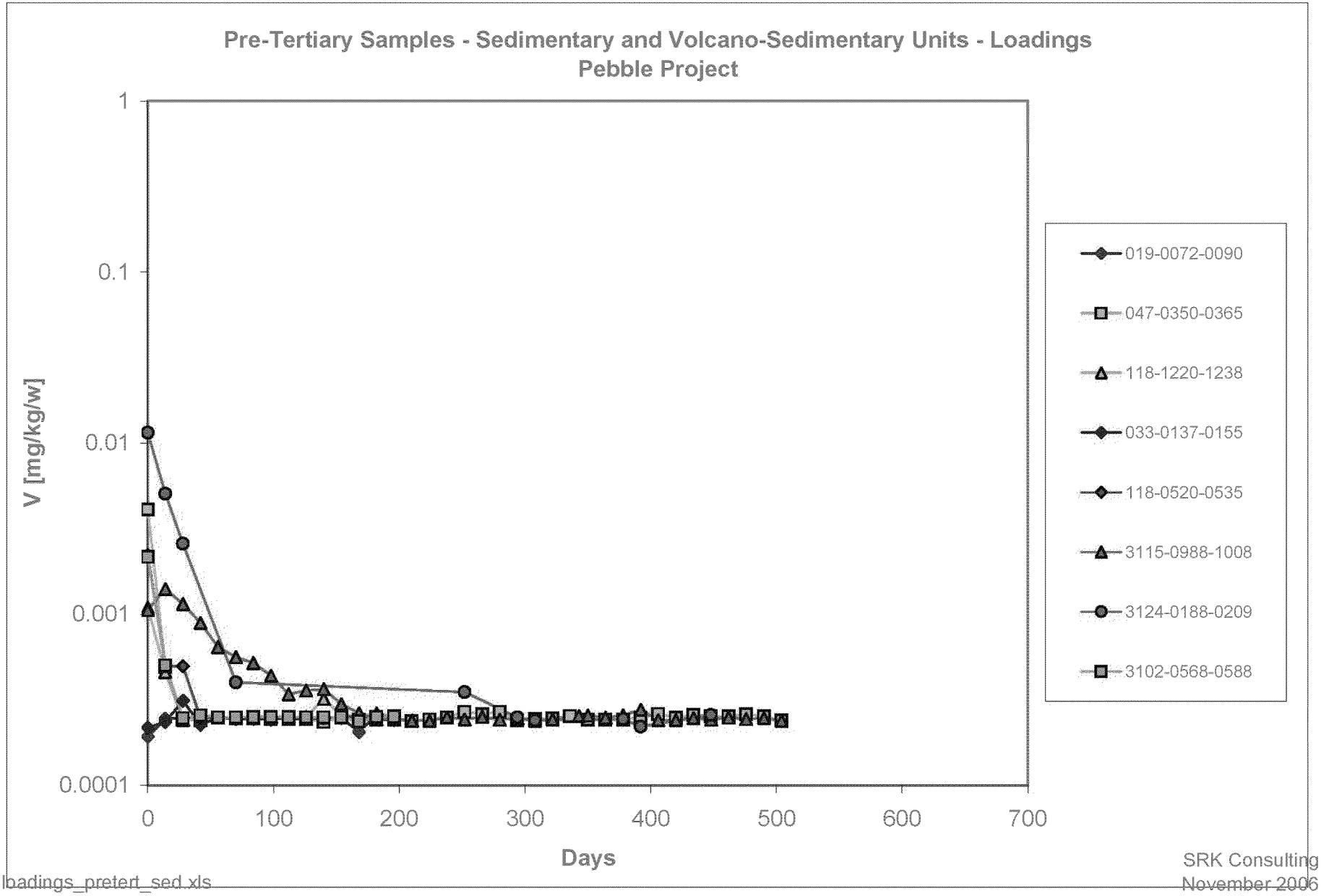
EPA-7609-0005804-0041
SOA 086804

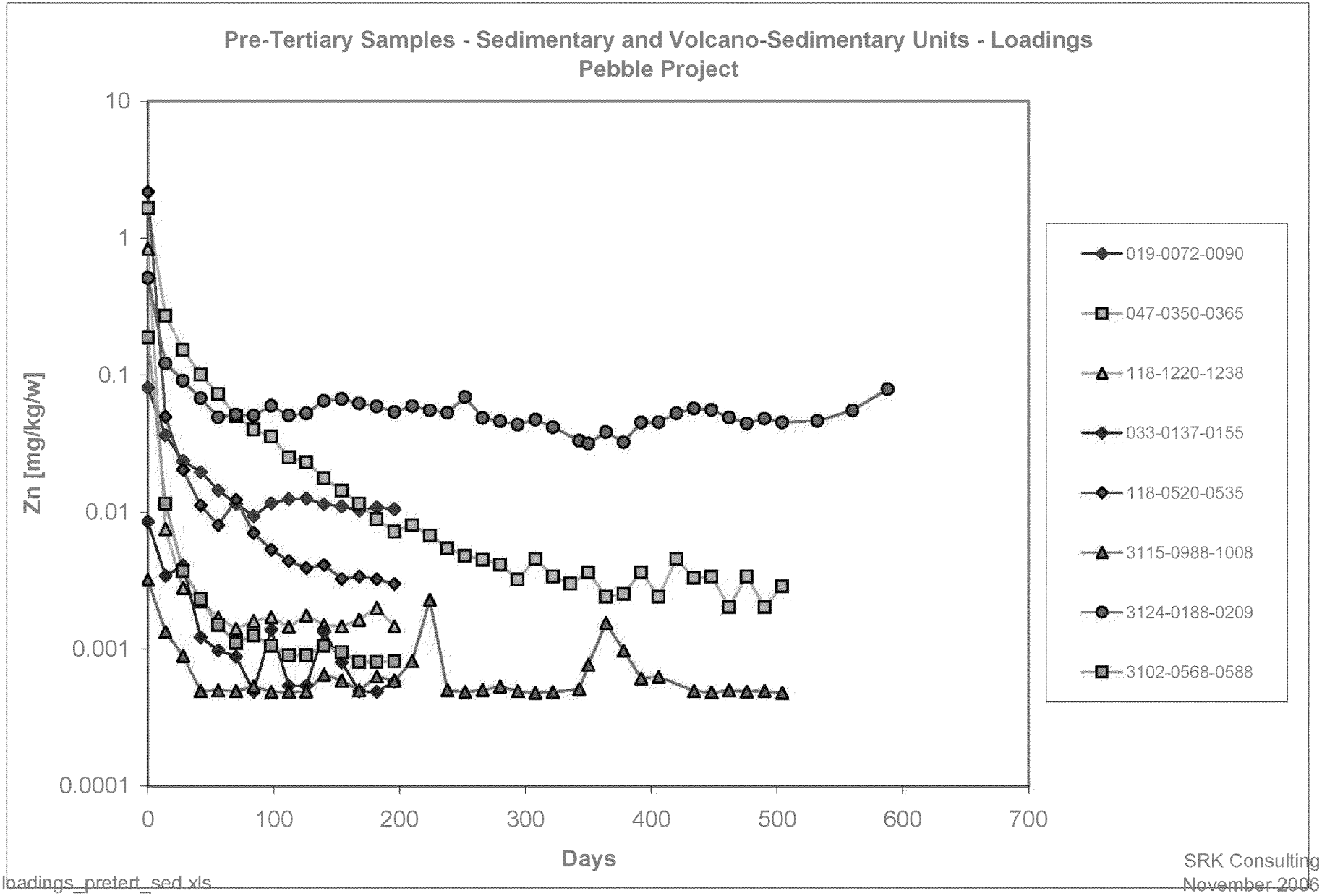


EPA-7609-0005804-0042
SOA 086805


Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Loadings
Pebble Project
Tl [mg/kg/w]
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588

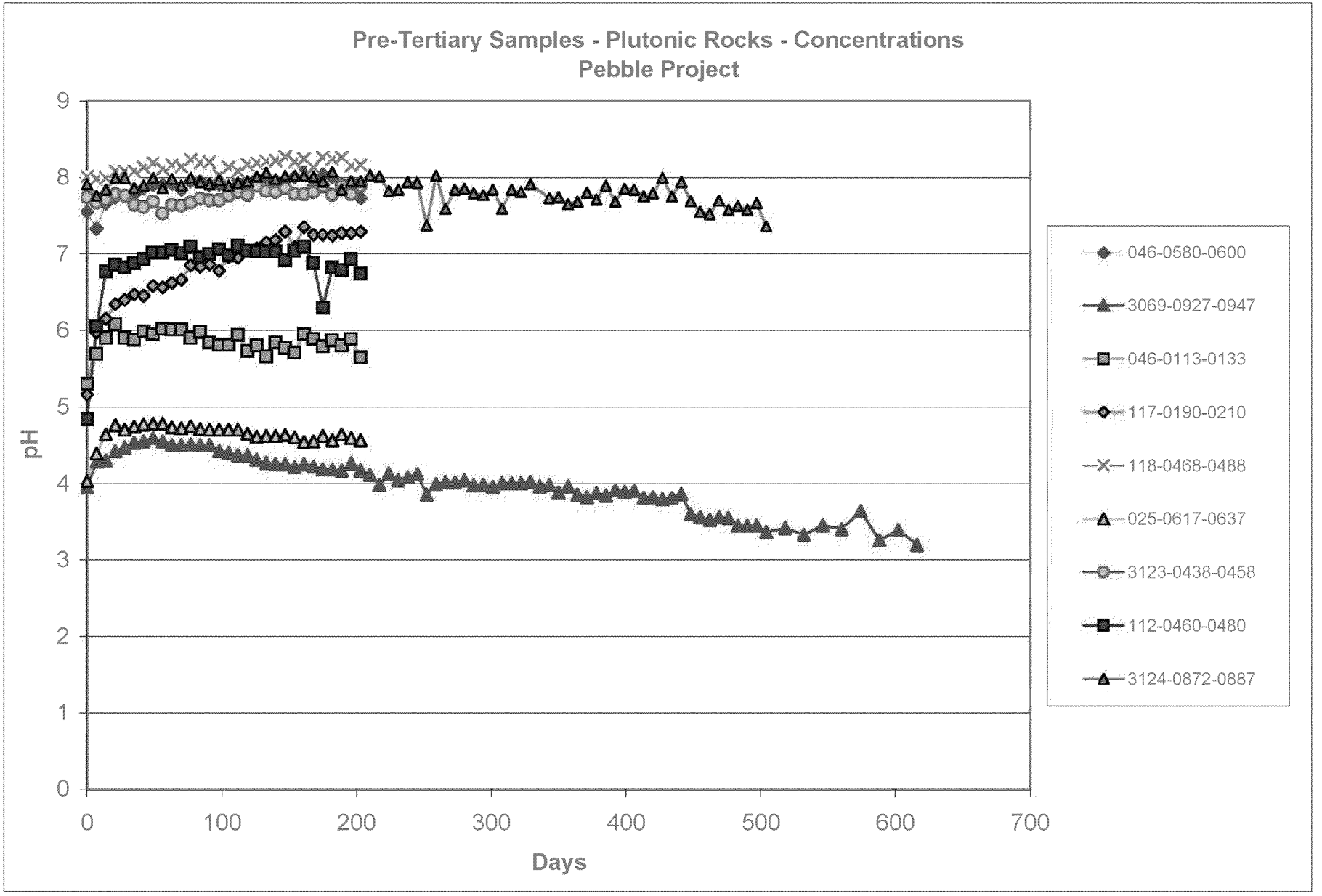

Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Loadings
Pebble Project
Sn [mg/kg/w]
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588

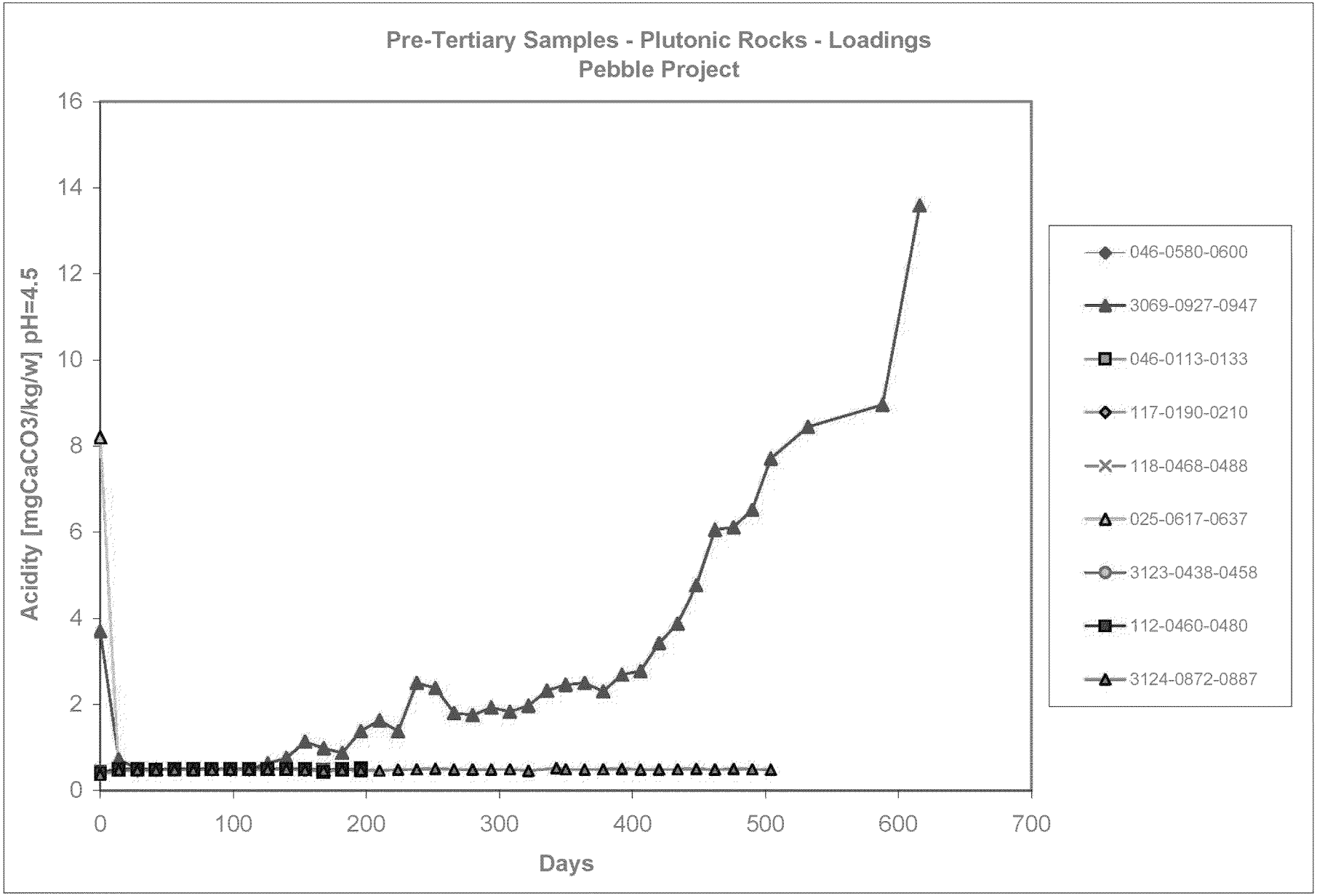

Pre-Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Loadings
Pebble Project
V [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
019-0072-0090
047-0350-0365
118-1220-1238
033-0137-0155
118-0520-0535
3115-0988-1008
3124-0188-0209
3102-0568-0588

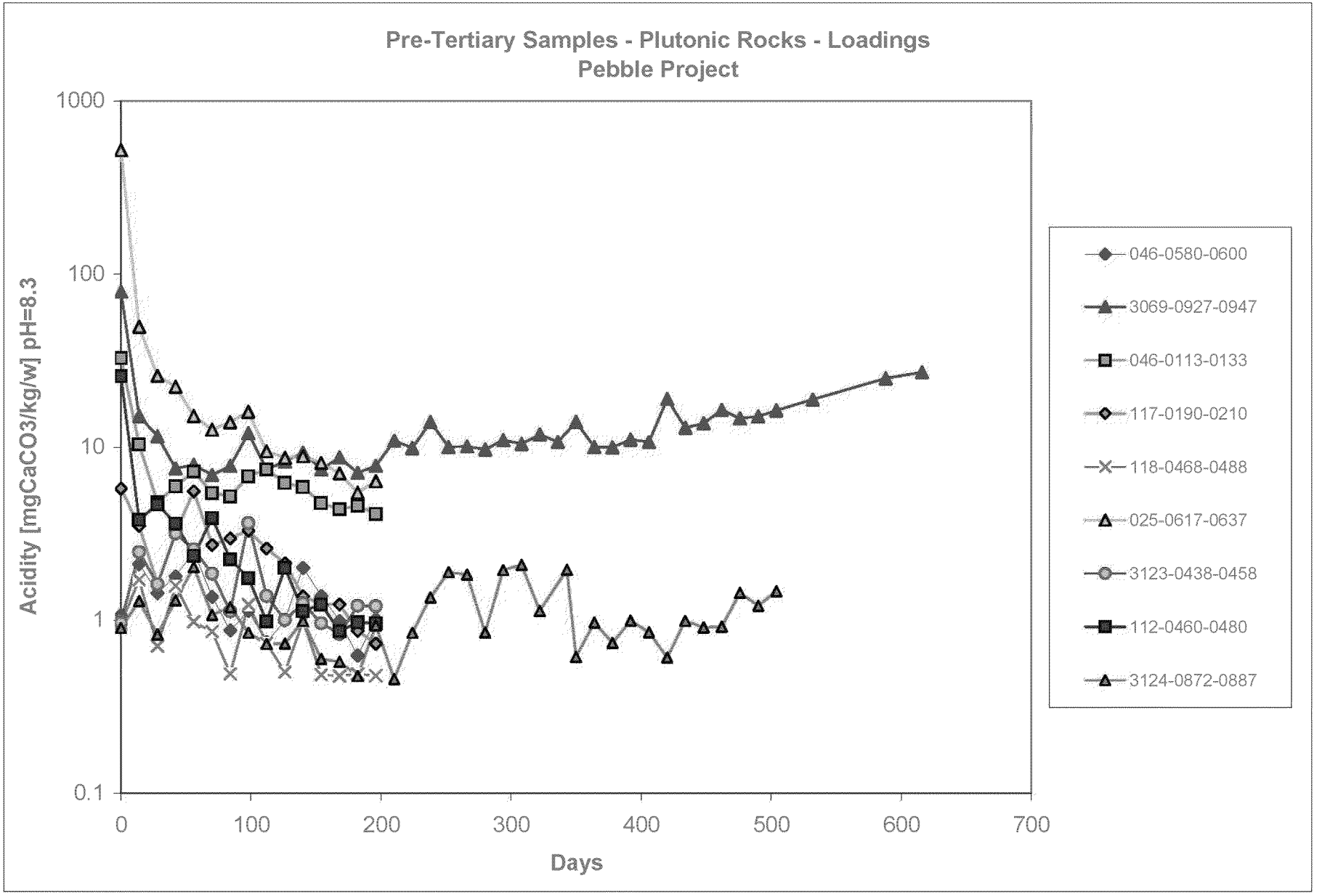


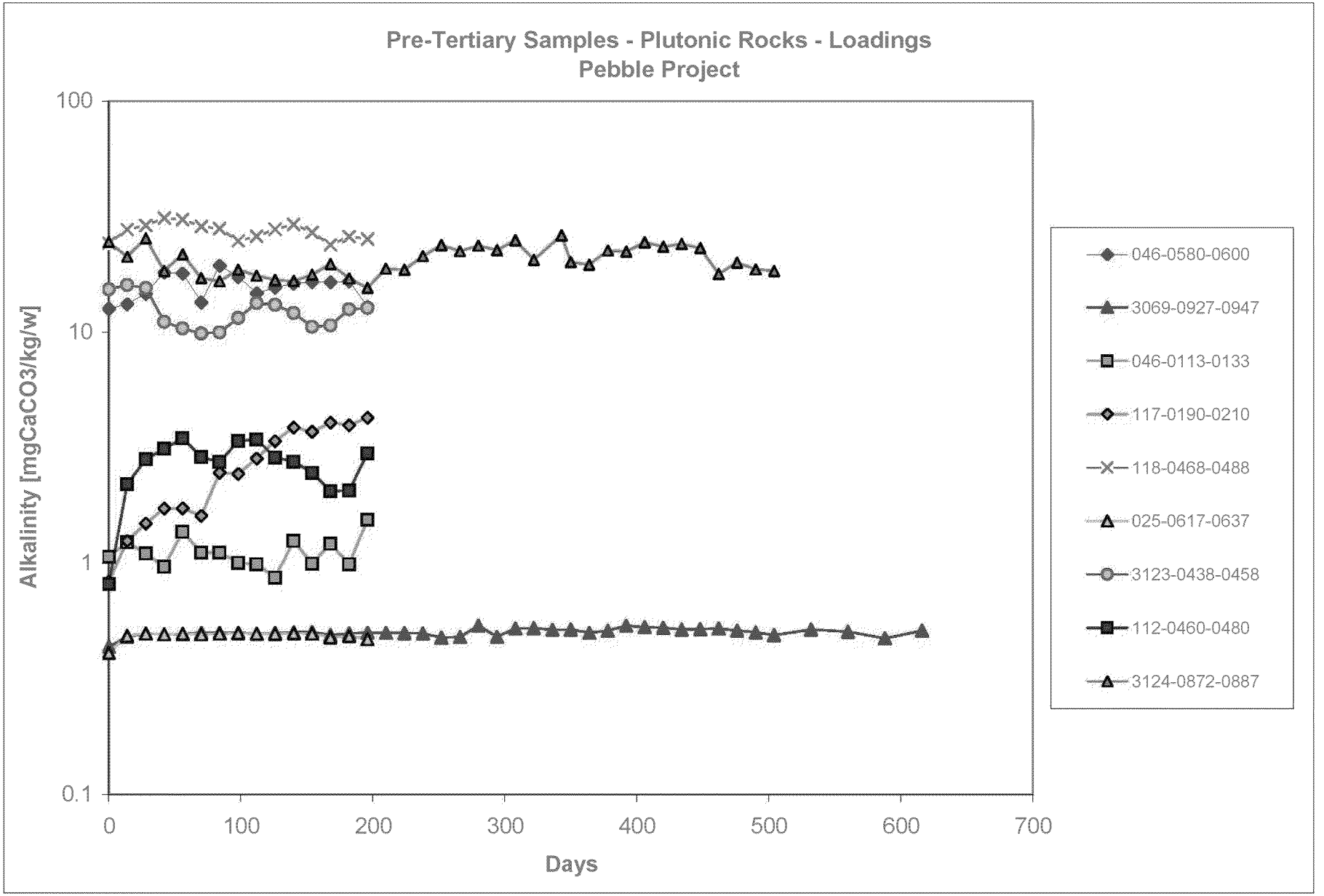
EPA-7609-0005804-0046
SOA 086809

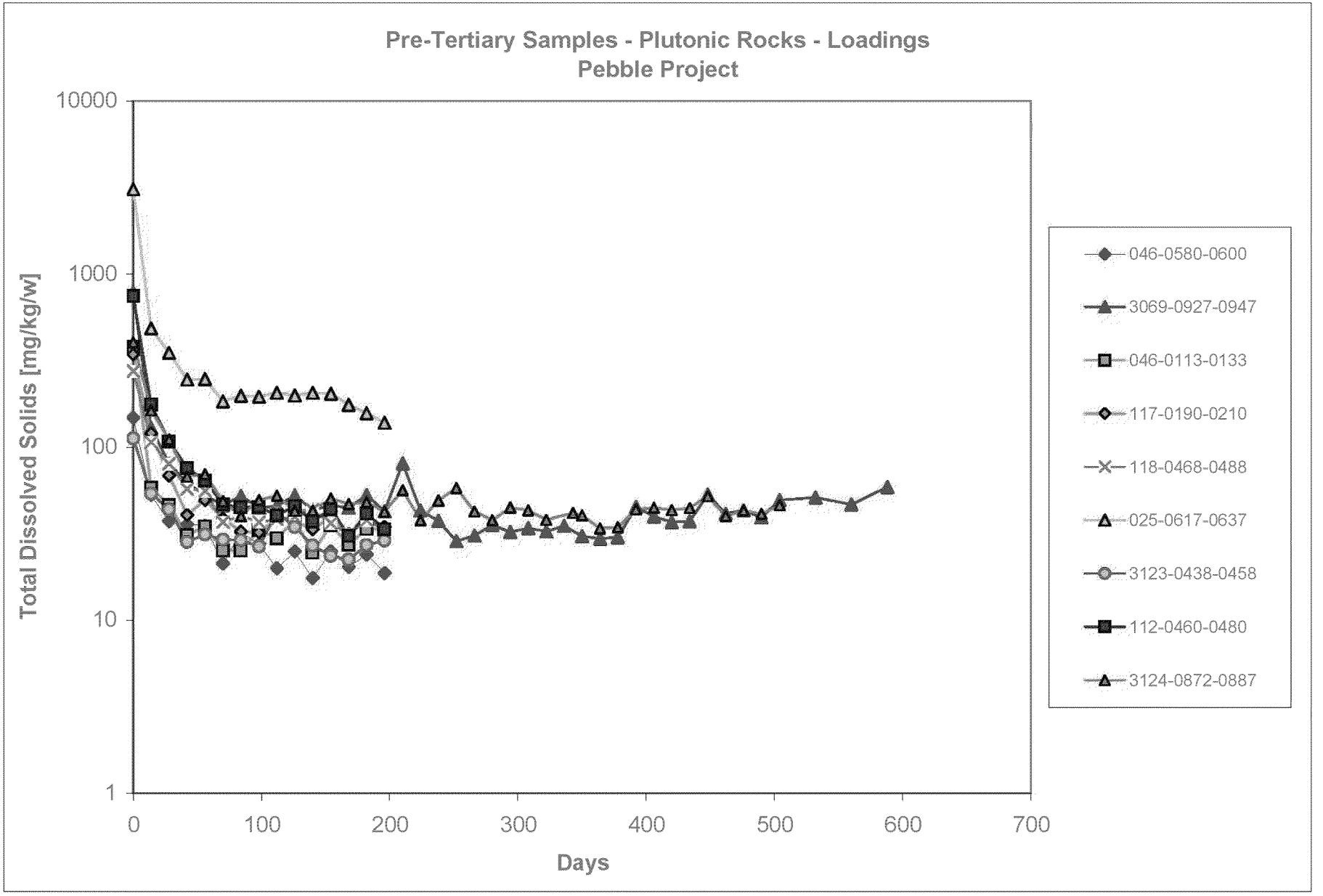
Attachment B
Graphs for Pre-Tertiary Plutonic Rock Humidity Cells

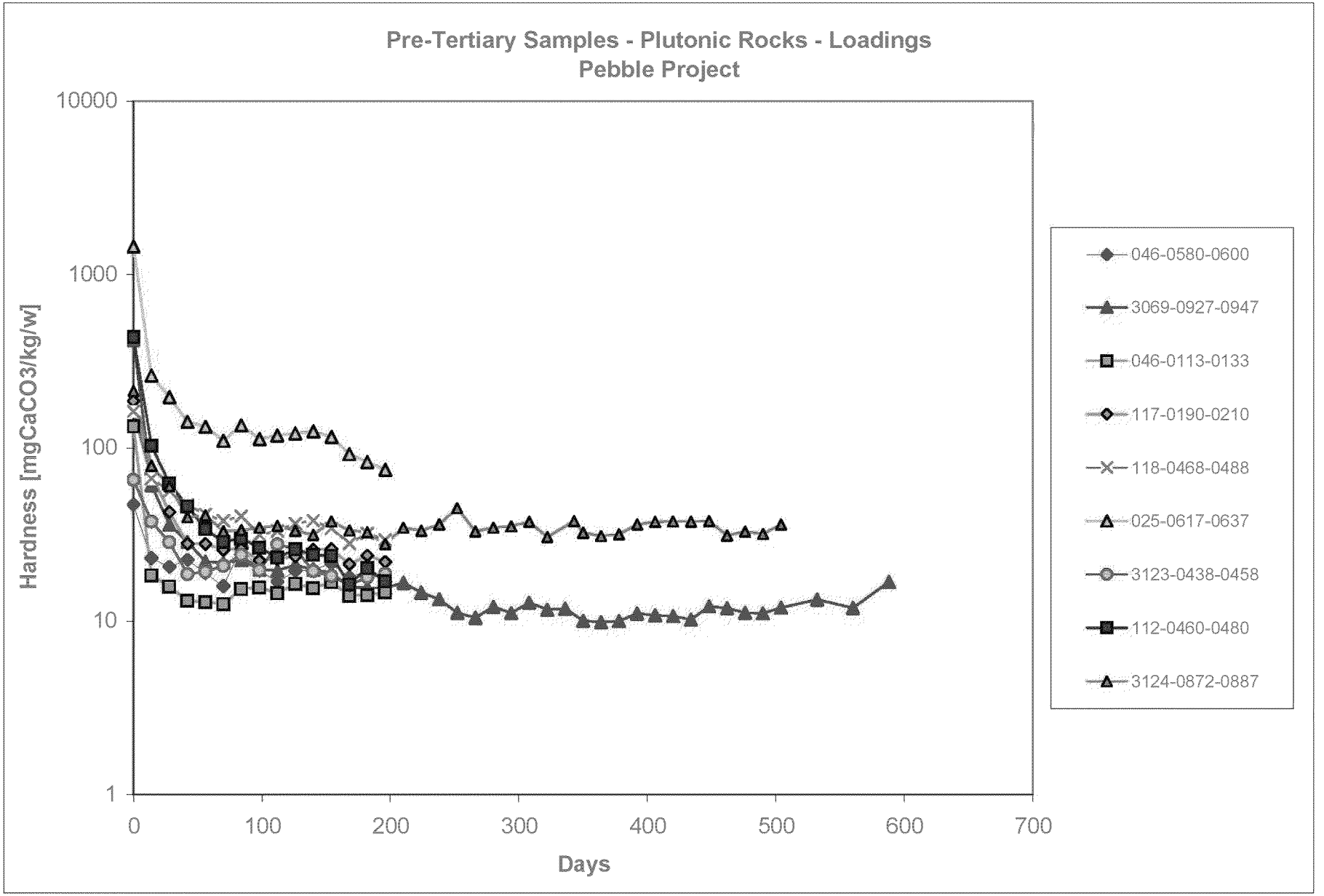

Pre-Tertiary Samples - Plutonic Rocks - Concentrations
Pebble Project
pH
Days
0
1
2
3
4
5
6
7
8
9
0
100
200
300
400
500
600
700
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

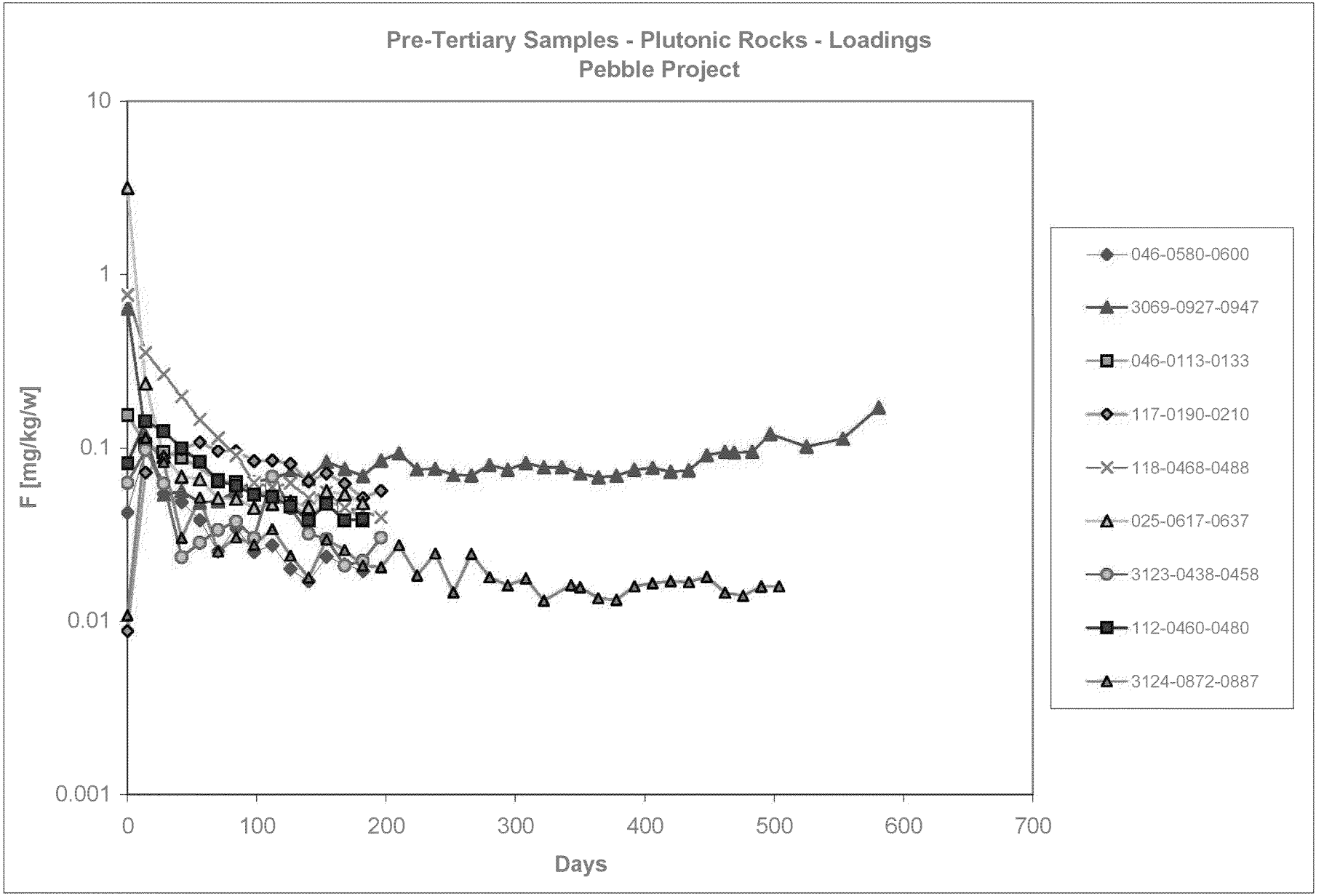

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Acidity [mgCaCO3/kg/w] pH=4.5
Days
0
2
4
6
8
10
12
14
16
0
100
200
300
400
500
600
700
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

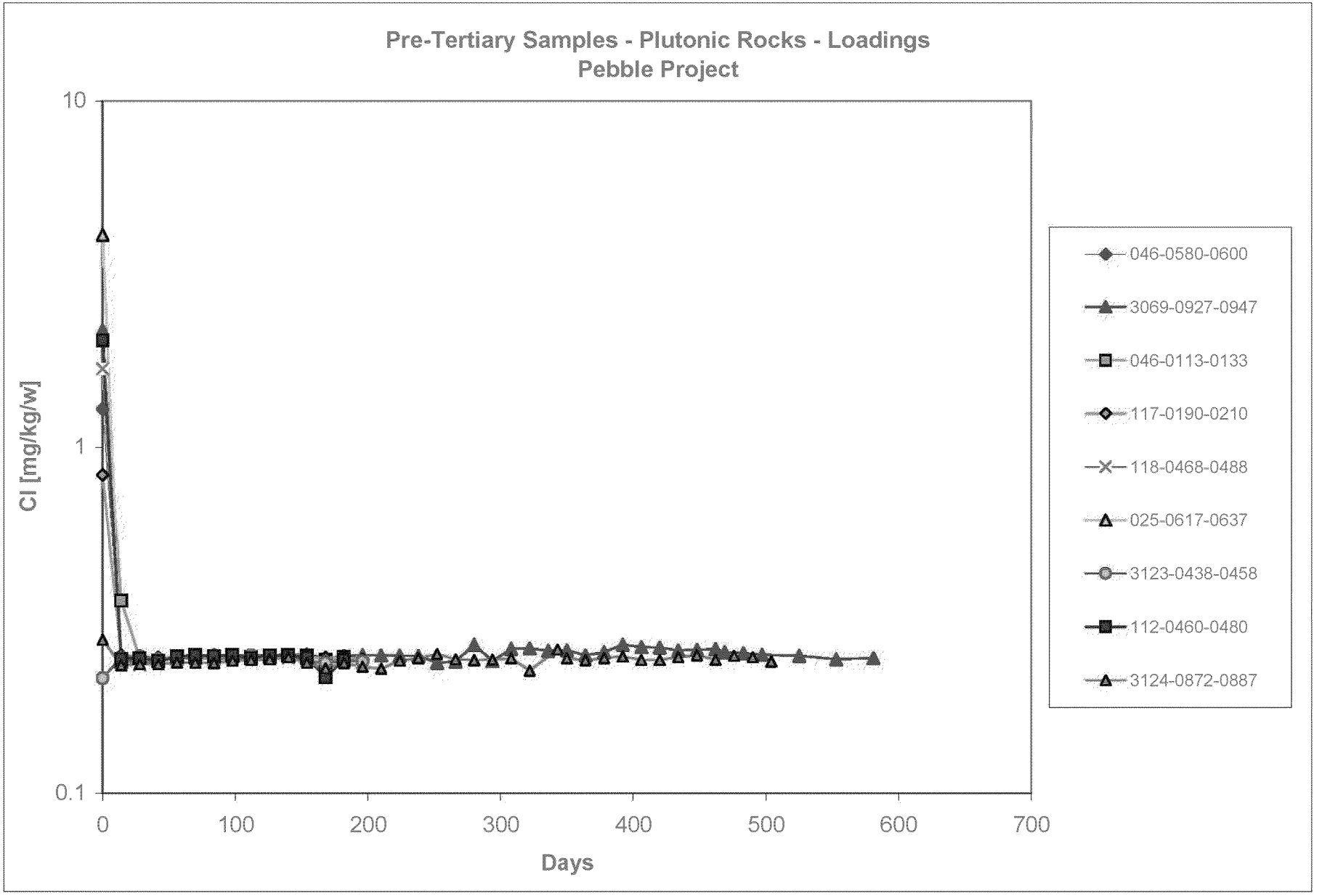

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Acidity [mgCaCO3/kg/w] pH=8.3
1000
100
10
1
0.1
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

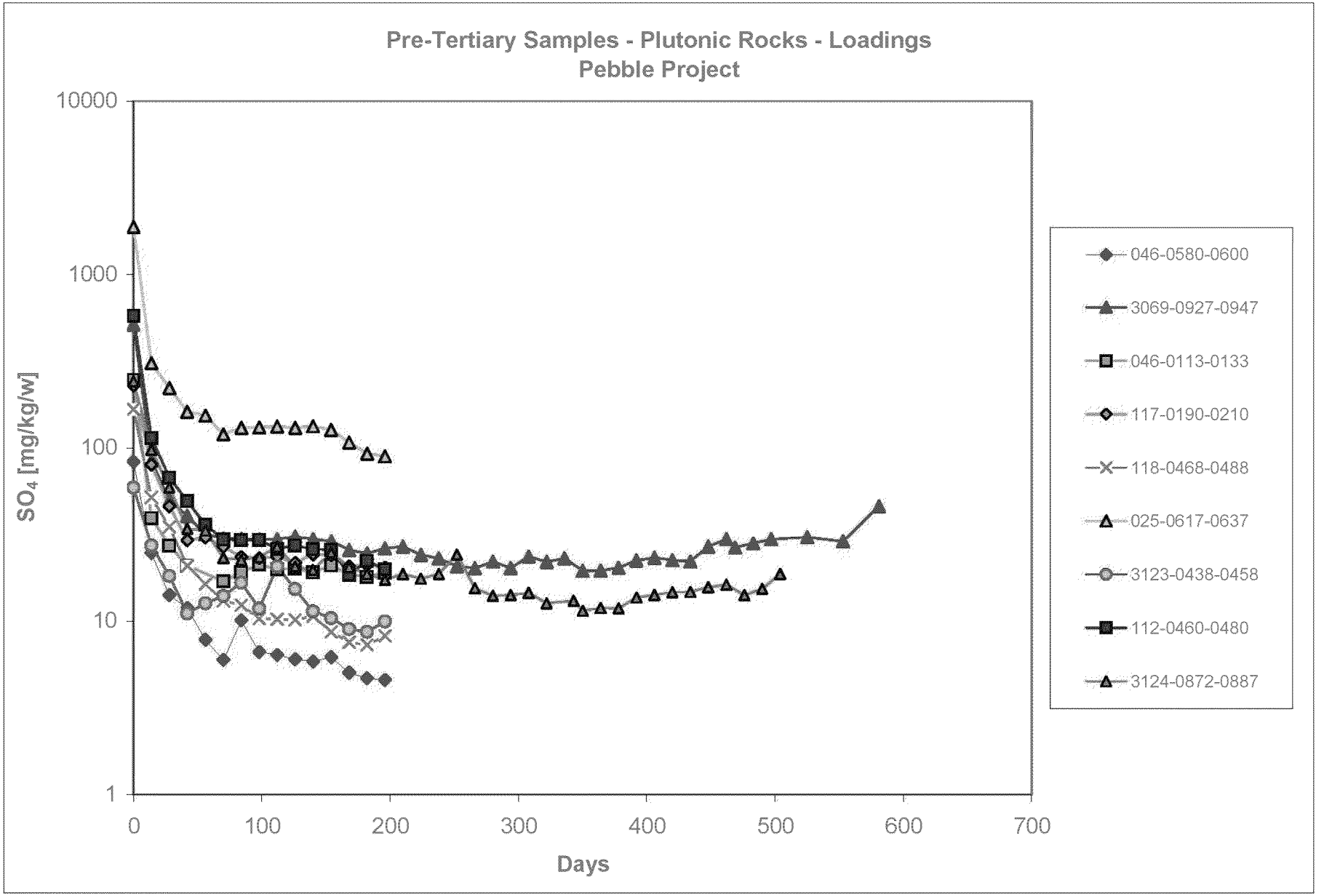

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Alkalinity [mgCaCO3/kg/w]
100
10
1
0.1
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

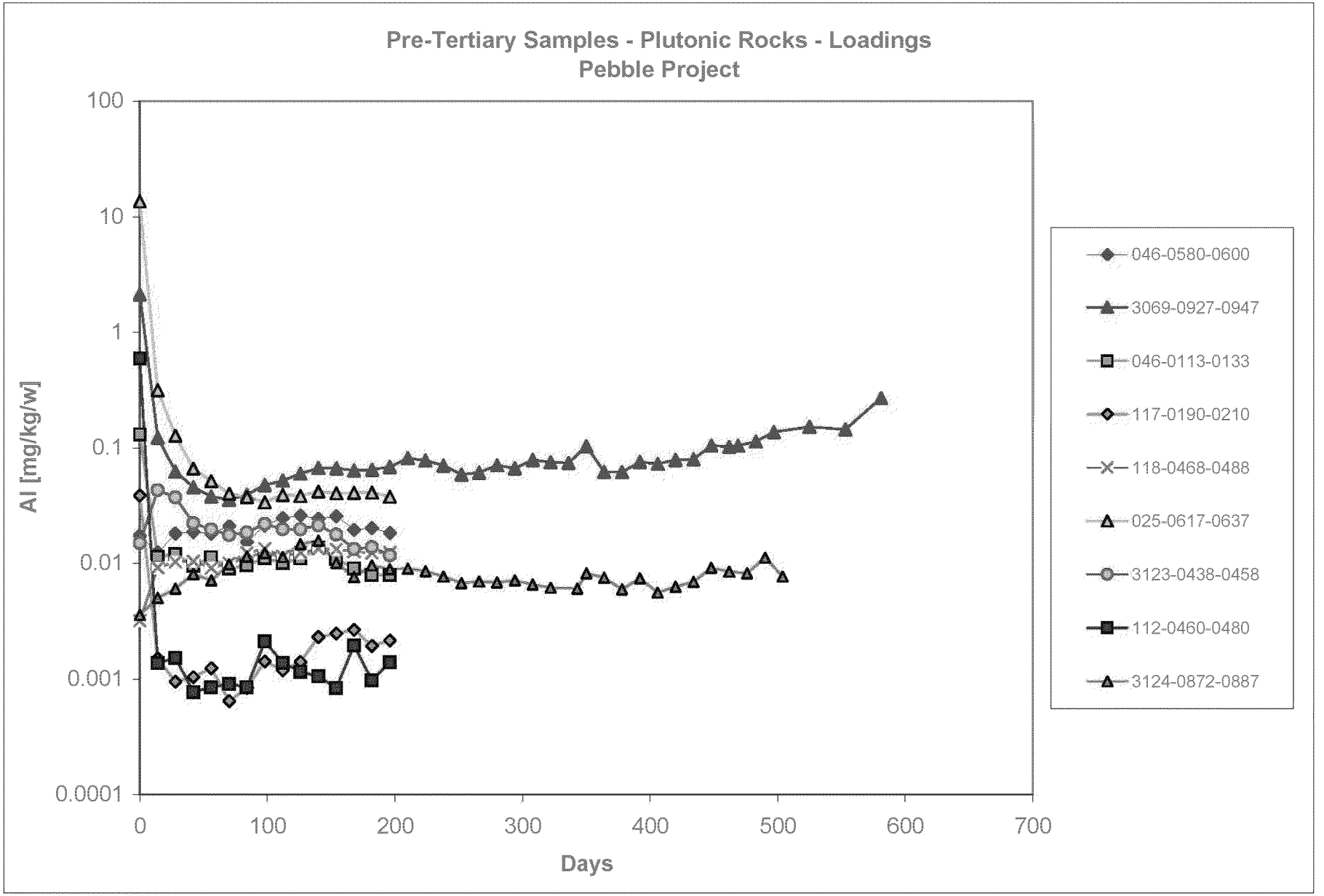

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Total Dissolved Solids [mg/kg/w]
10000
1000
100
10
1
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

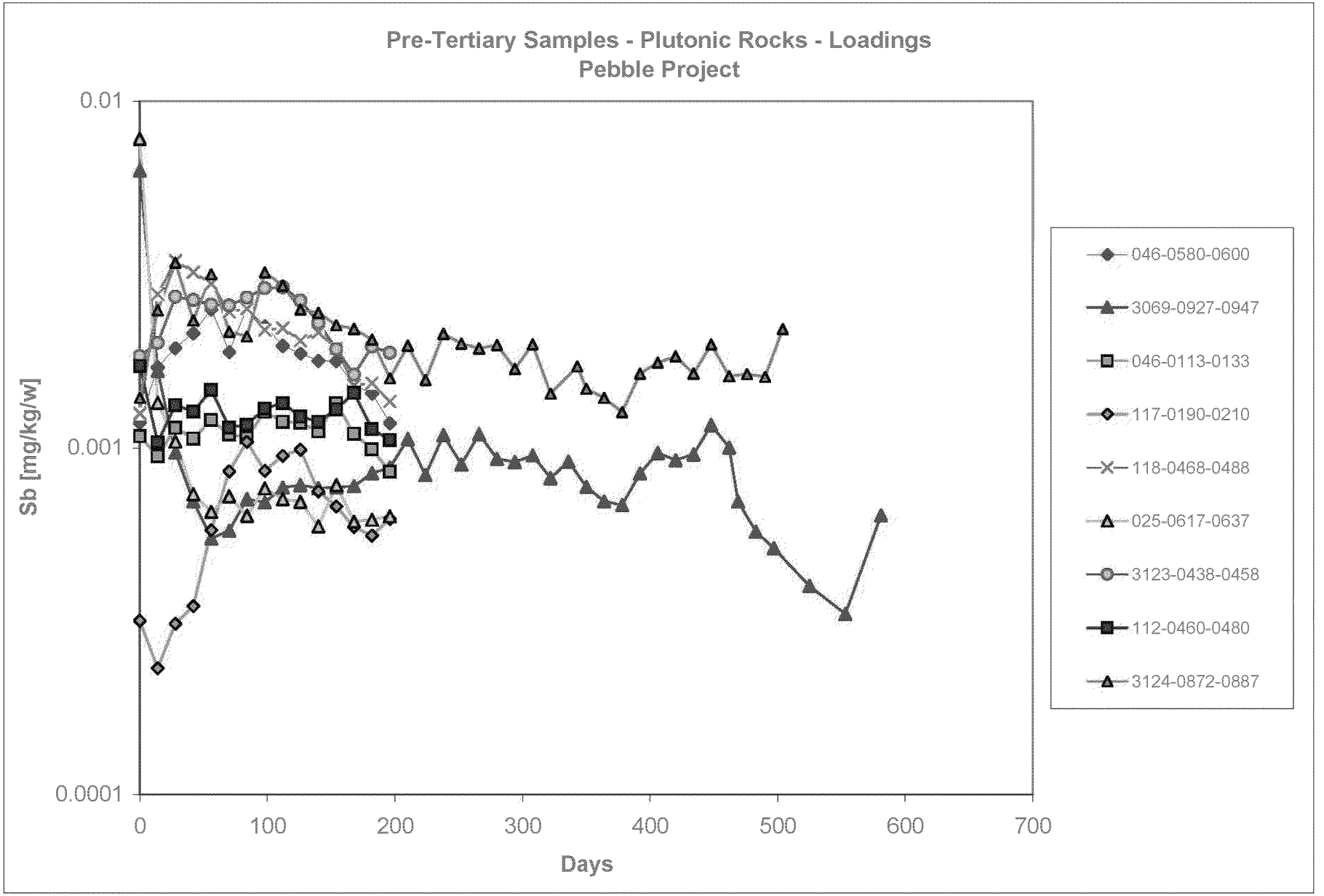

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Hardness [mgCaCO3/kg/w]
10000
1000
100
10
1
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

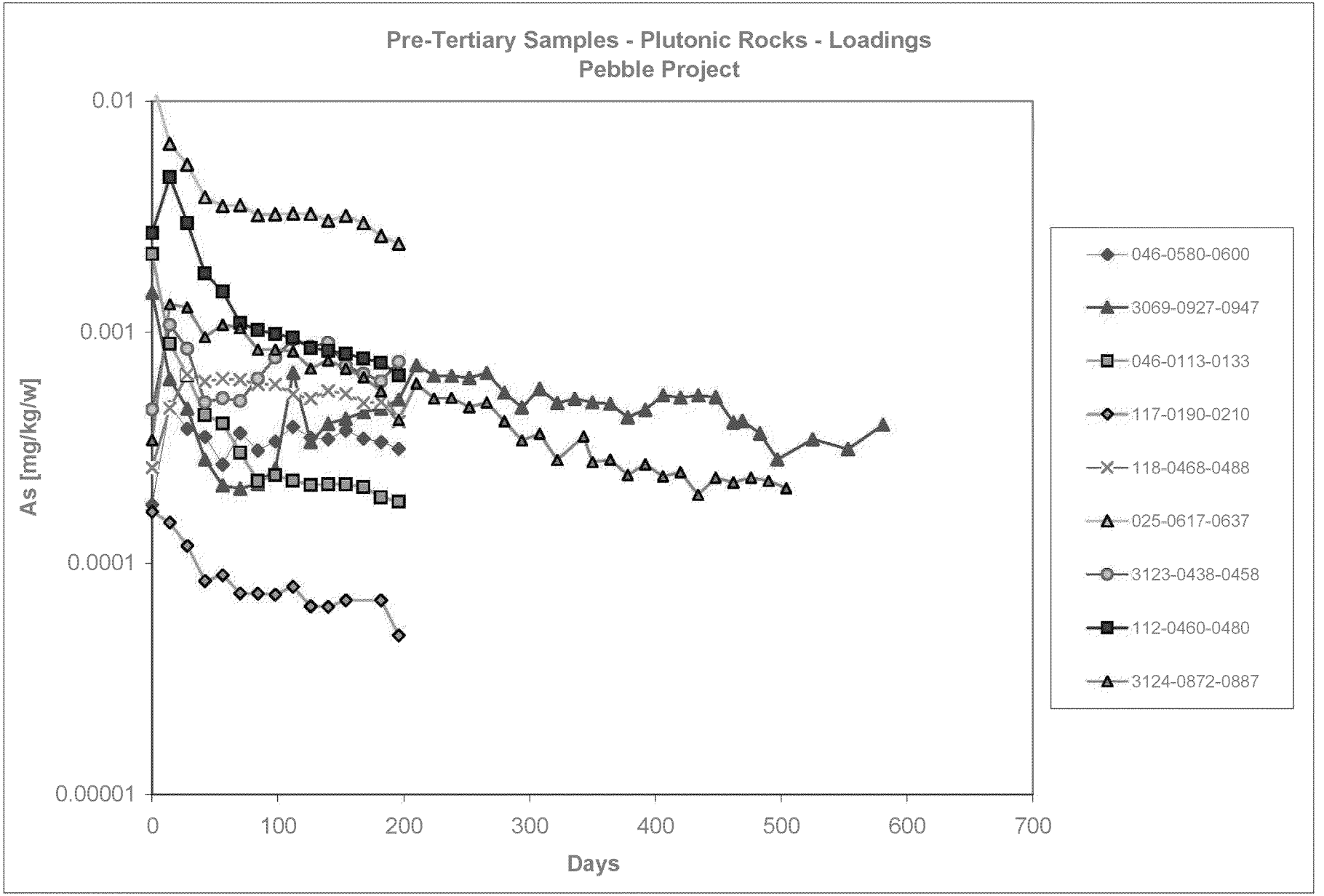

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
F [mg/kg/w]
10
1
0.1
0.01
0.001
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

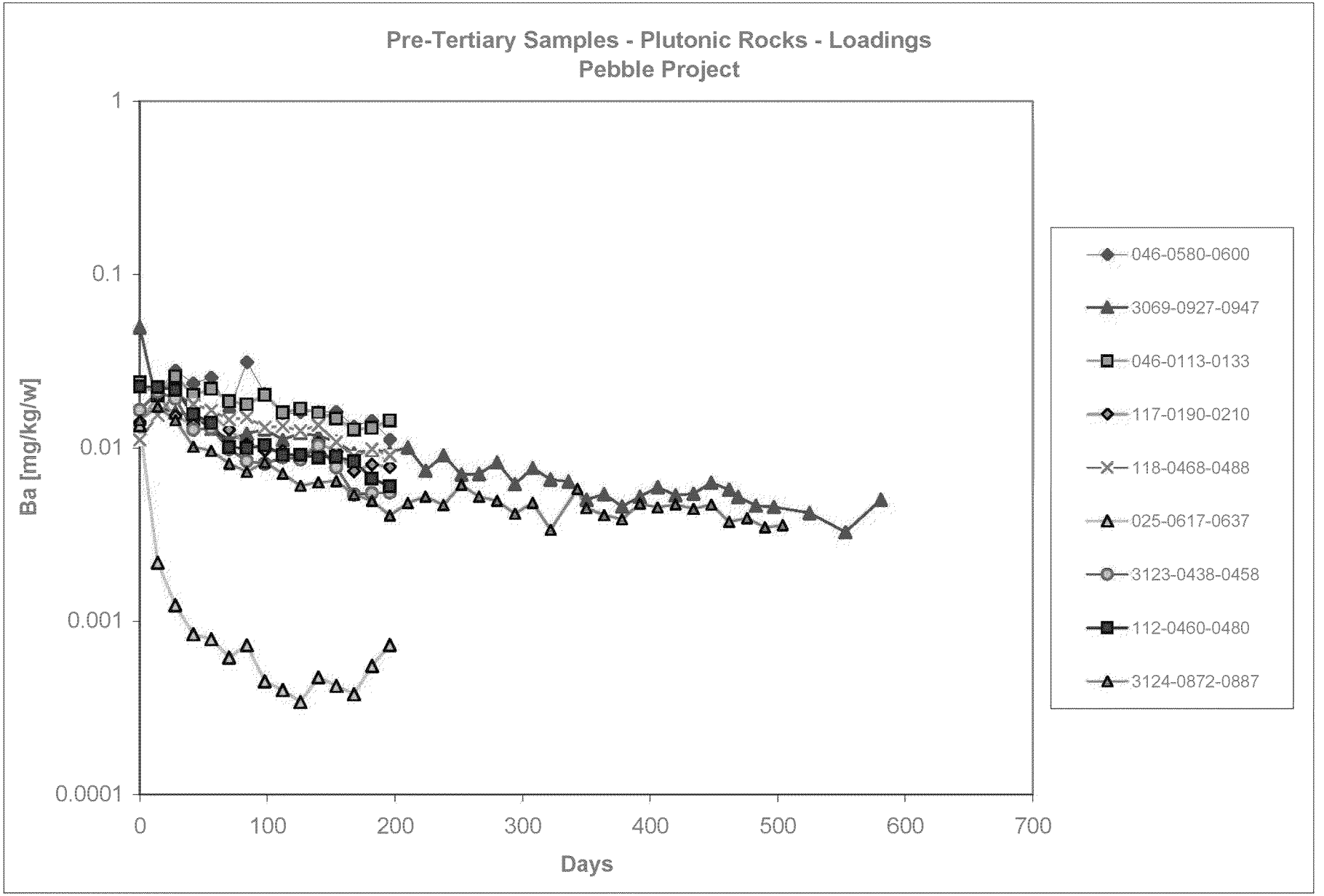

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Cl [mg/kg/w]
10
1
0.1
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

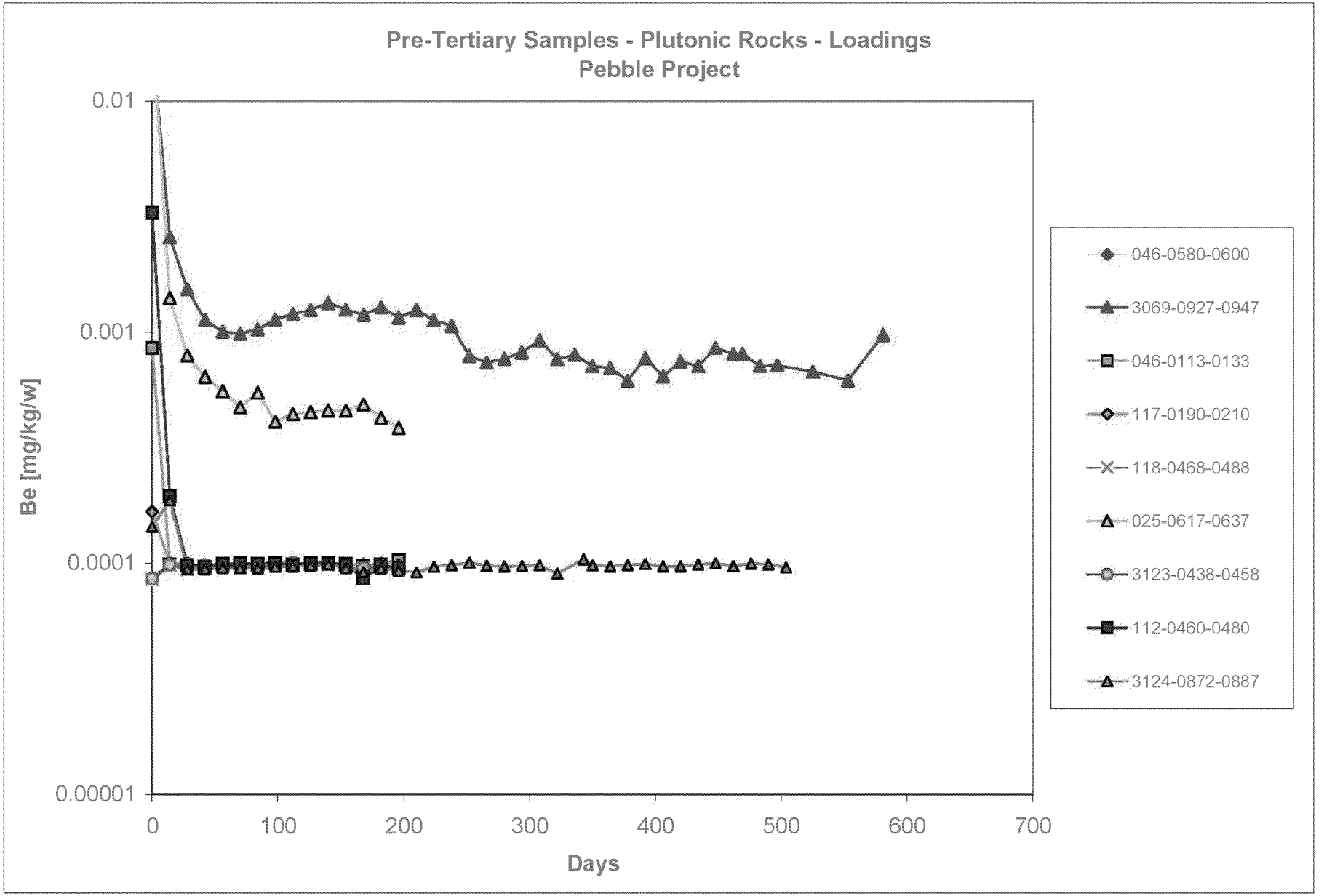

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
10000
1000
100
10
1
SO4 [mg/kg/w]
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

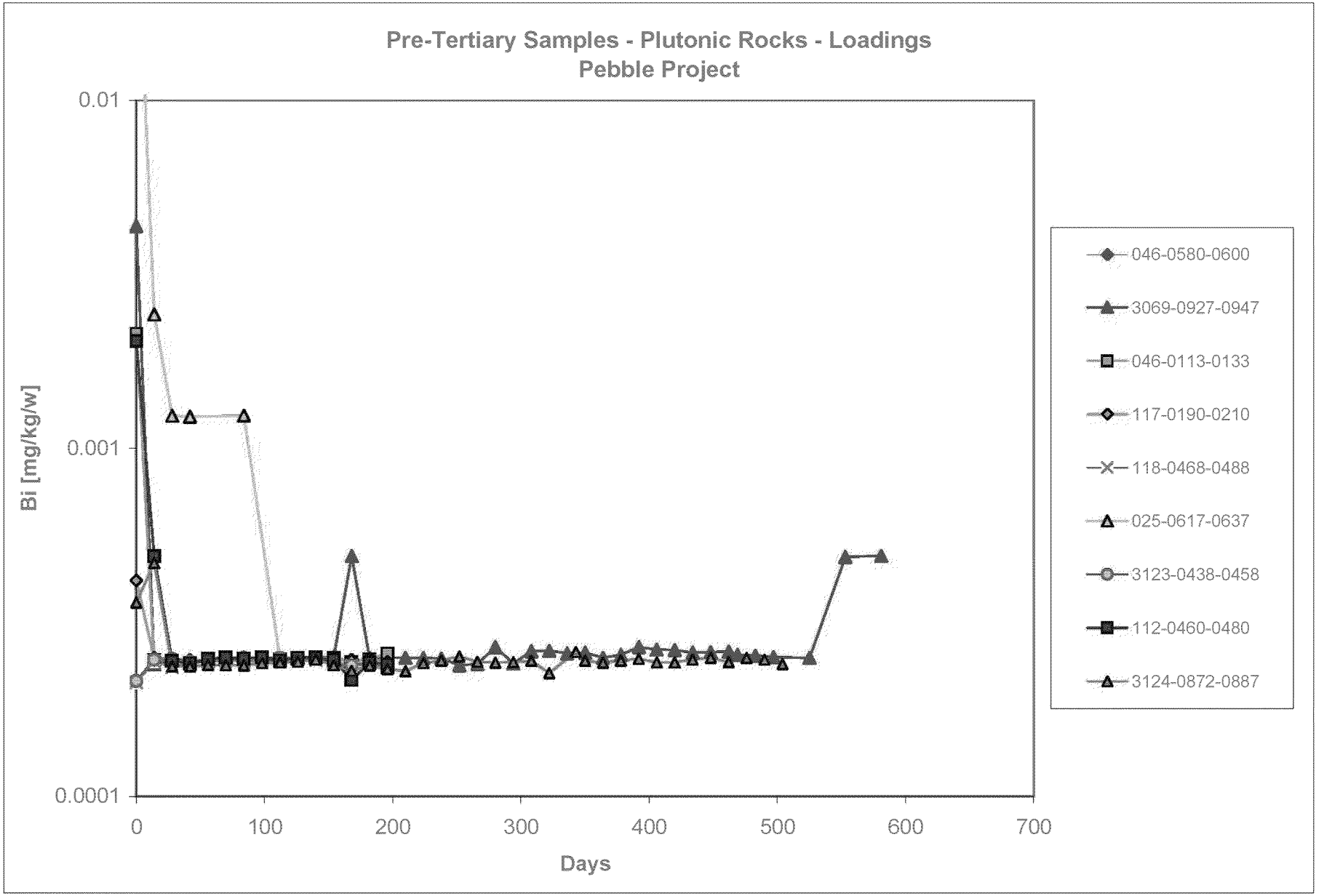

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Al [mg/kg/w]
100
10
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

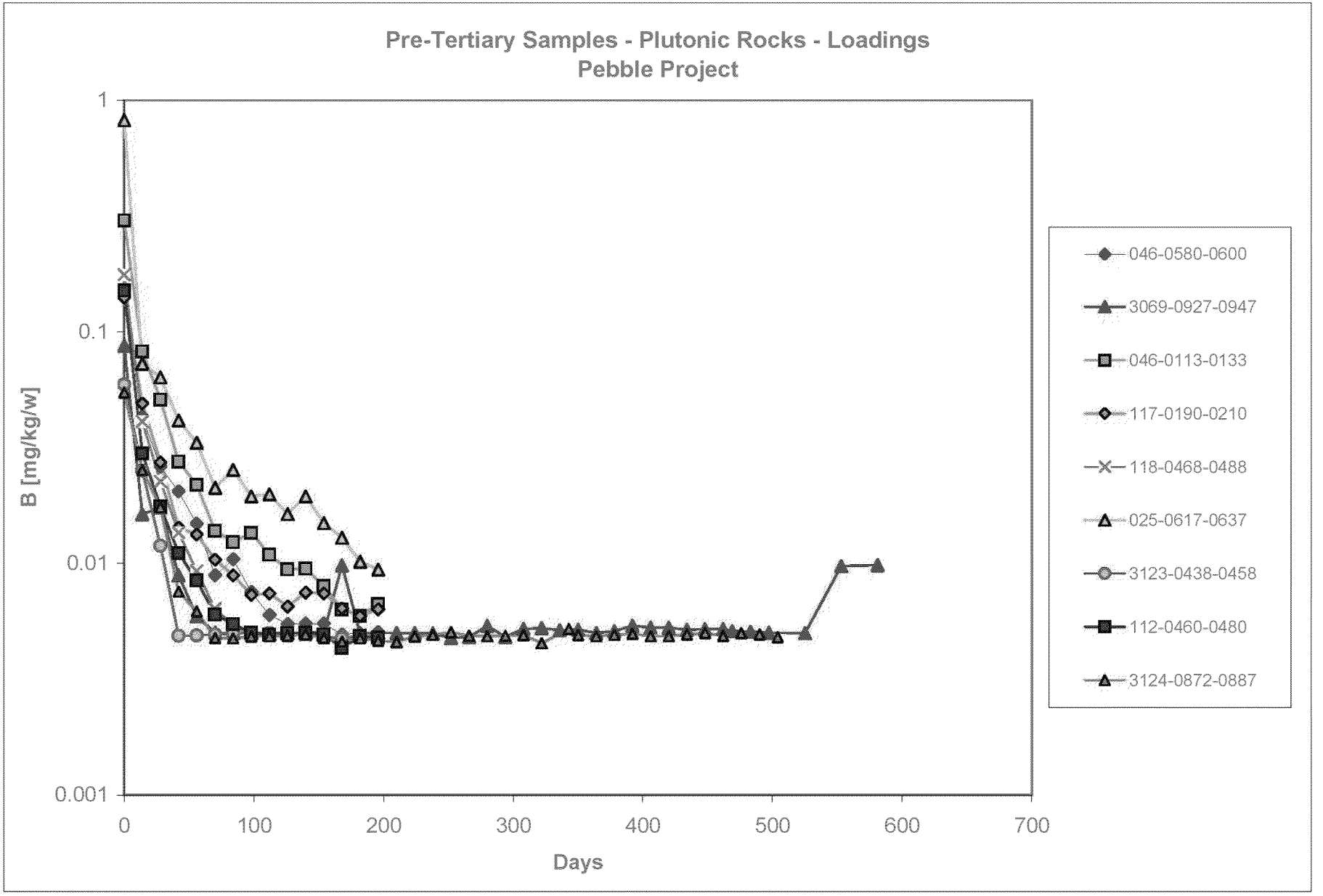

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Sb [mg/kg/w]
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

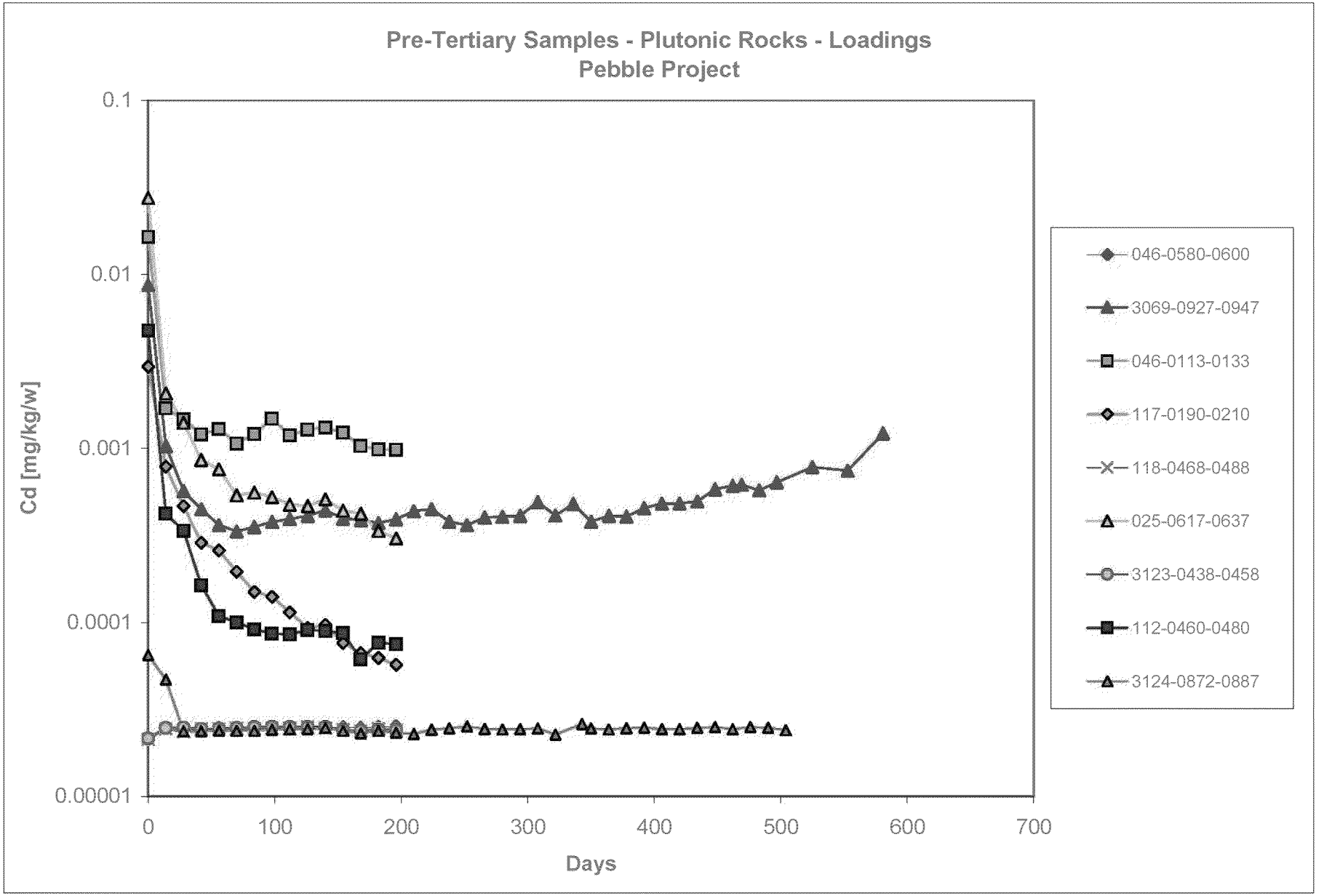

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
As [mg/kg/w]
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

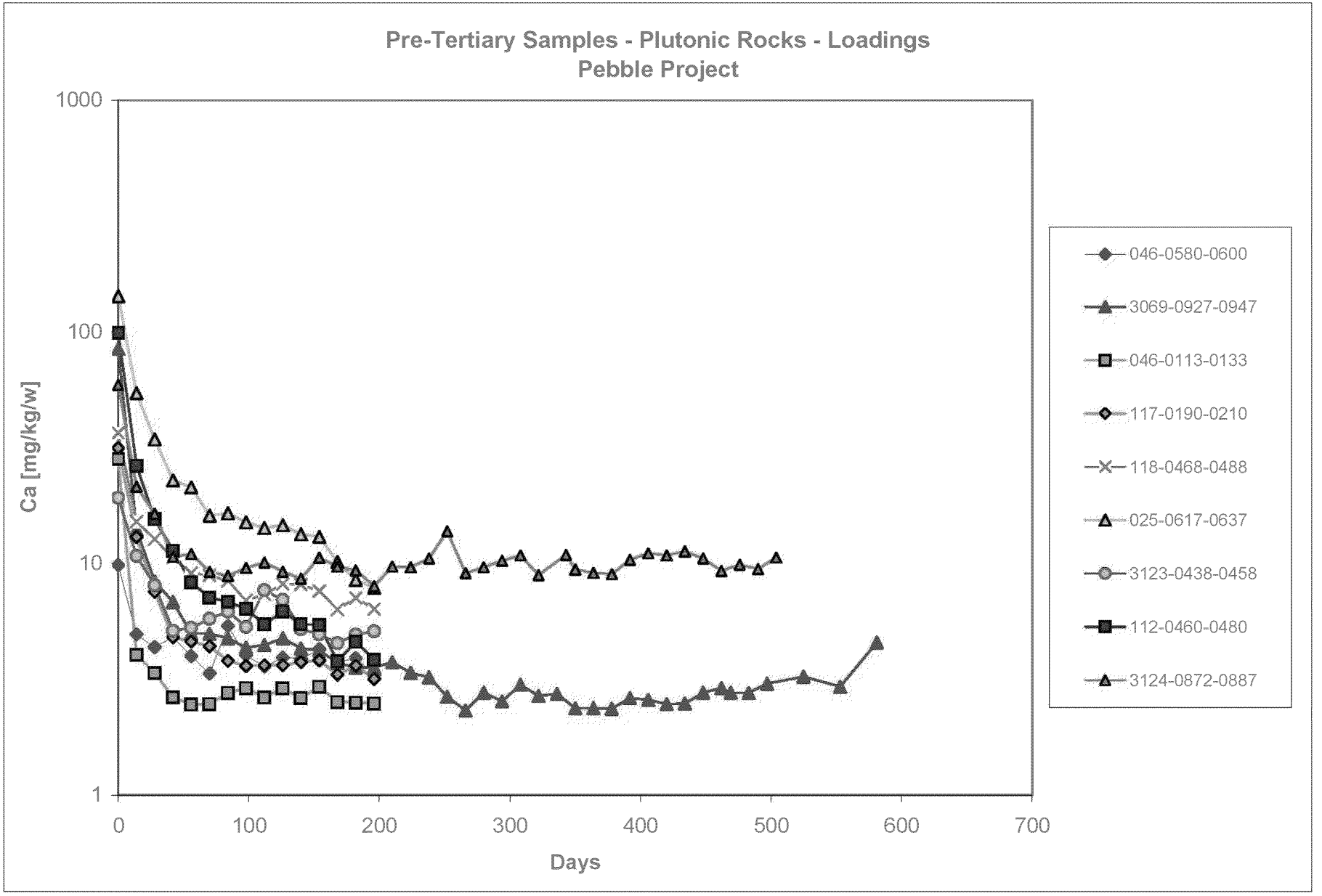

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Ba [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

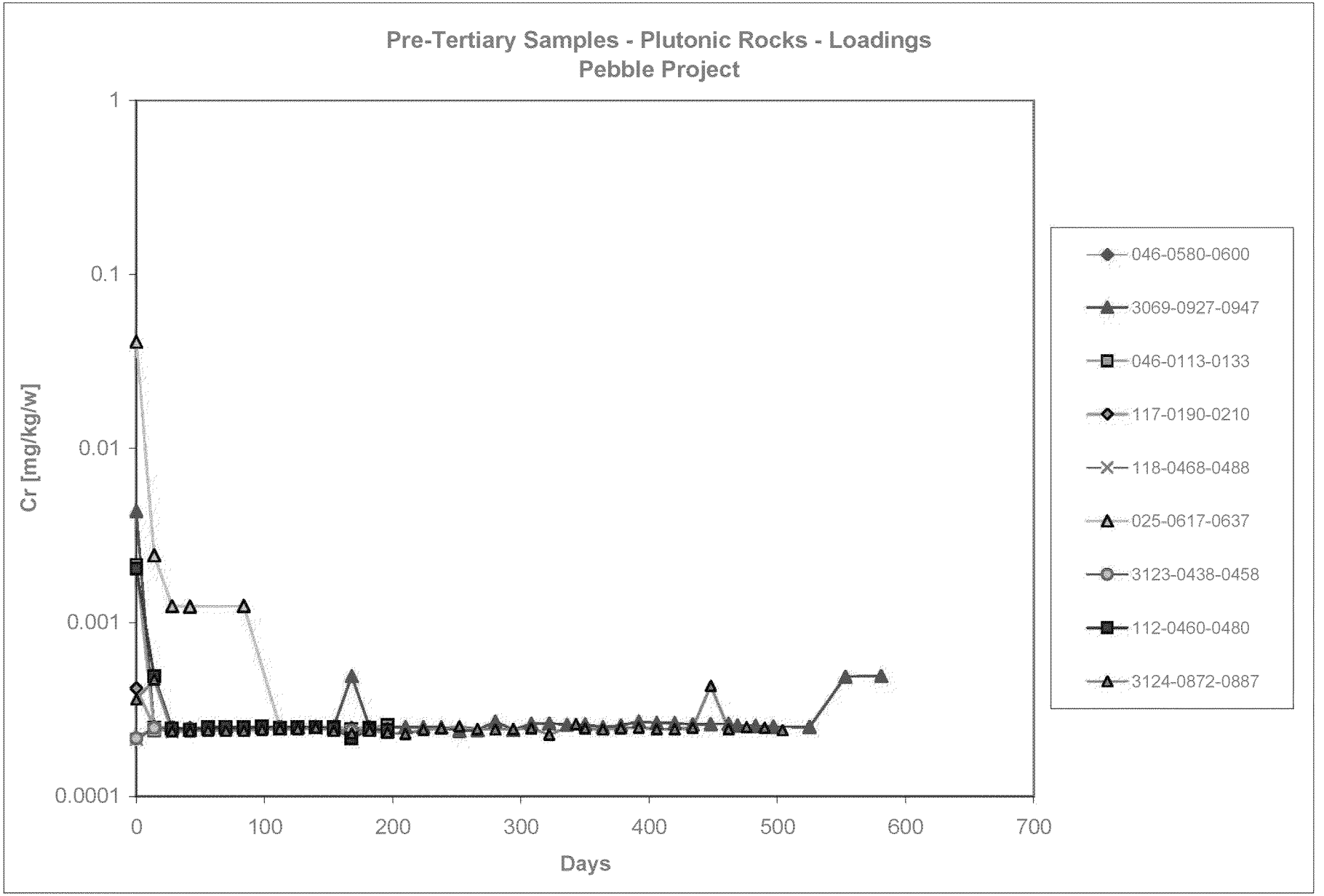

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Be [mg/kg/w]
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

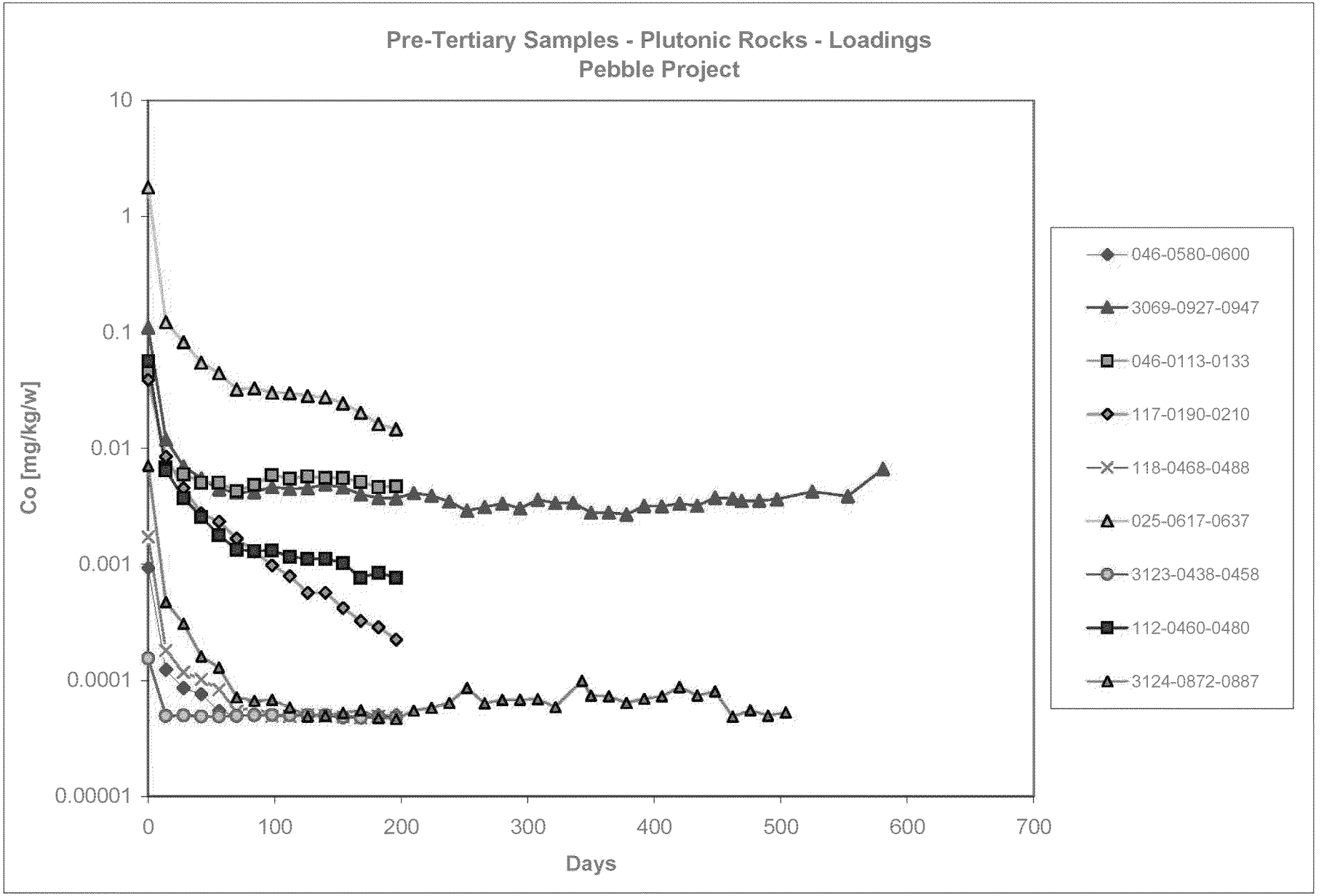

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Bi [mg/kg/w]
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

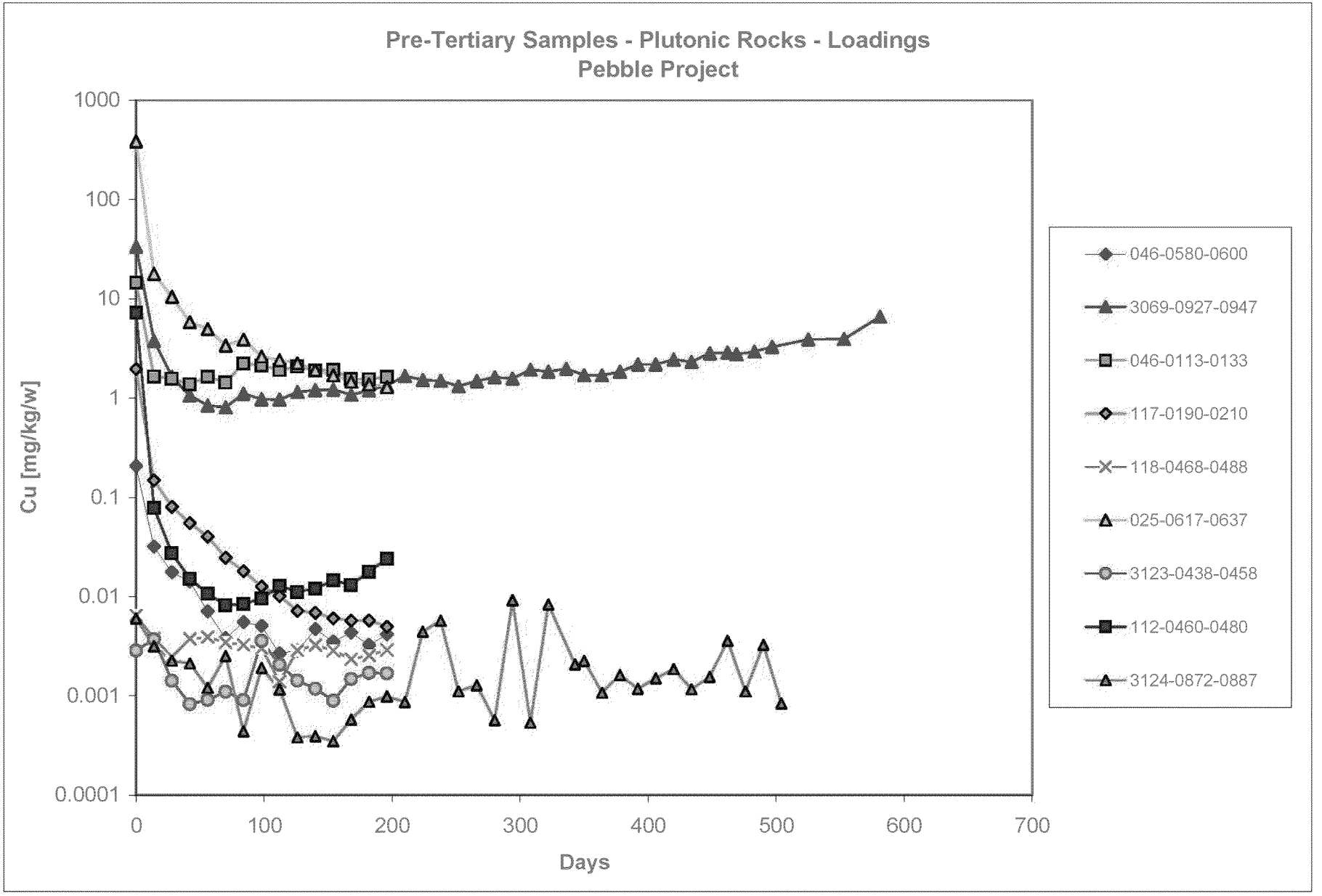

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
B [mg/kg/w]
1
0.1
0.01
0.001
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

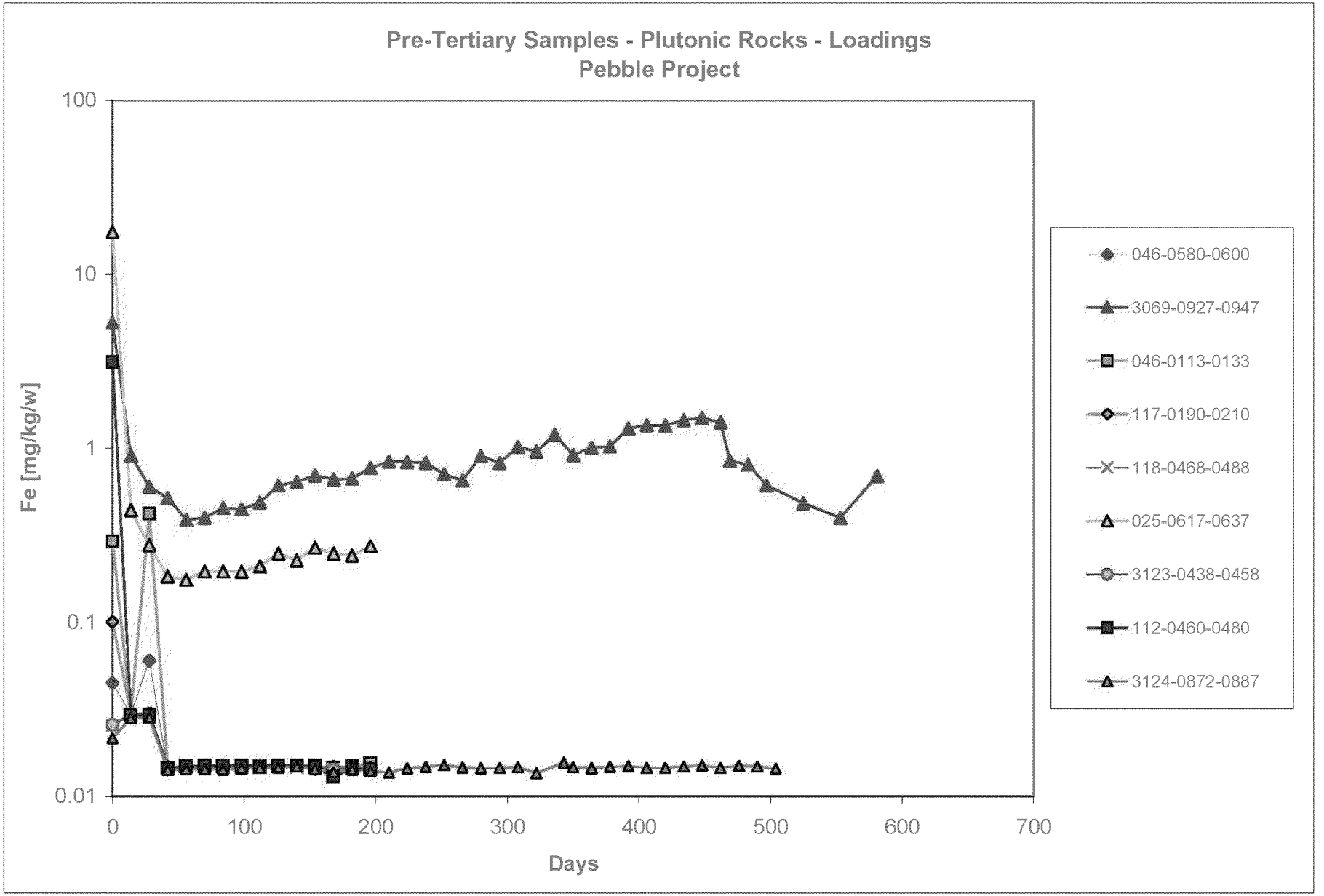

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Cd [mg/kg/w]
0.1
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

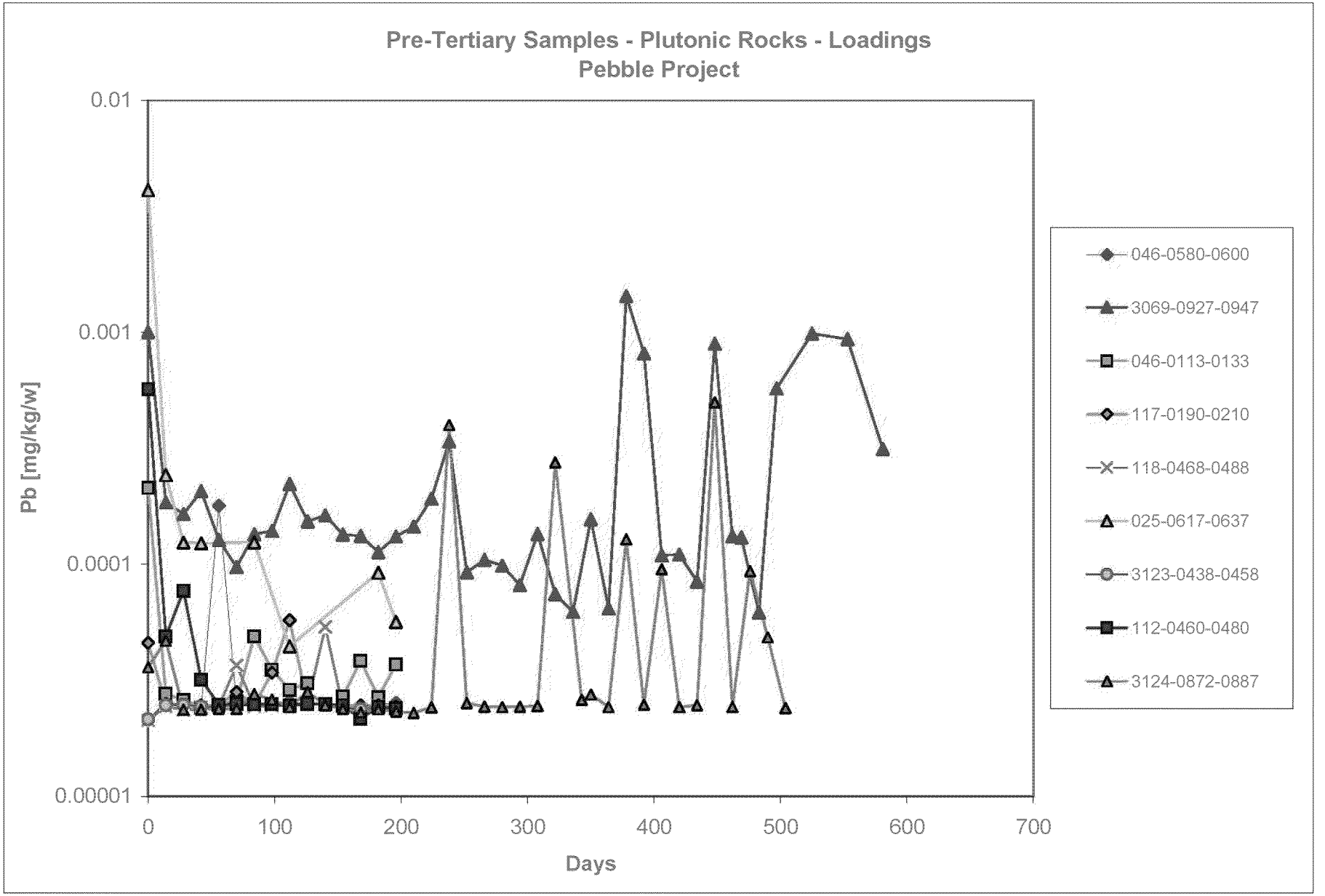

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Ca [mg/kg/w]
1000
100
10
1
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

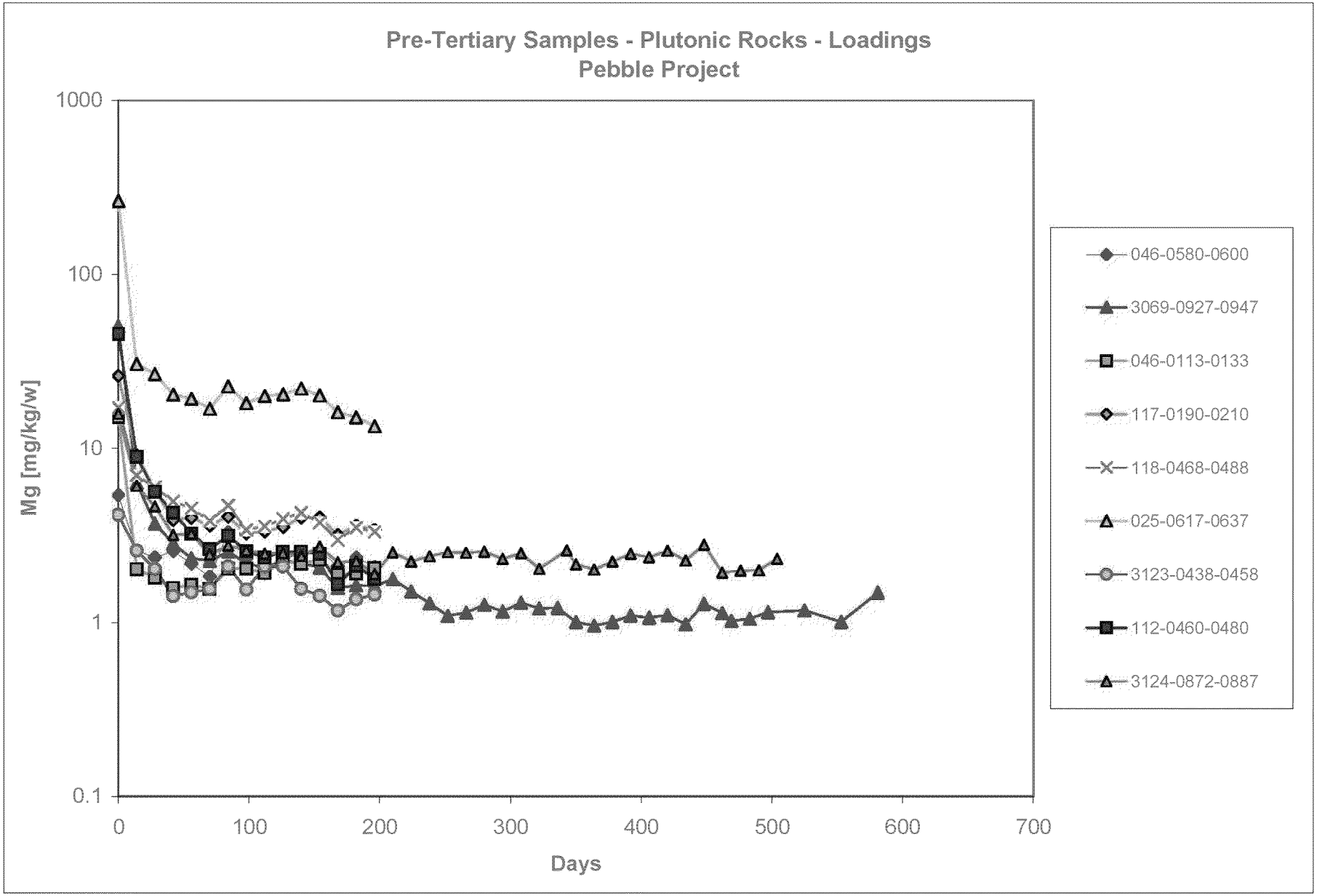

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Cr [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

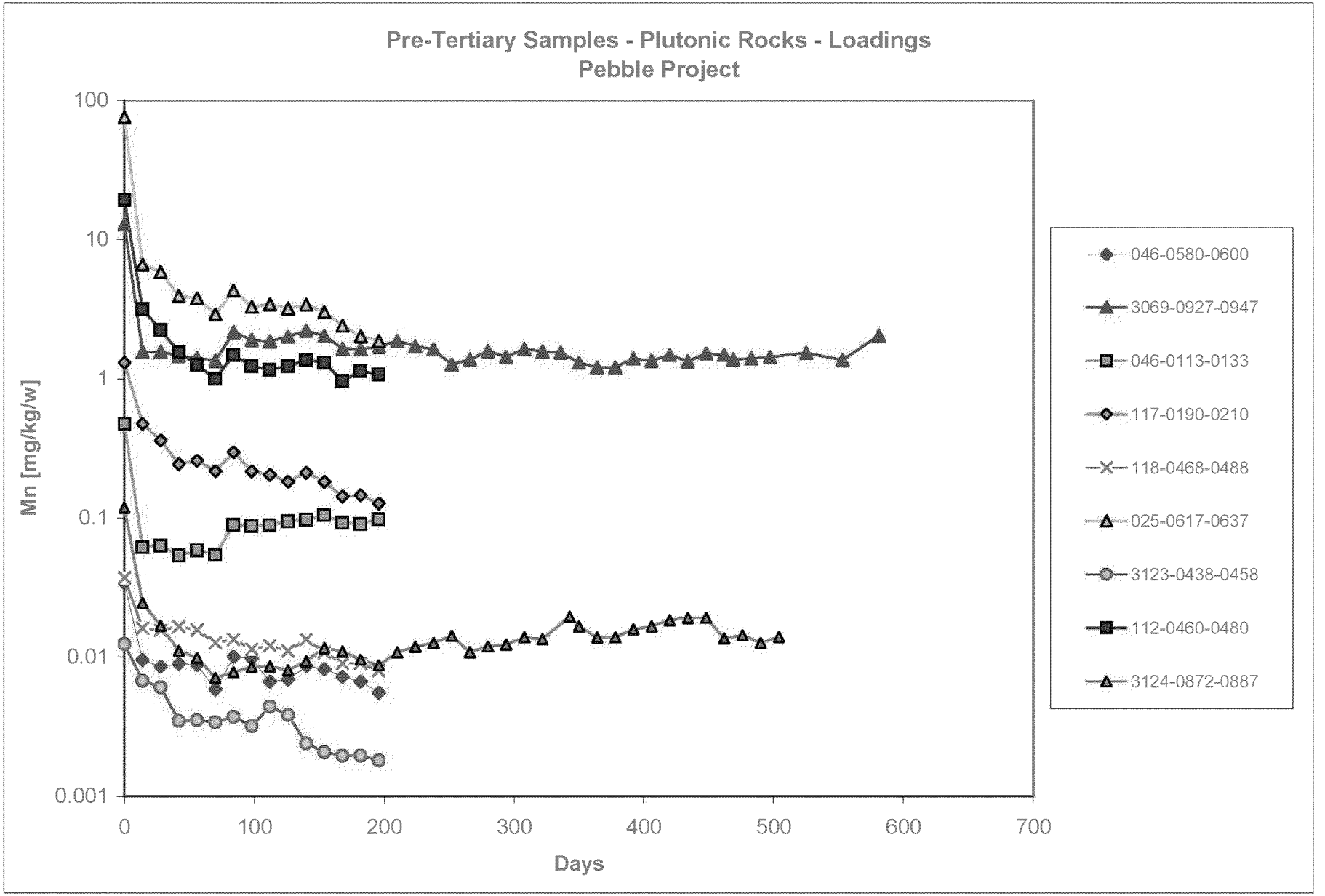

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Co [mg/kg/w]
10
1
0.1
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

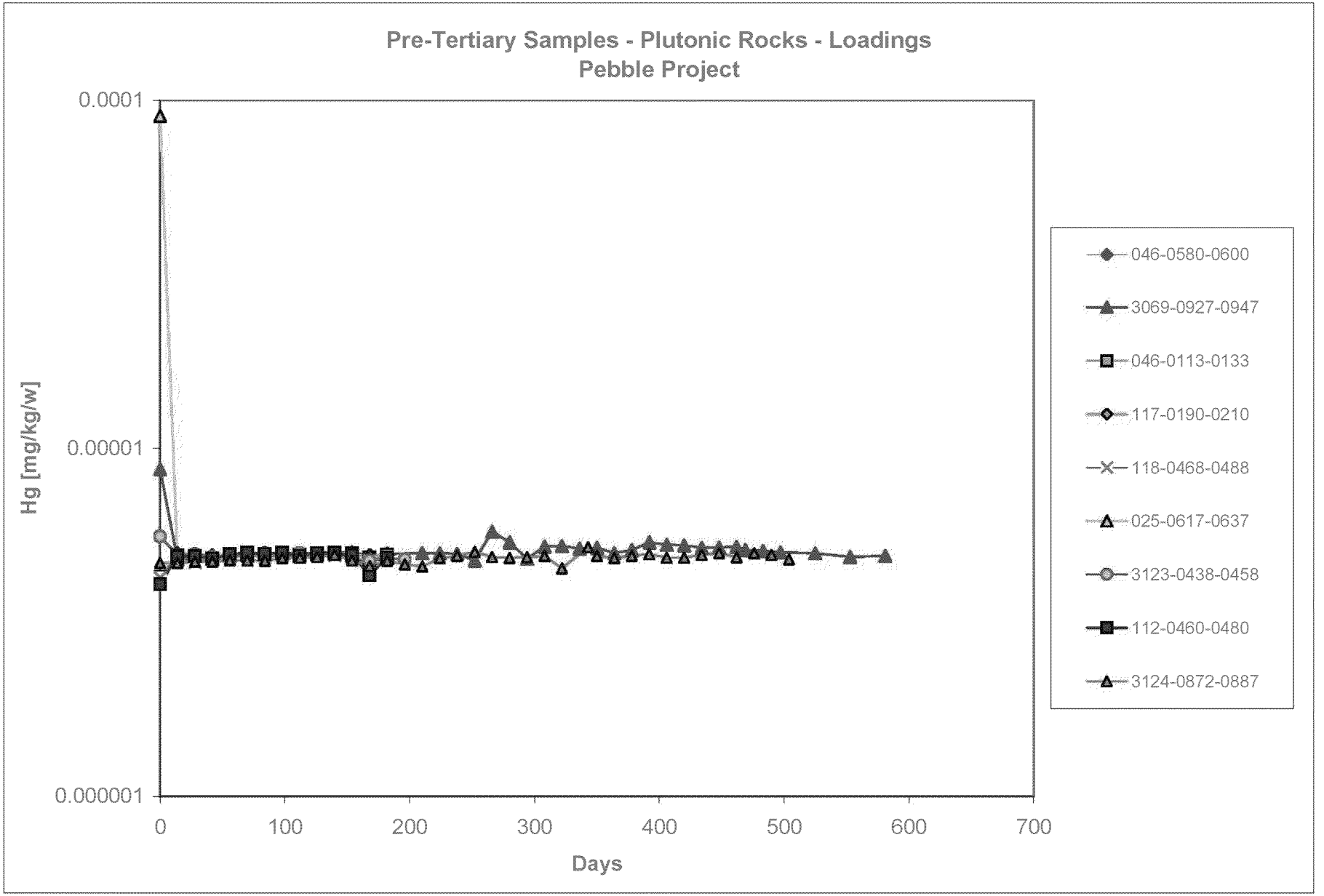

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Cu [mg/kg/w]
1000
100
10
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

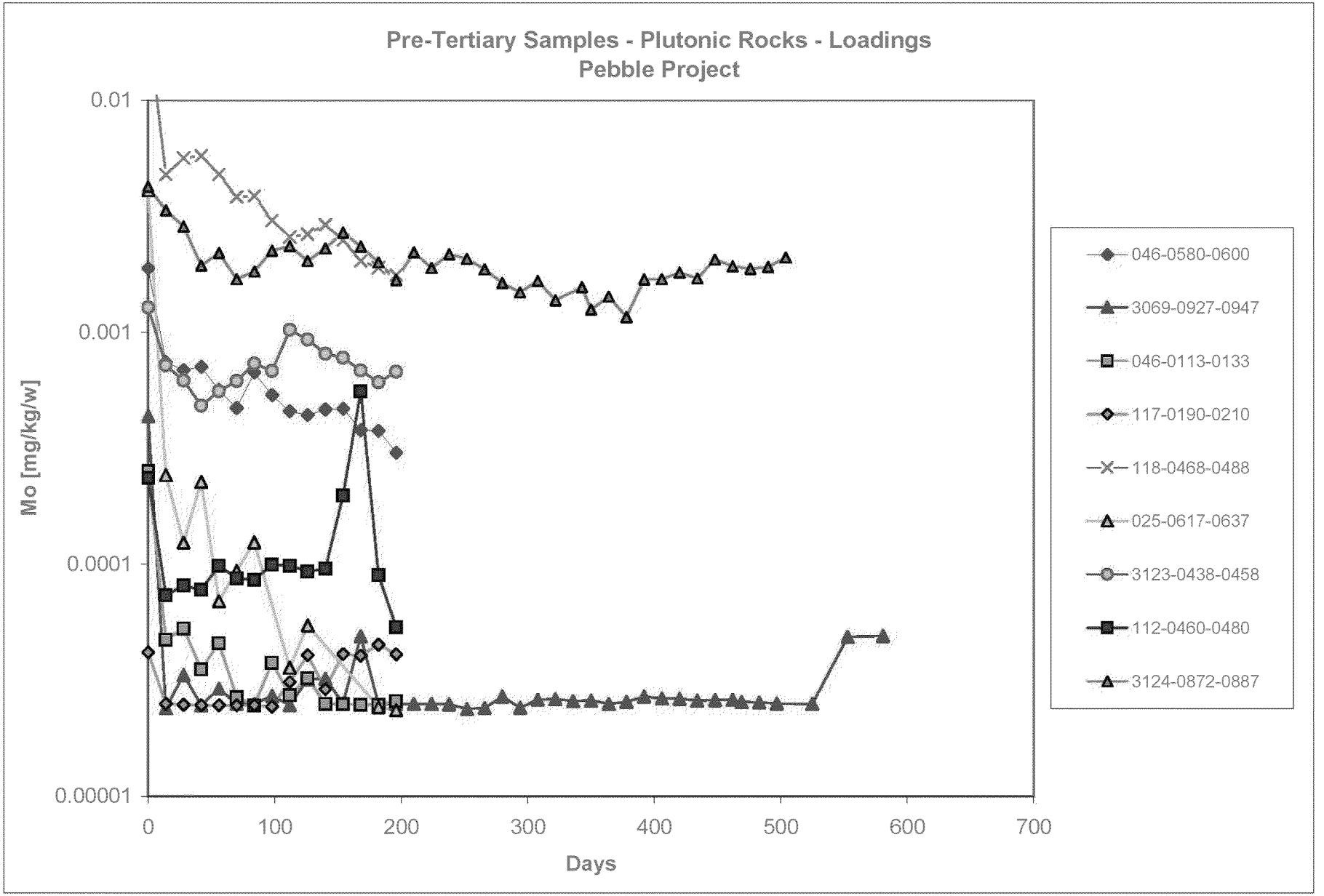

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Fe [mg/kg/w]
100
10
1
0.1
0.01
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

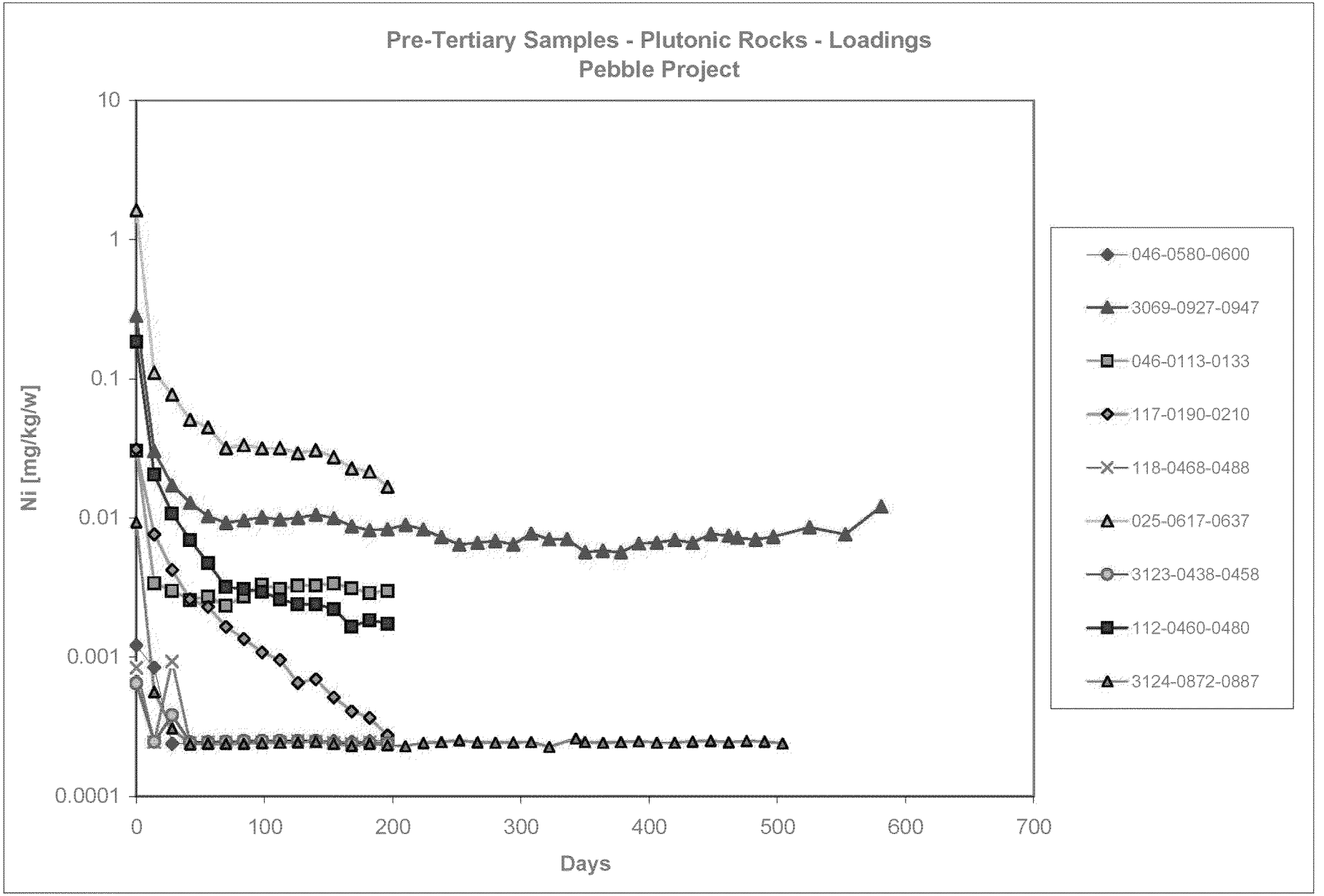

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Pb [mg/kg/w]
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

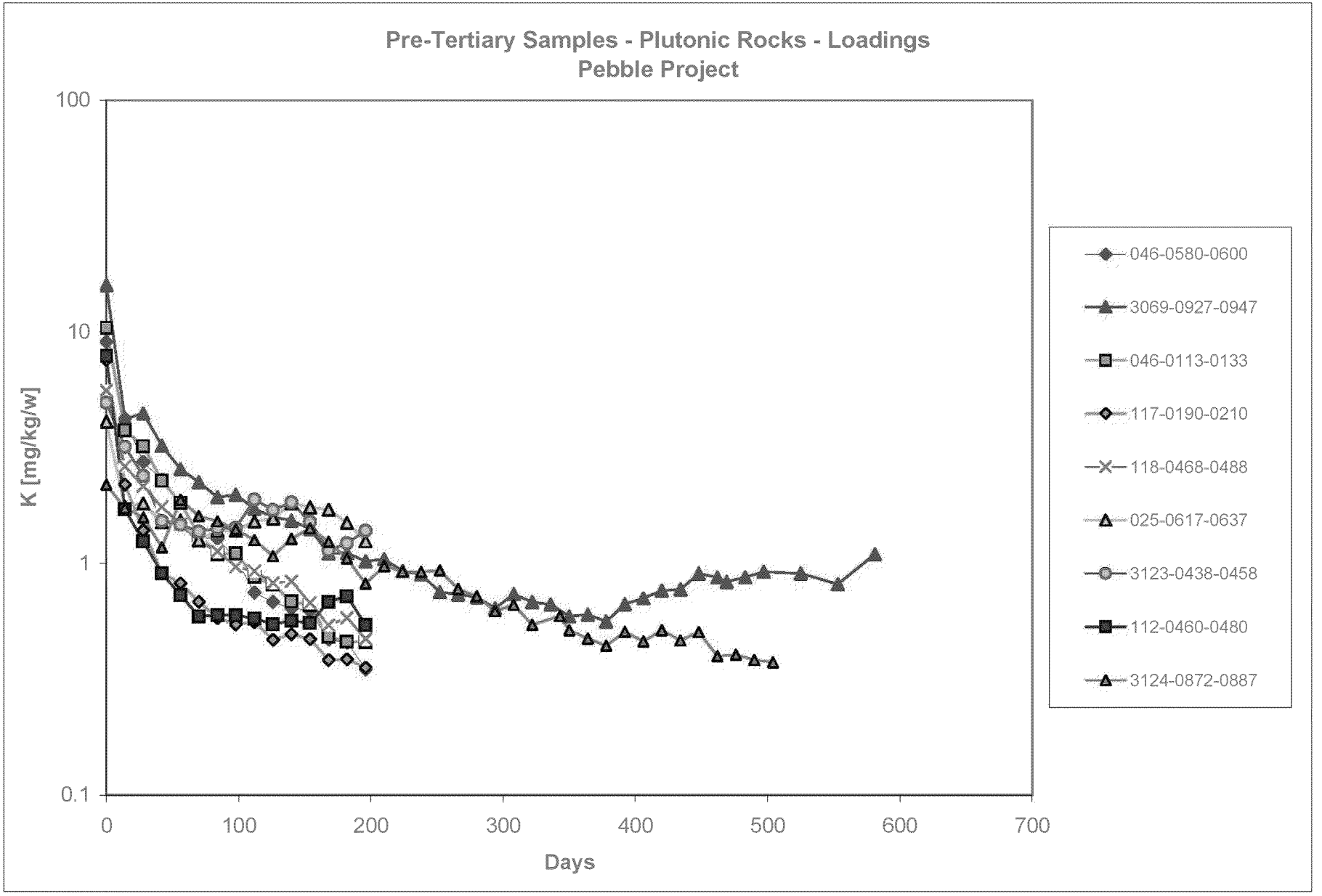

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Mg [mg/kg/w]
1000
100
10
1
0.1
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

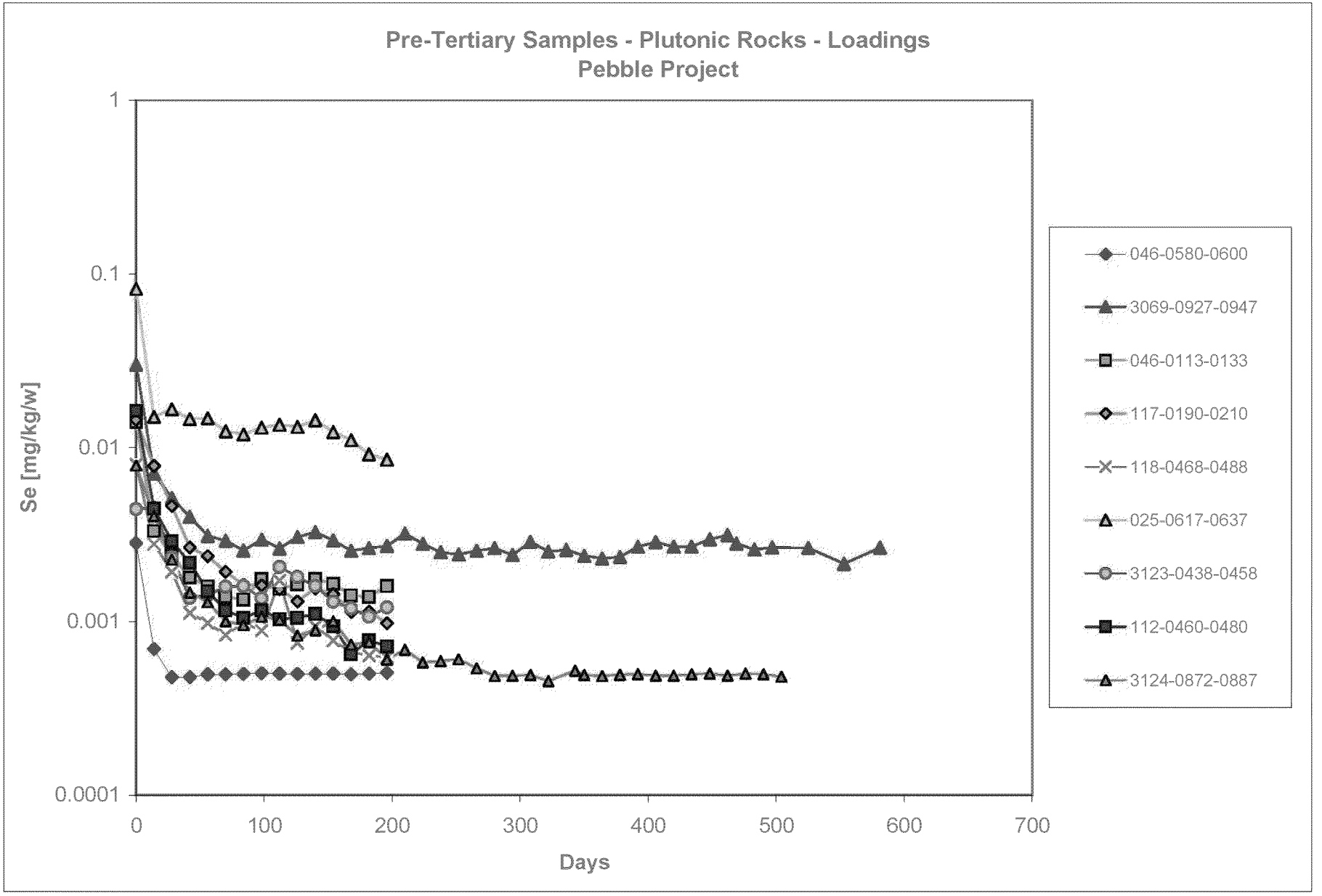

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Mn [mg/kg/w]
100
10
1
0.1
0.01
0.001
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

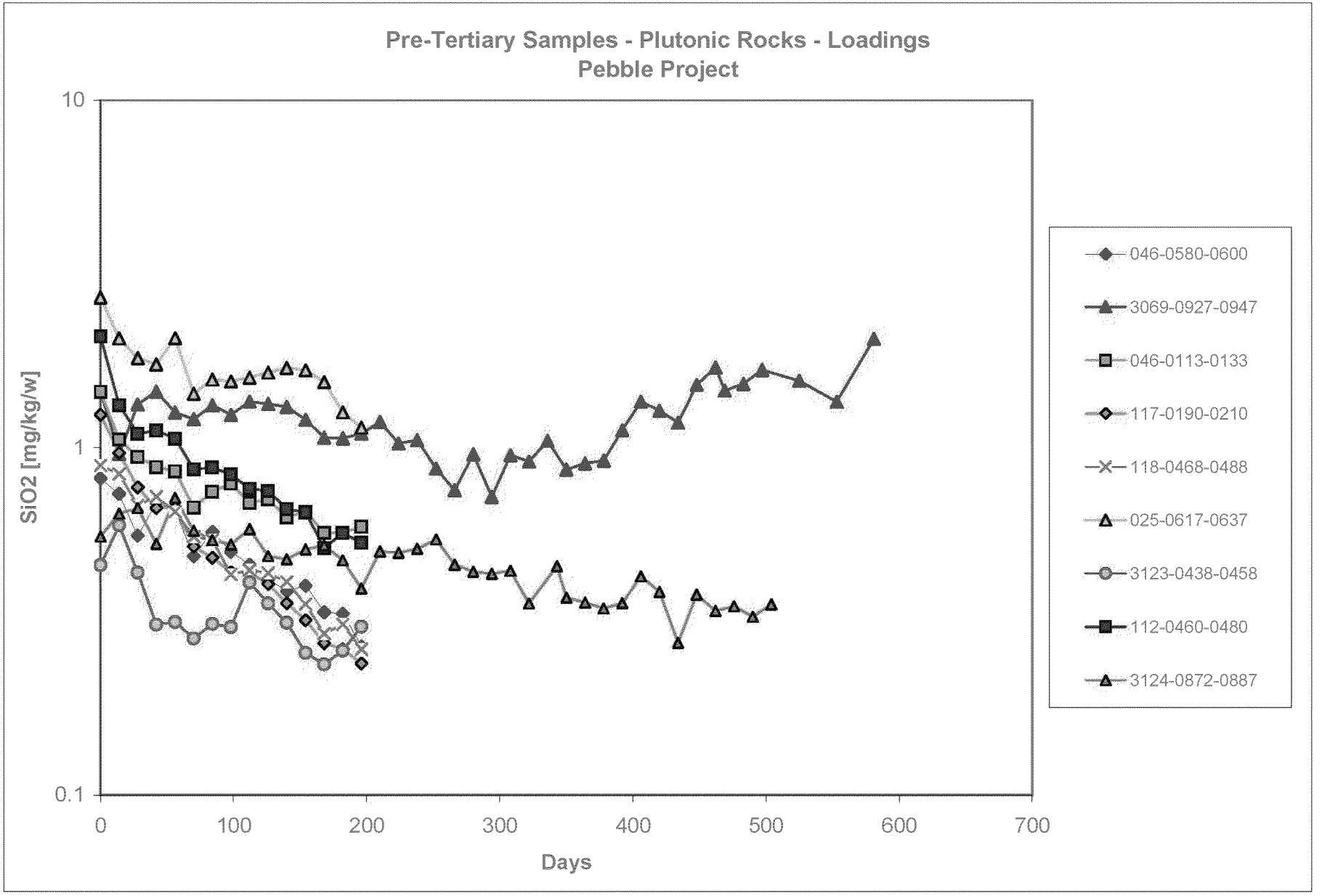

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Hg [mg/kg/w]
0.0001
0.00001
0.000001
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

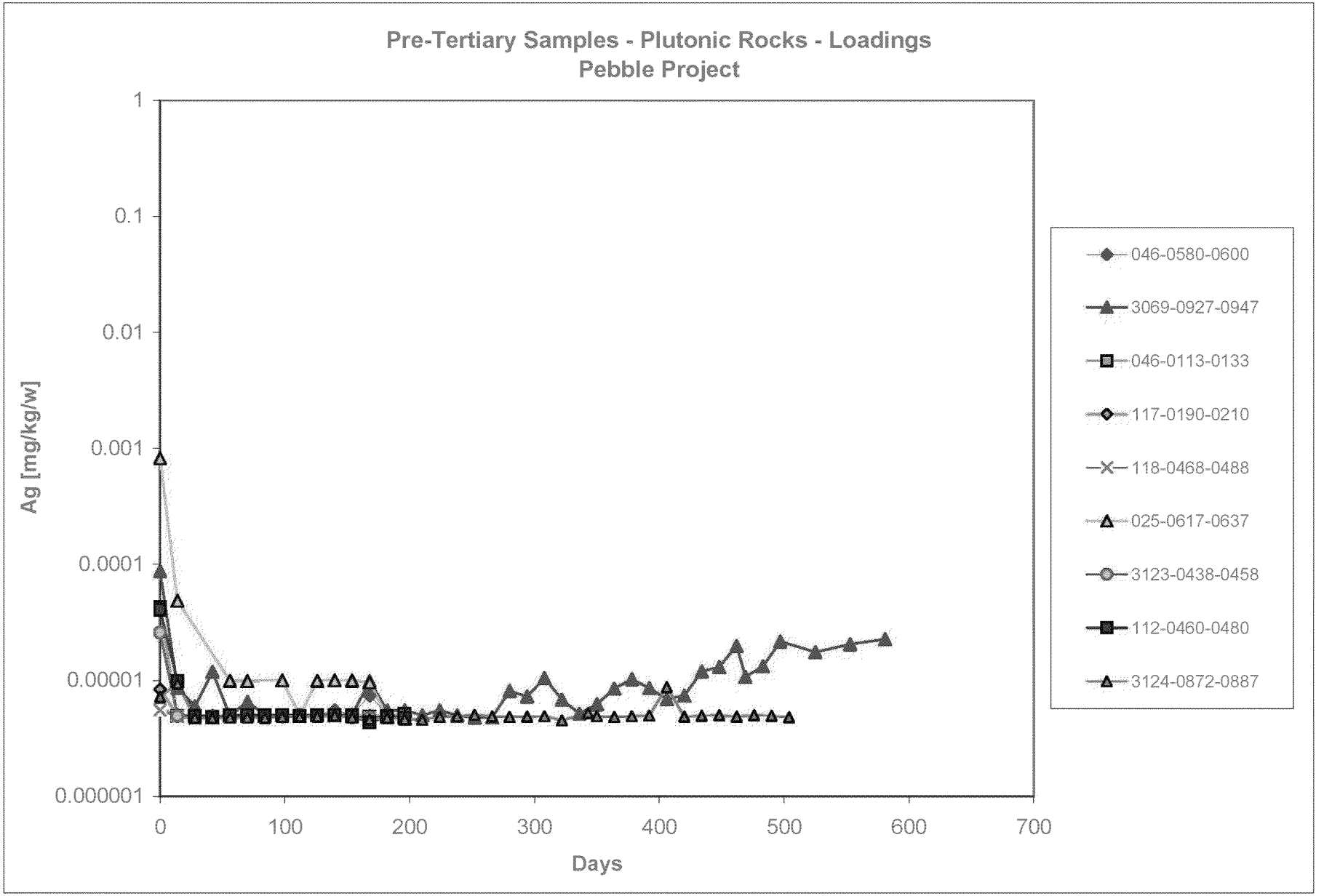

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Mo [mg/kg/w]
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

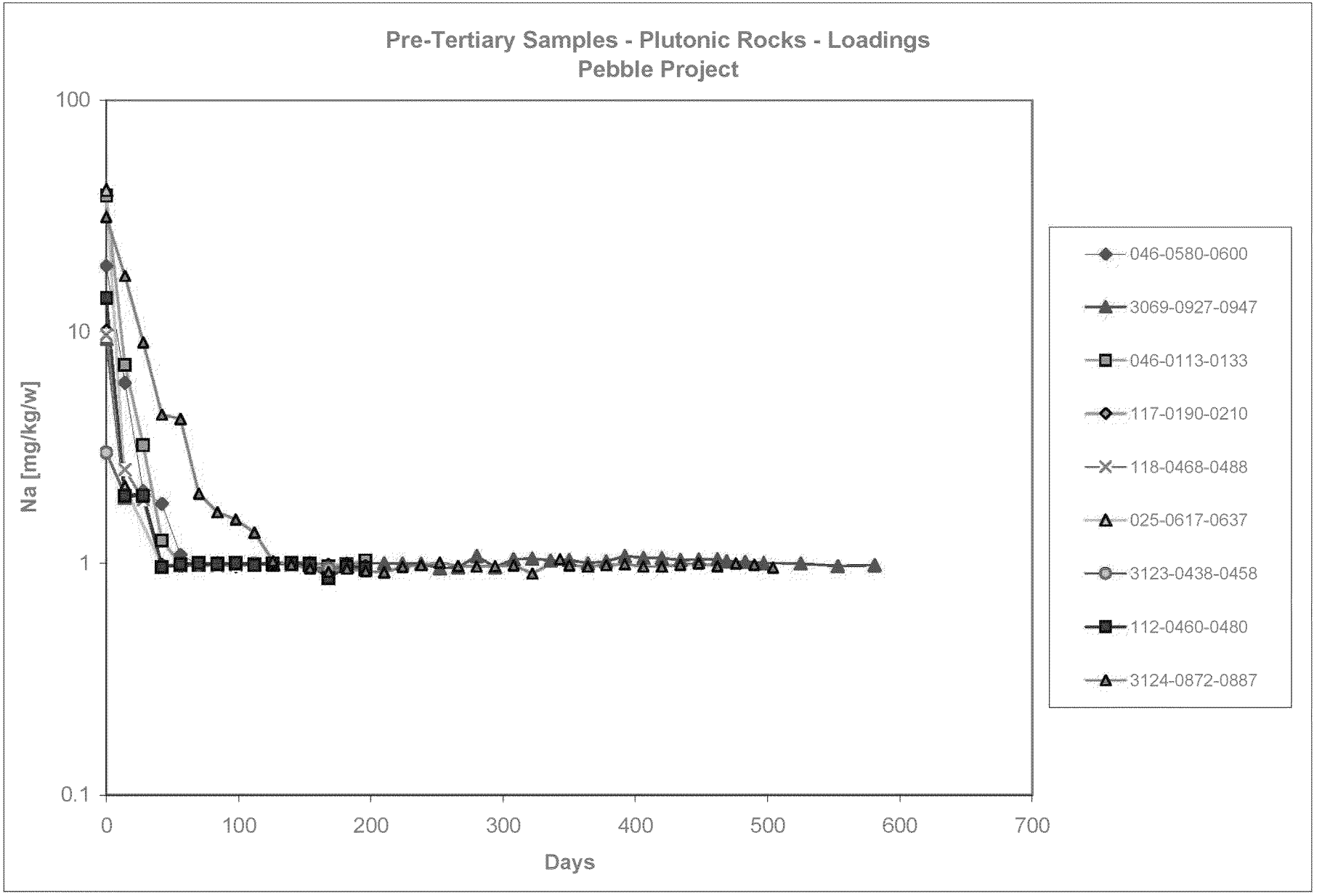

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Ni [mg/kg/w]
10
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

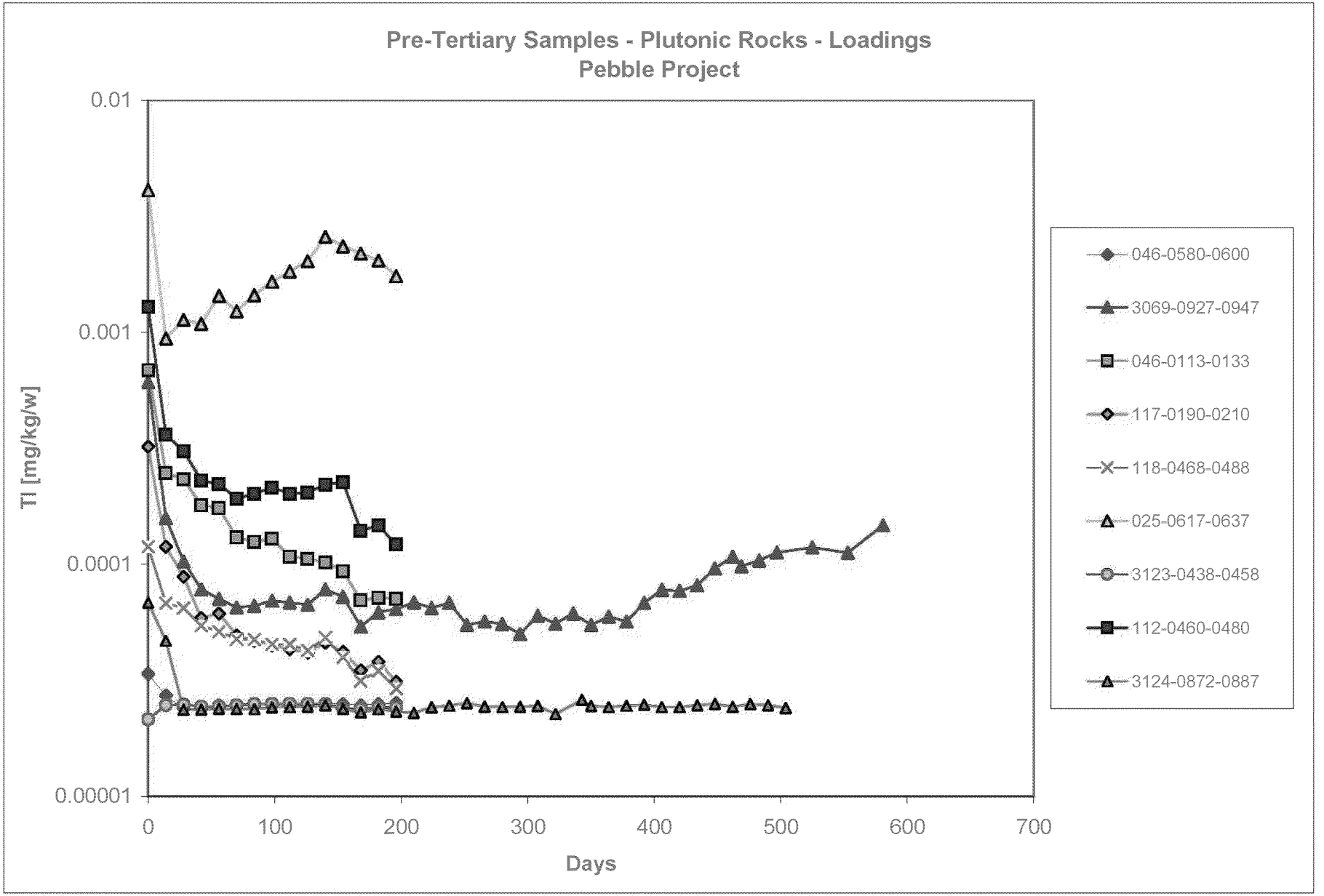

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
K [mg/kg/w]
100
10
1
0.1
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

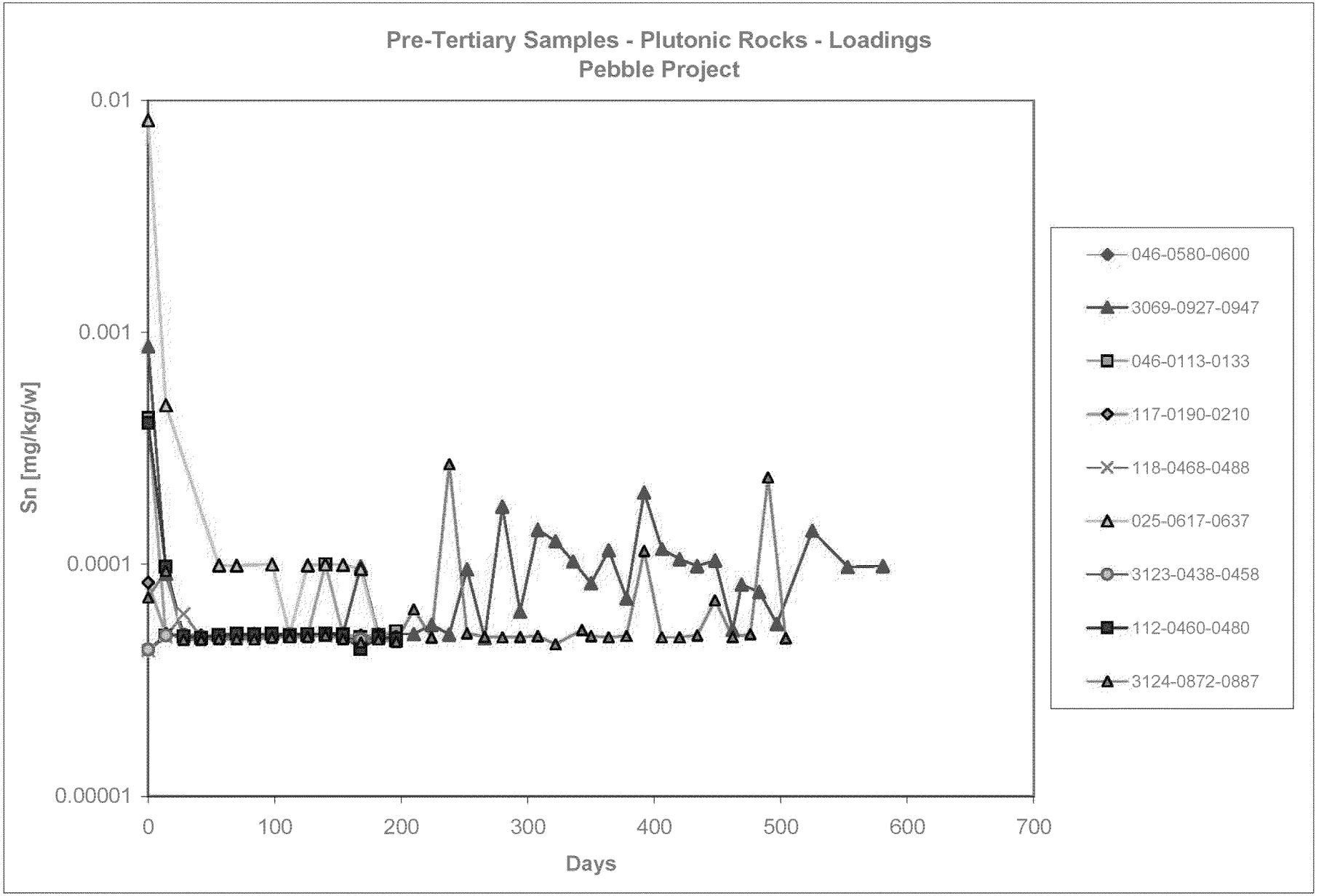

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Se [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

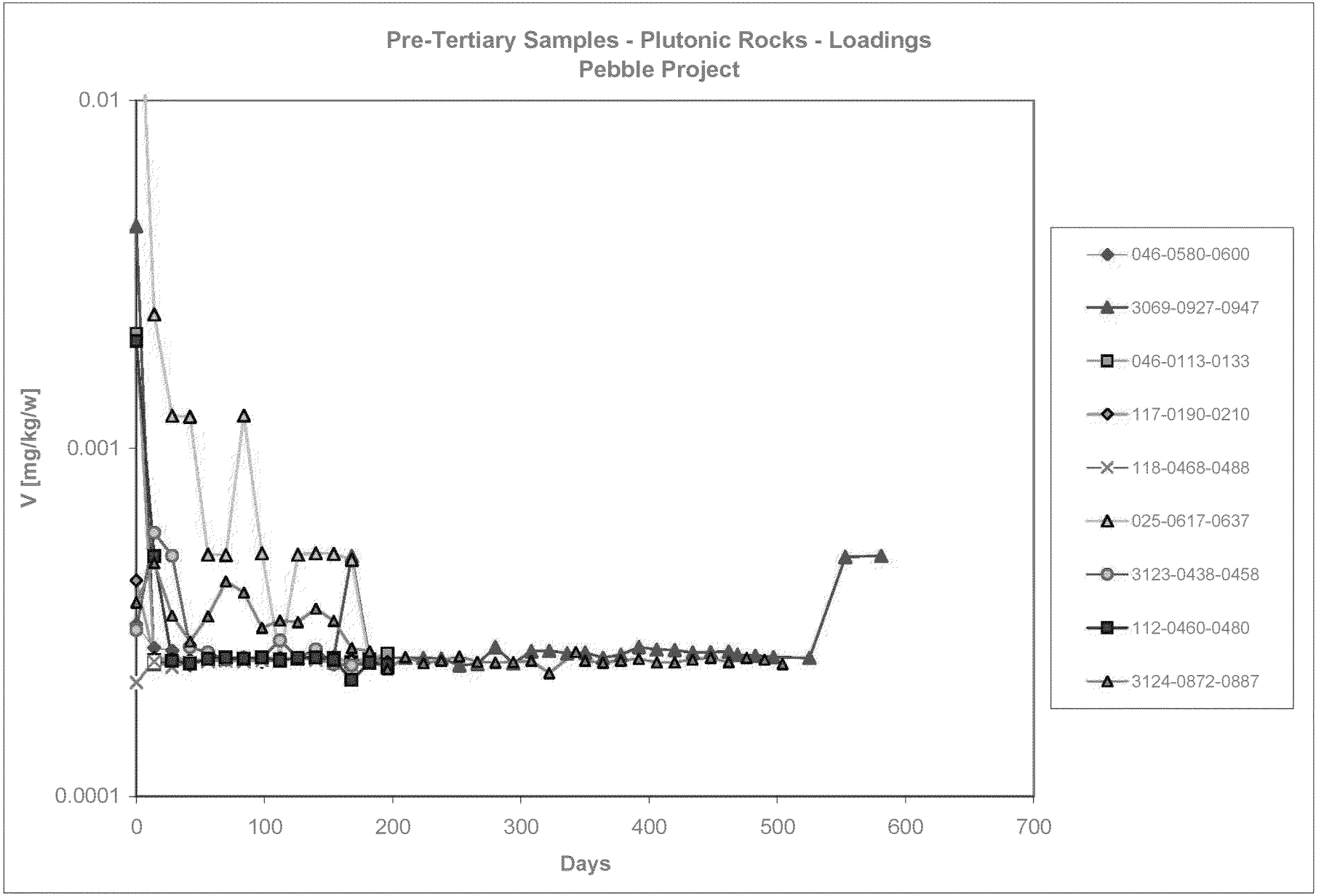

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
SiO2 [mg/kg/w]
10
1
0.1
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

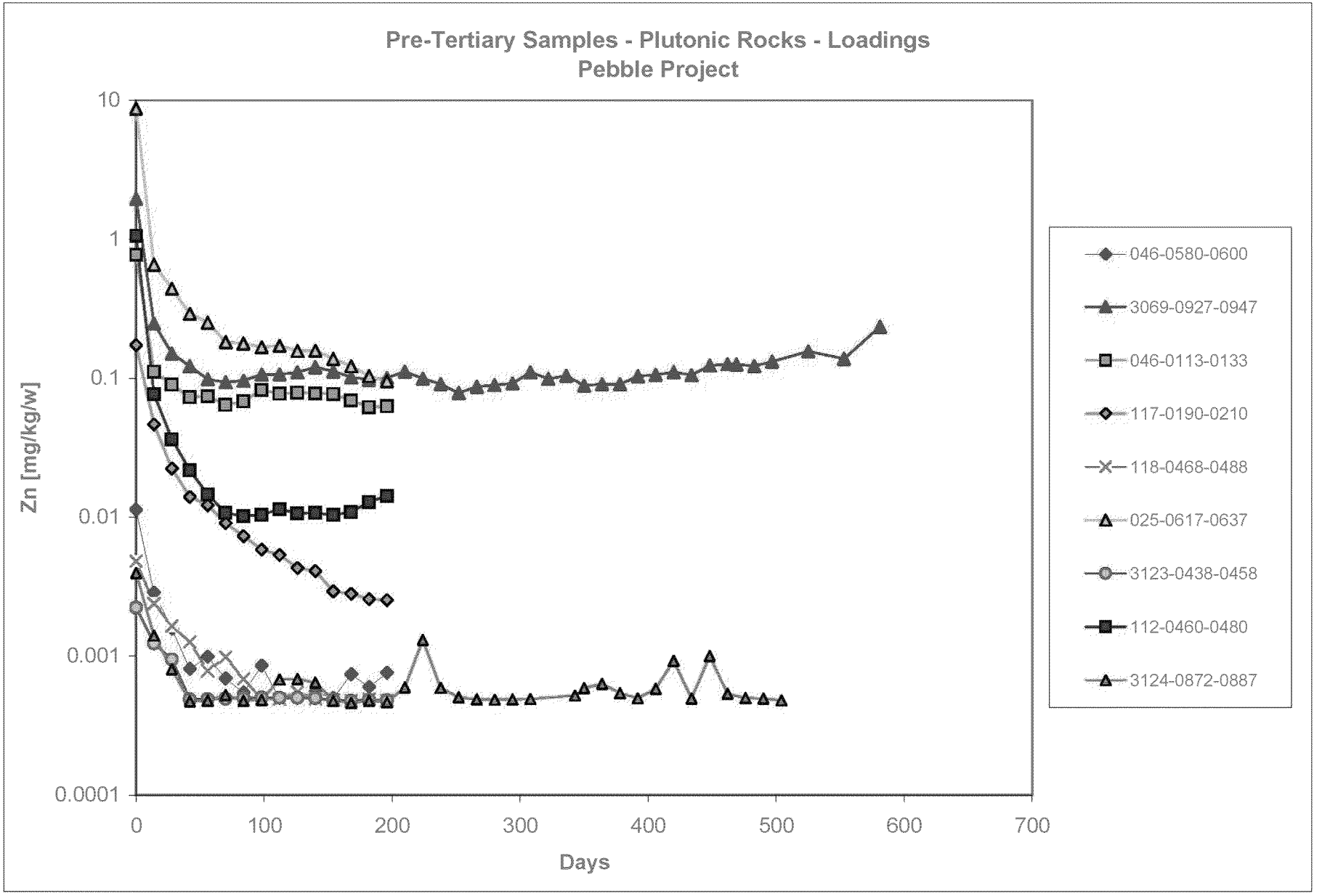

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Ag [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0.00001
0.000001
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887


Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Na [mg/kg/w]
100
10
1
0.1
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

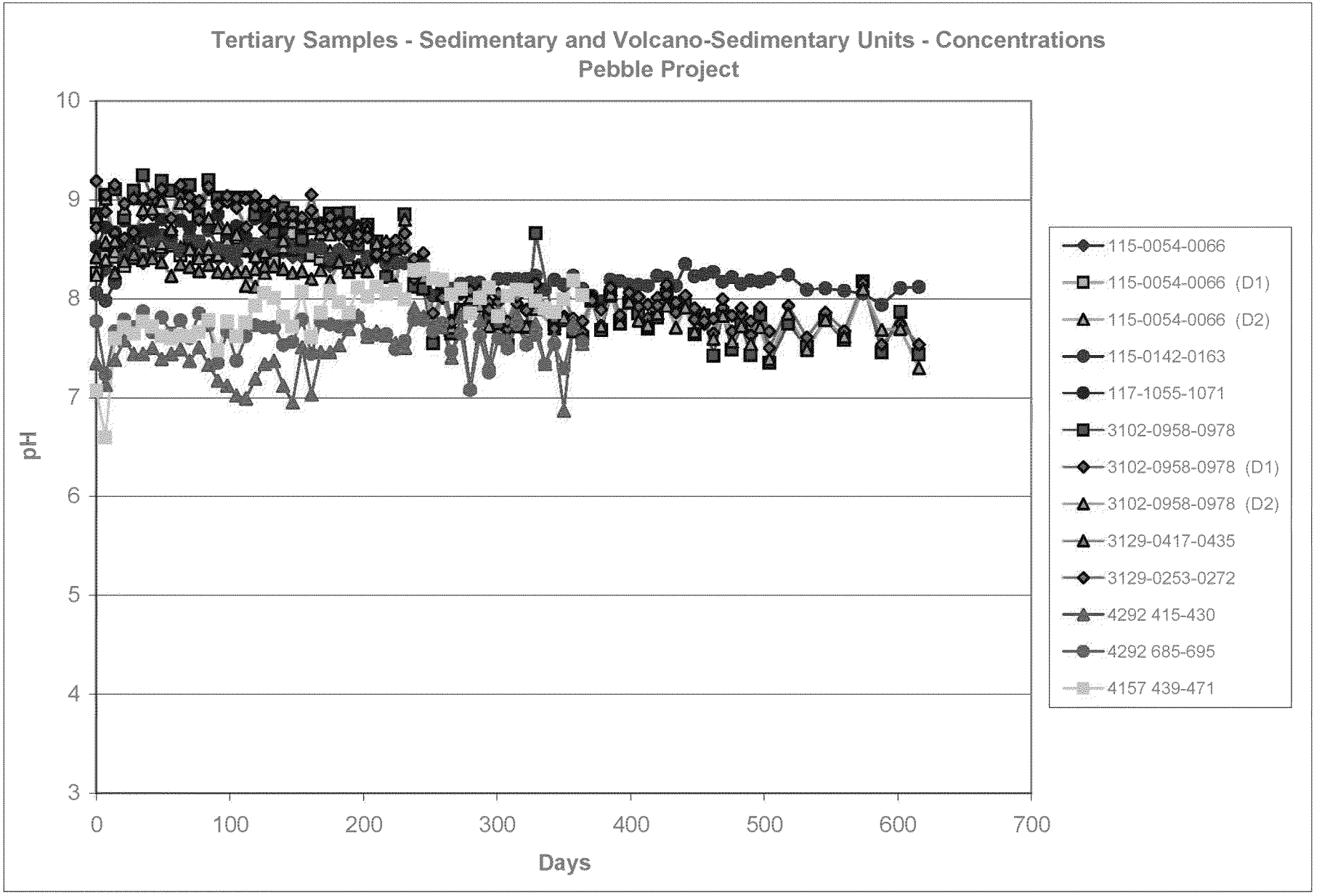

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Tl [mg/kg/w]
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

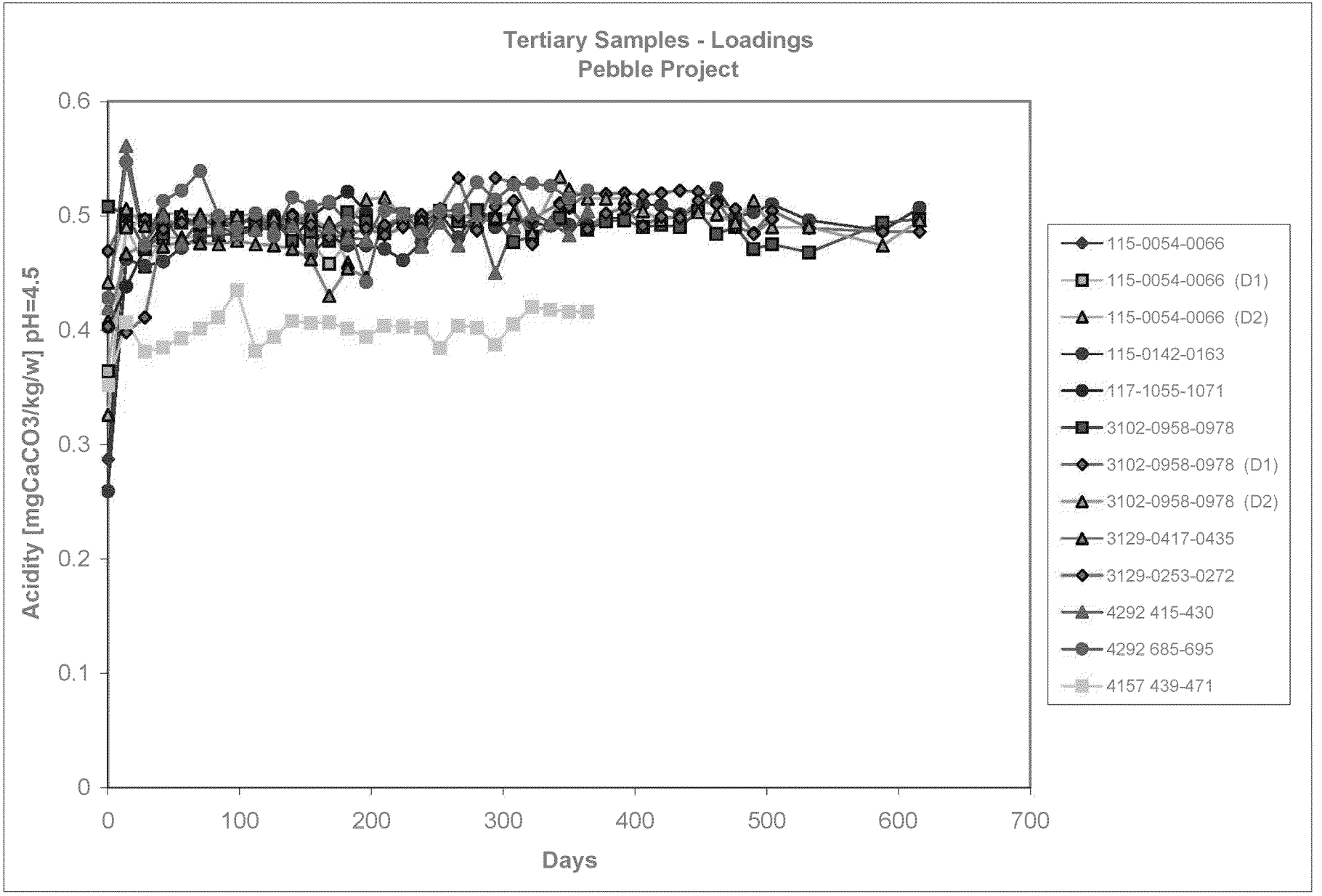

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Sn [mg/kg/w]
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

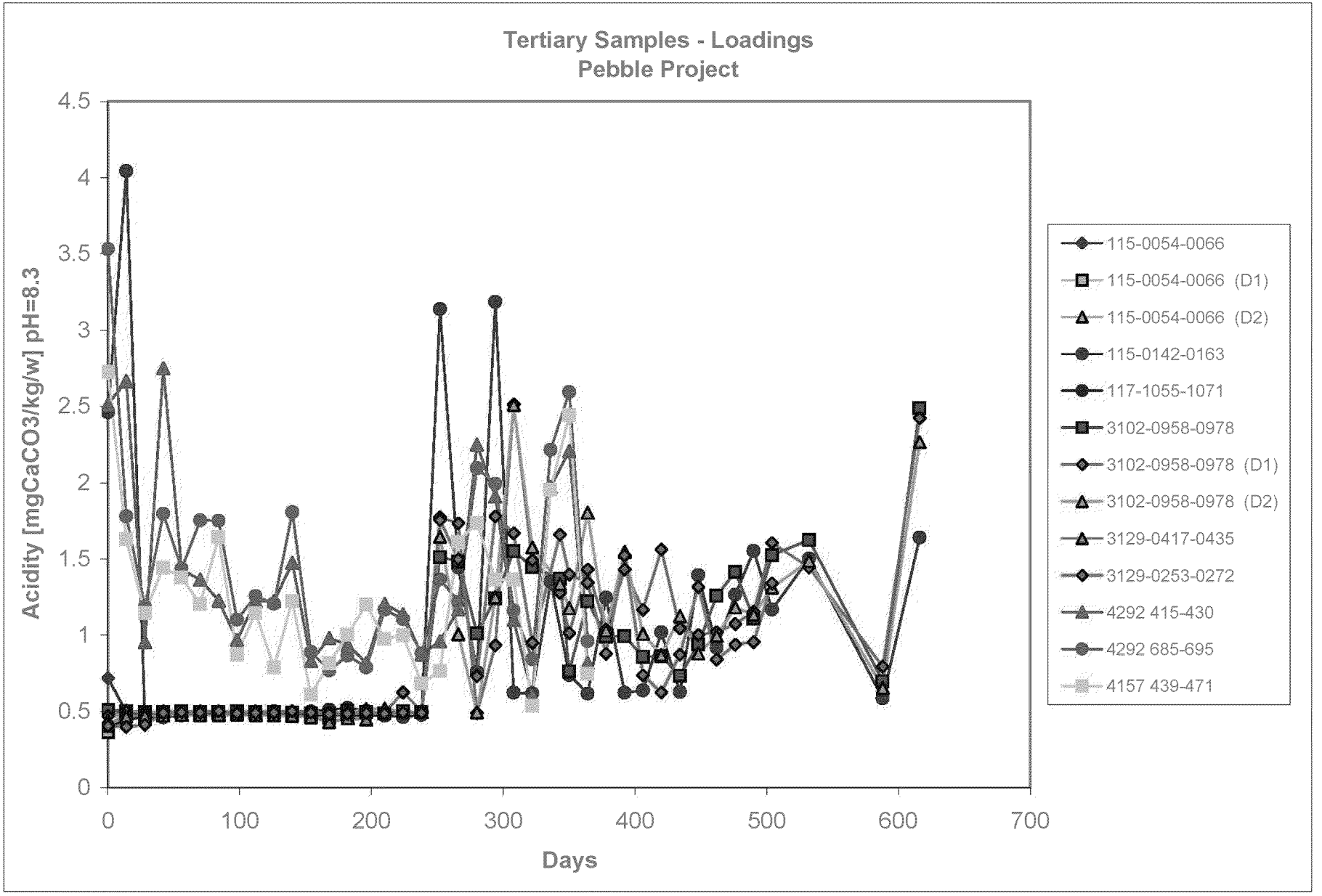

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
V [mg/kg/w]
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

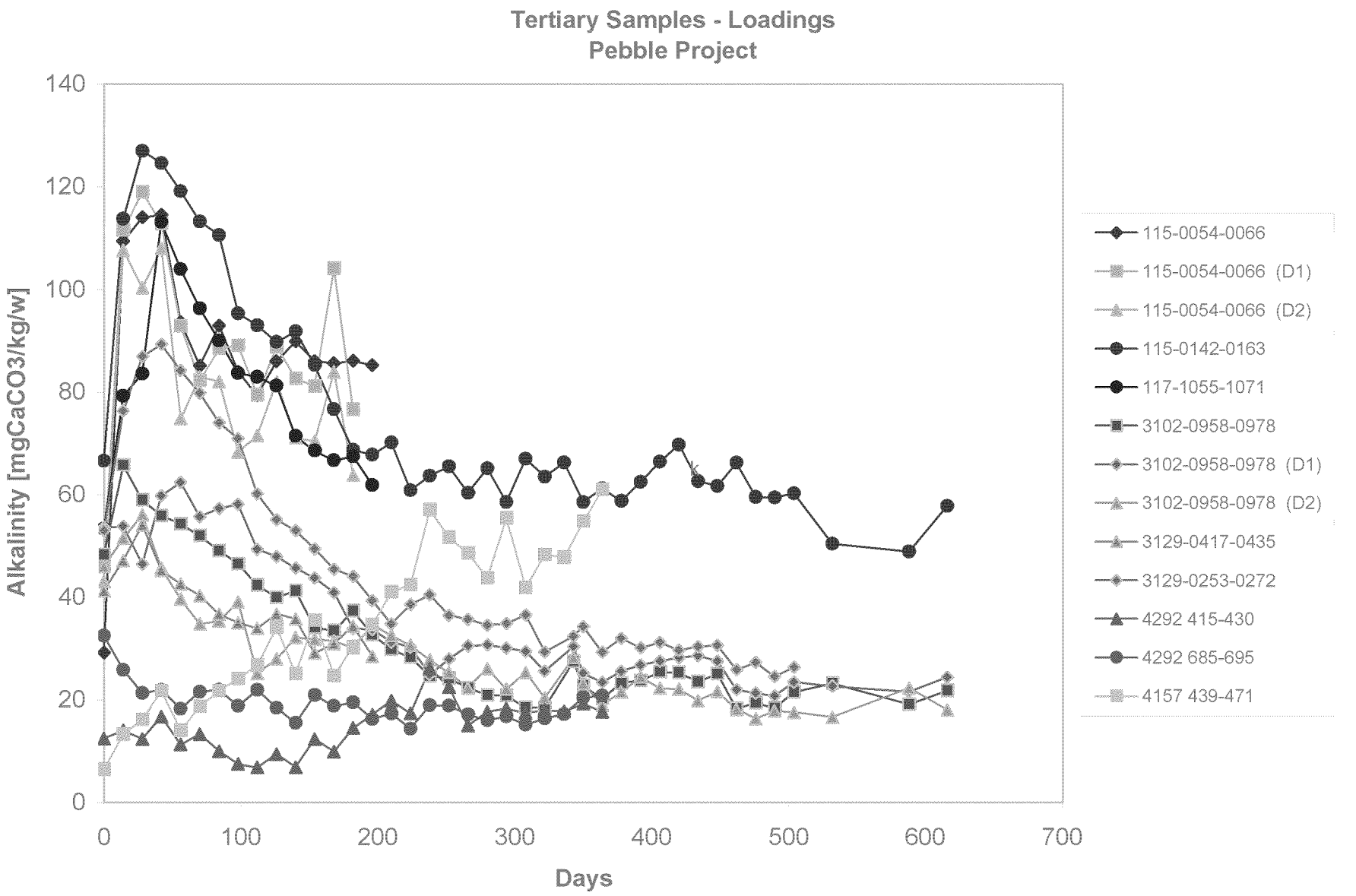

Pre-Tertiary Samples - Plutonic Rocks - Loadings
Pebble Project
Zn [mg/kg/w]
10
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
046-0580-0600
3069-0927-0947
046-0113-0133
117-0190-0210
118-0468-0488
025-0617-0637
3123-0438-0458
112-0460-0480
3124-0872-0887

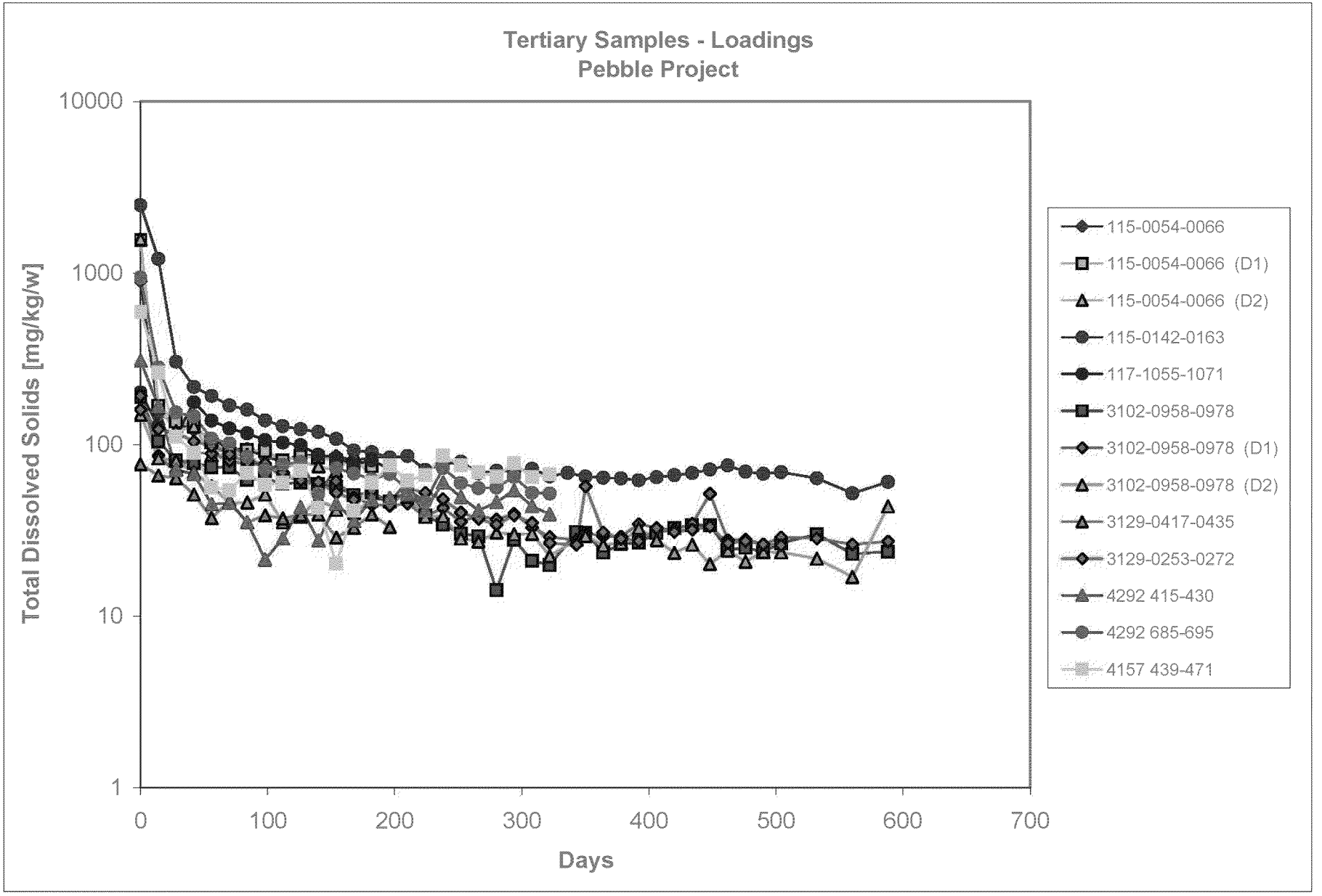
Attachment C
Graphs for Tertiary Rock Humidity Cells

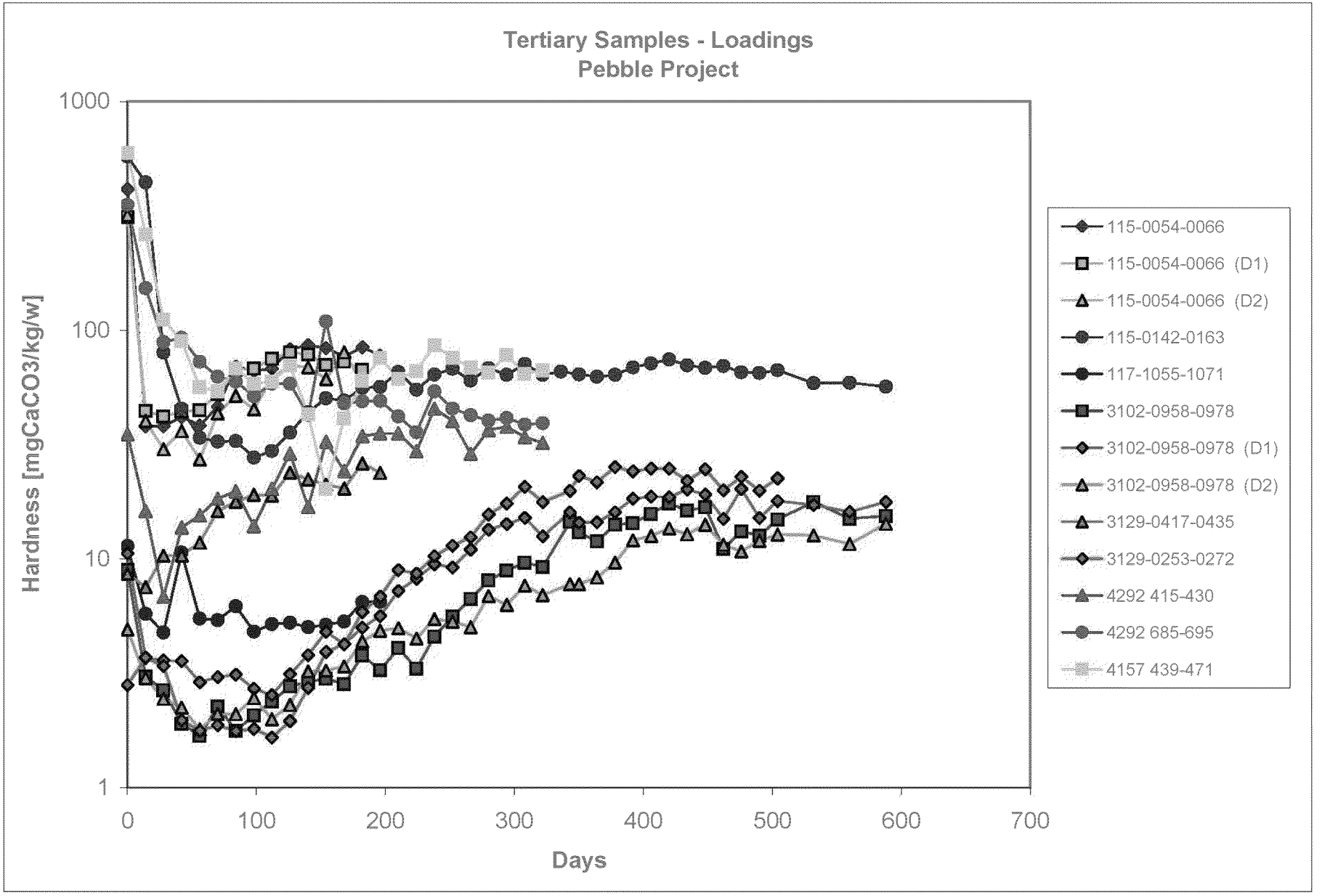

Tertiary Samples - Sedimentary and Volcano-Sedimentary Units - Concentrations
Pebble Project
pH
Days
10
9
8
7
6
5
4
3
0
100
200
300
400
500
600
700
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

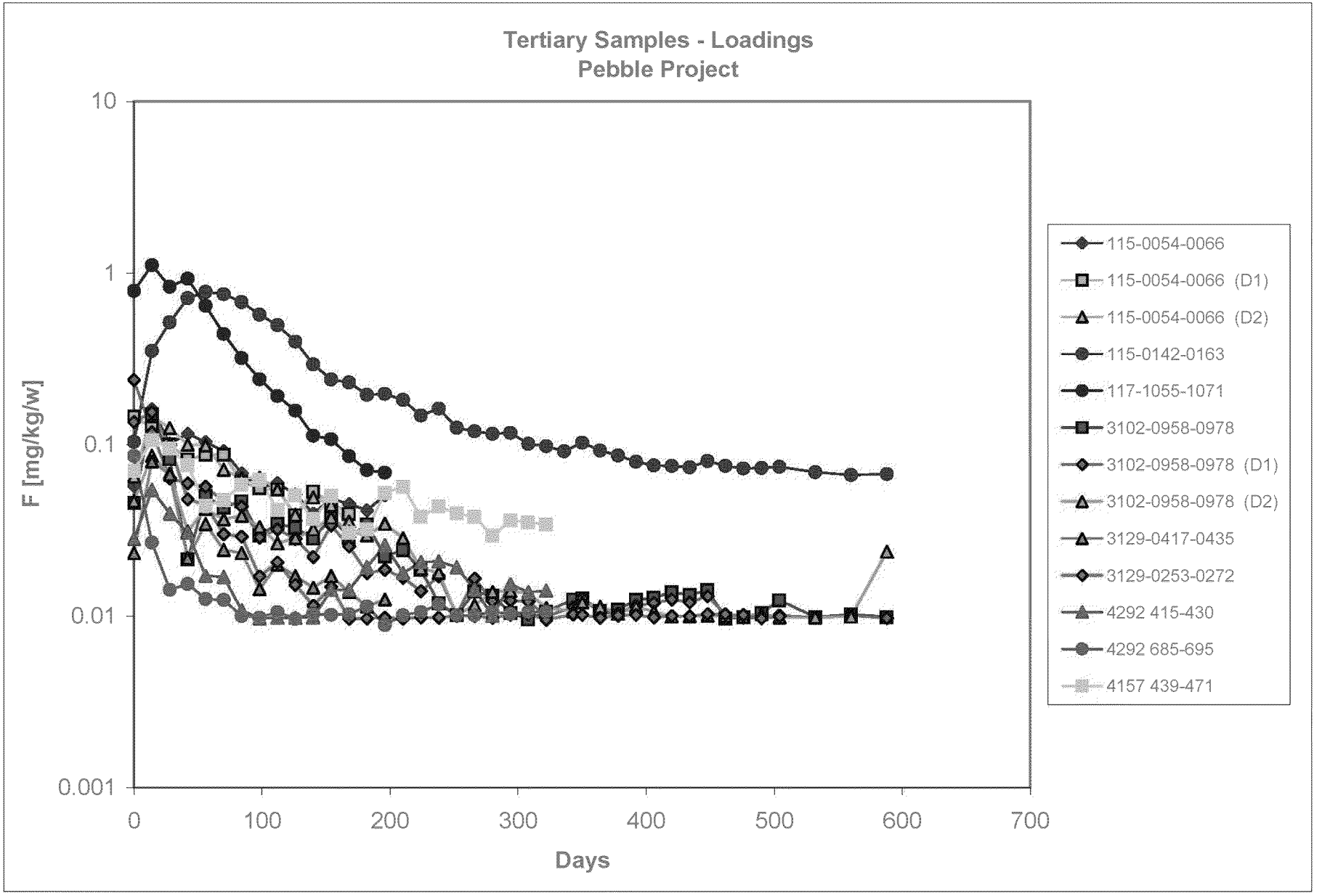

Tertiary Samples - Loadings
Pebble Project
Acidity [mgCaCO3/kg/w] pH=4.5
0.6
0.5
0.4
0.3
0.2
0.1
0
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

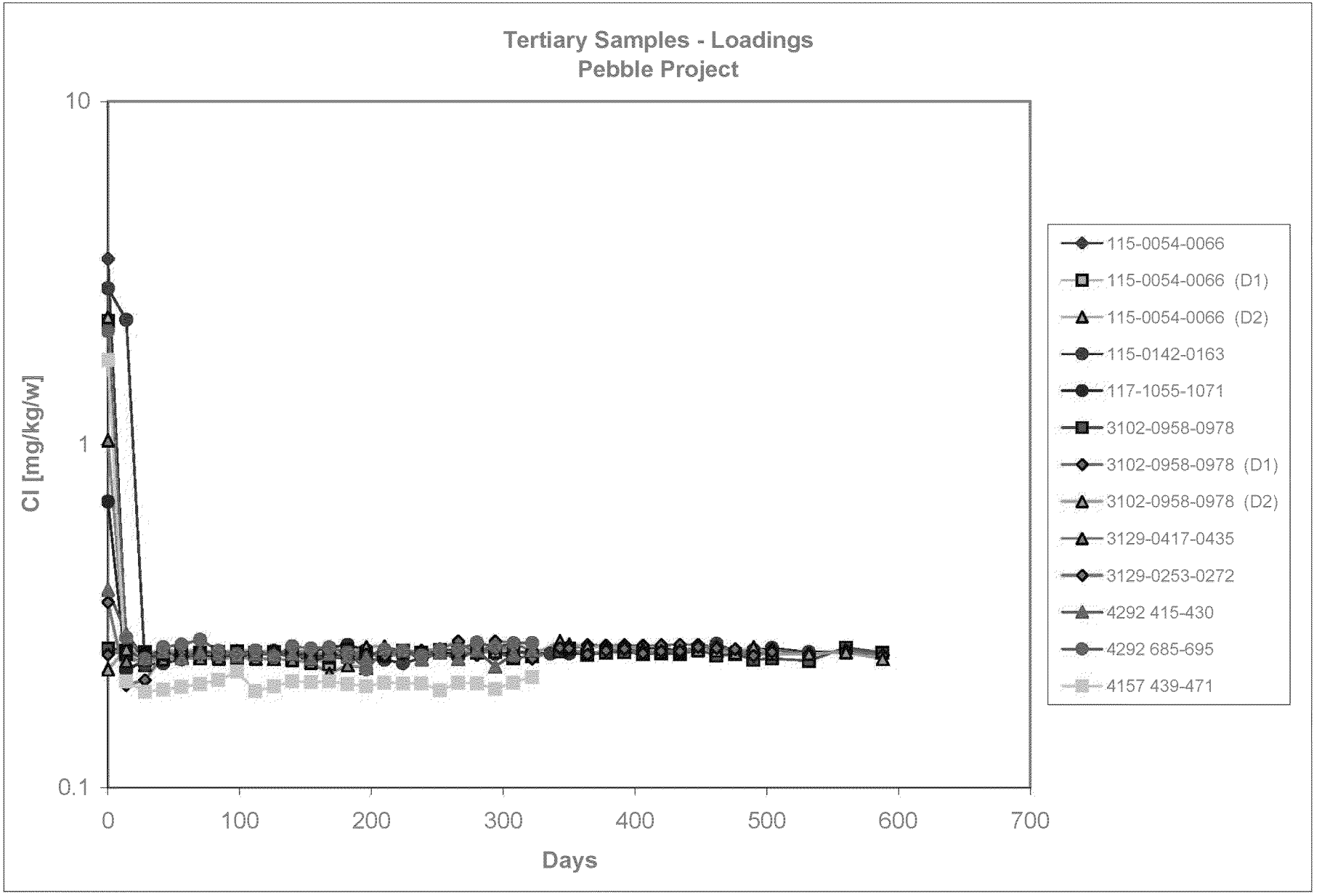

Tertiary Samples - Loadings
Pebble Project
Acidity [mgCaCO3/kg/w] pH=8.3
Days
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
0
100
200
300
400
500
600
700
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

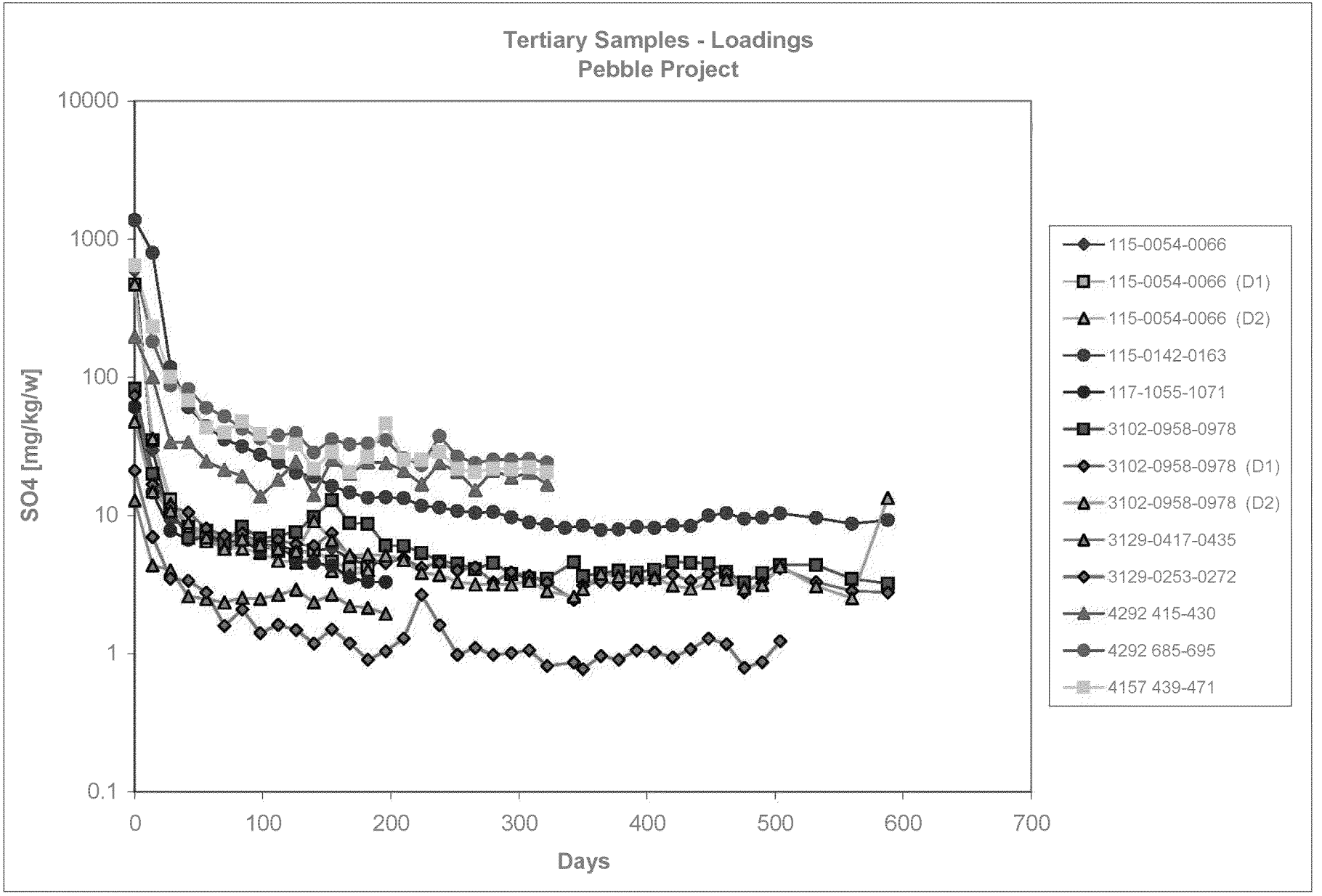

Tertiary Samples - Loadings
Pebble Project
Alkalinity [mgCaCO3/kg/w]
Days
0
20
40
60
80
100
120
140
0
100
200
300
400
500
600
700
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

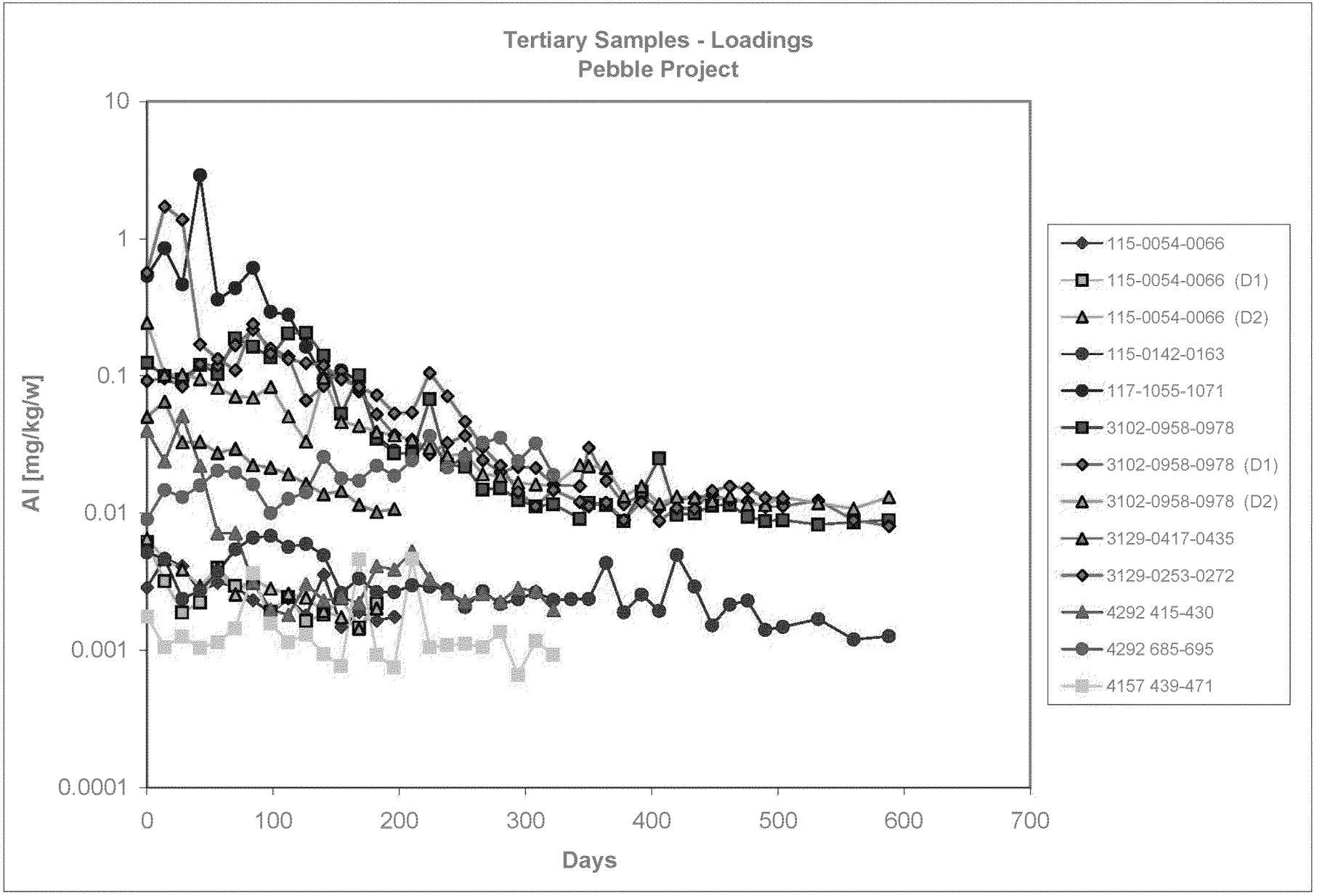

Tertiary Samples - Loadings
Pebble Project
Total Dissolved Solids [mg/kg/w]
10000
1000
100
10
1
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

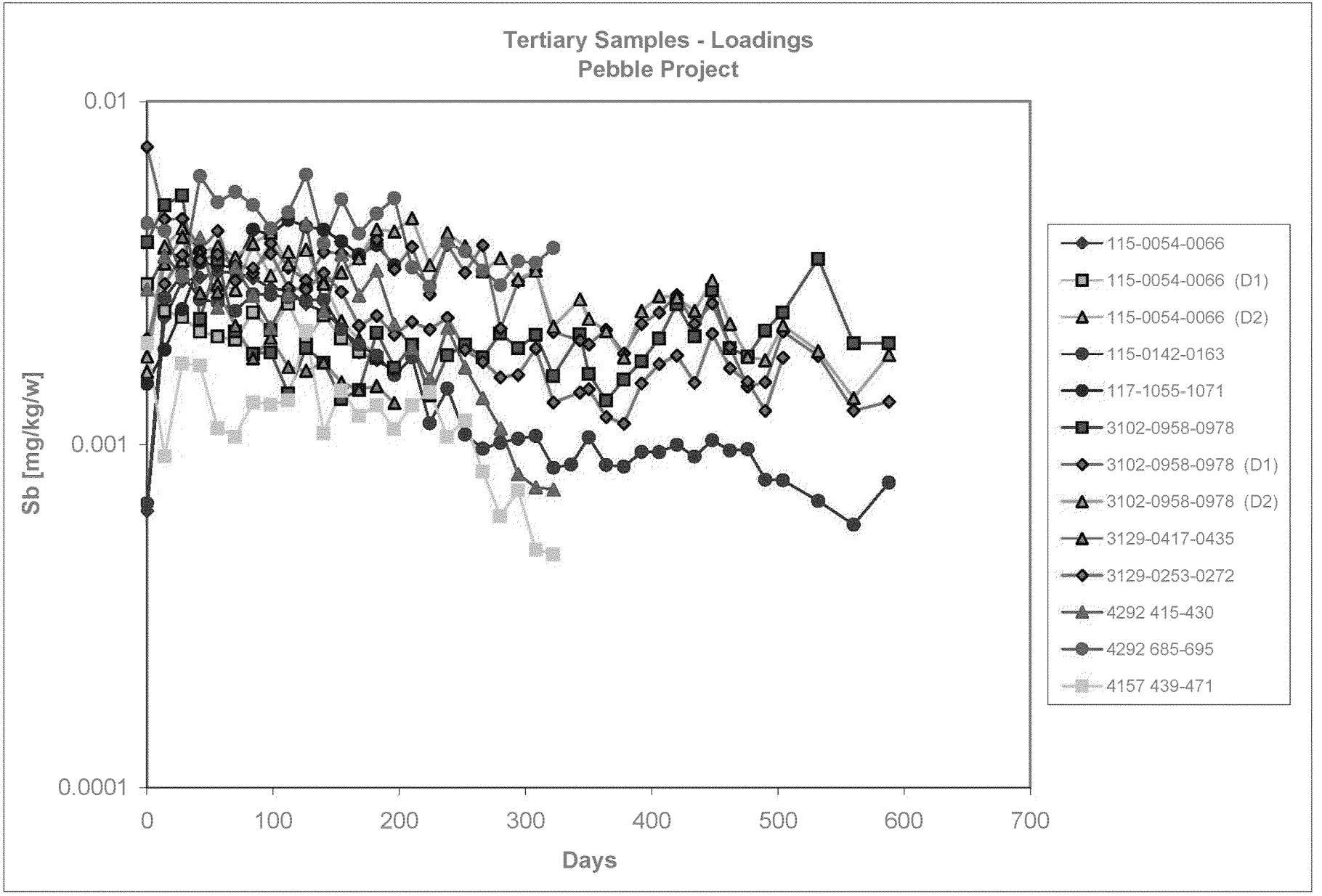

Tertiary Samples - Loadings
Pebble Project
Hardness [mgCaCO3/kg/w]
1000
100
10
1
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

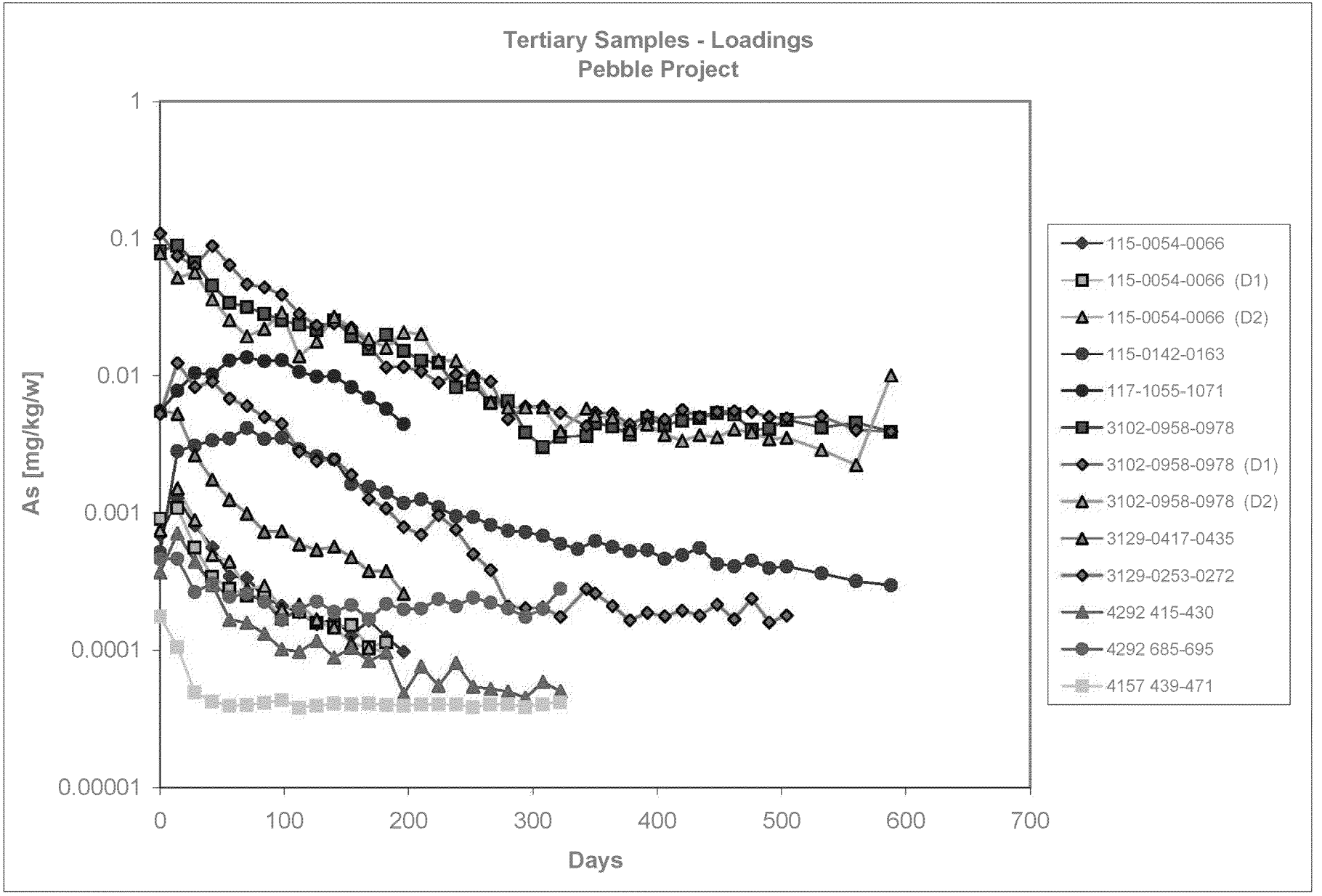

Tertiary Samples - Loadings
Pebble Project
F [mg/kg/w]
10
1
0.1
0.01
0.001
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

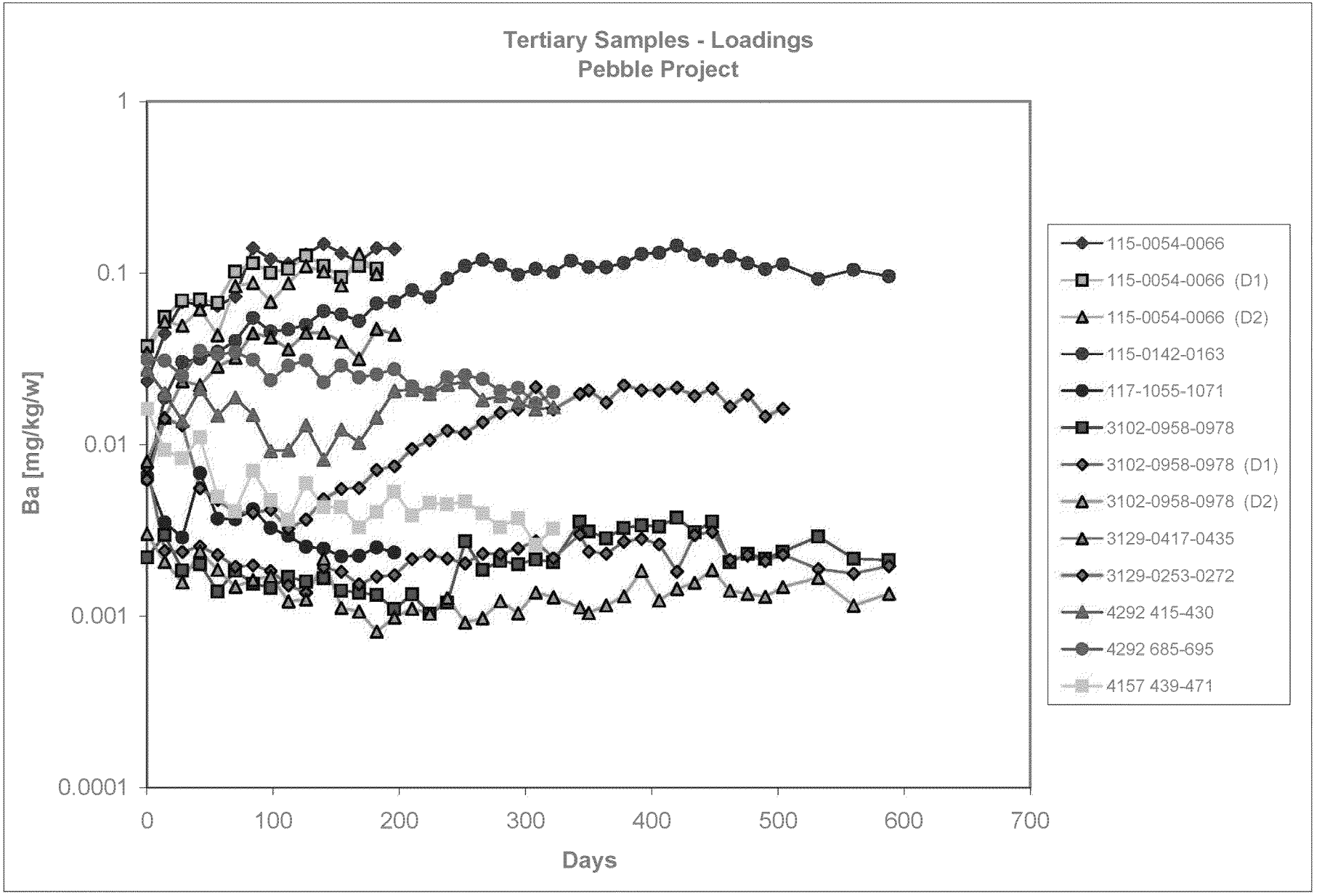

Tertiary Samples - Loadings
Pebble Project
Cl [mg/kg/w]
10
1
0.1
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

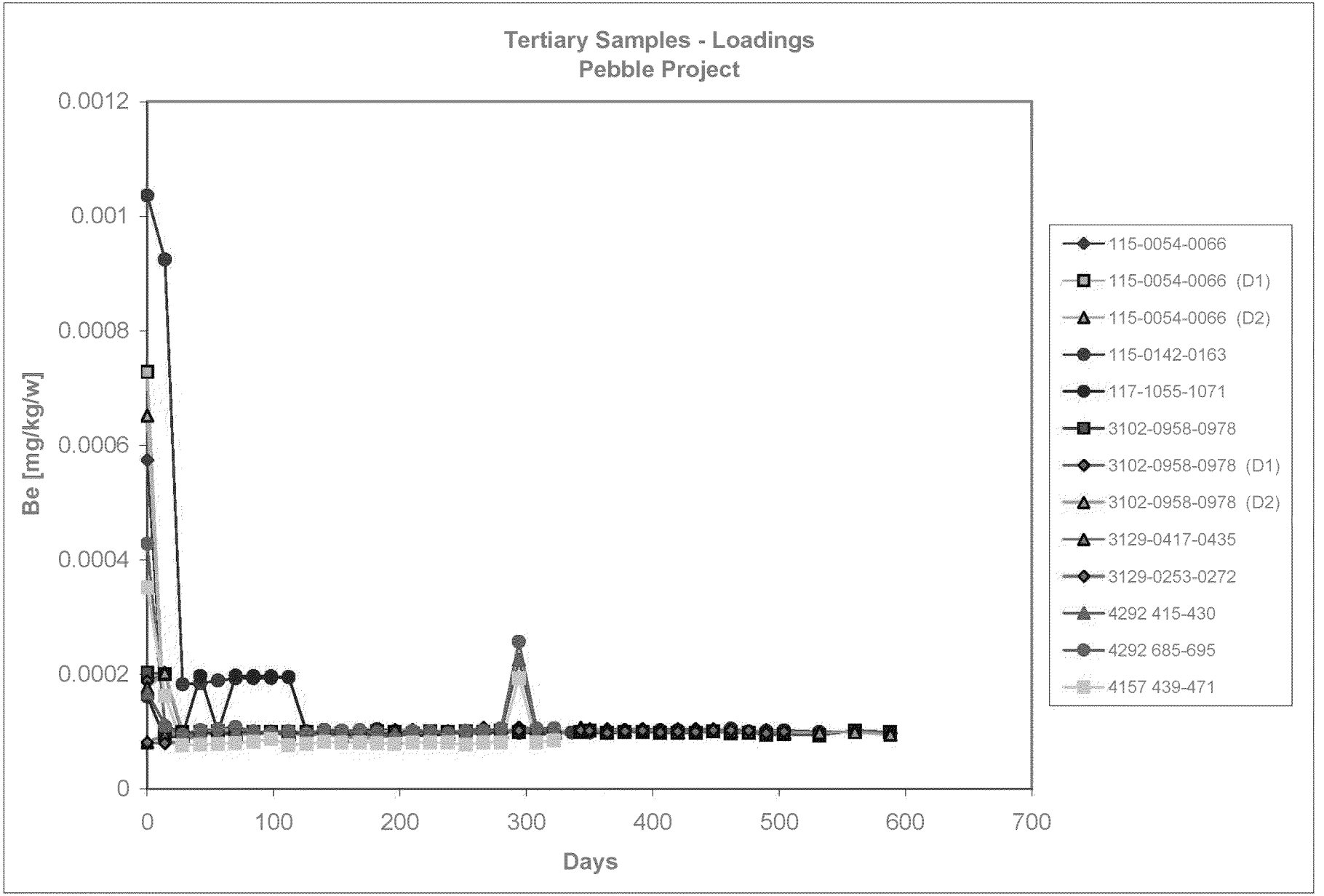

Tertiary Samples - Loadings
Pebble Project
SO4 [mg/kg/w]
10000
1000
100
10
1
0.1
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

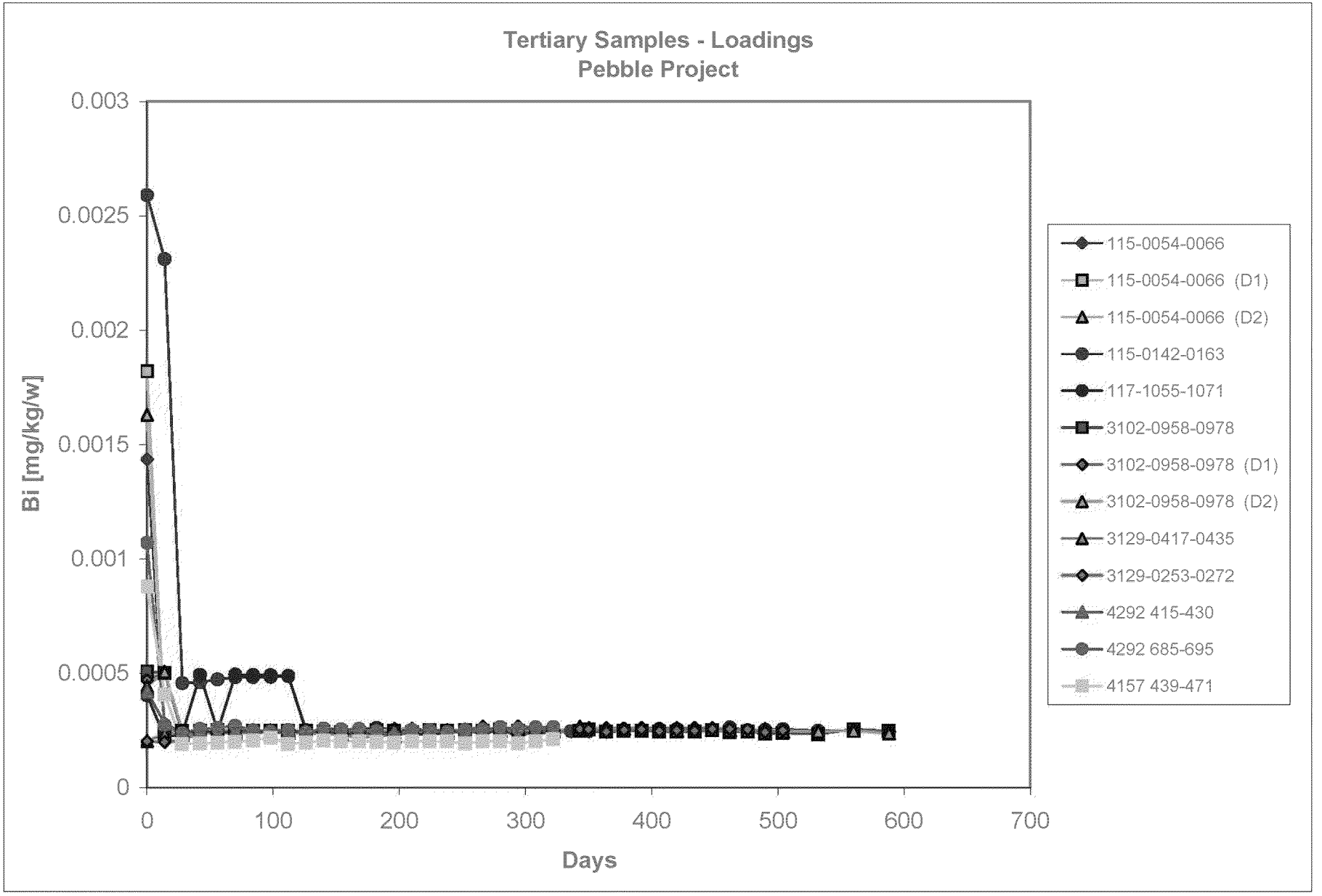

Tertiary Samples - Loadings
Pebble Project
Al [mg/kg/w]
10
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

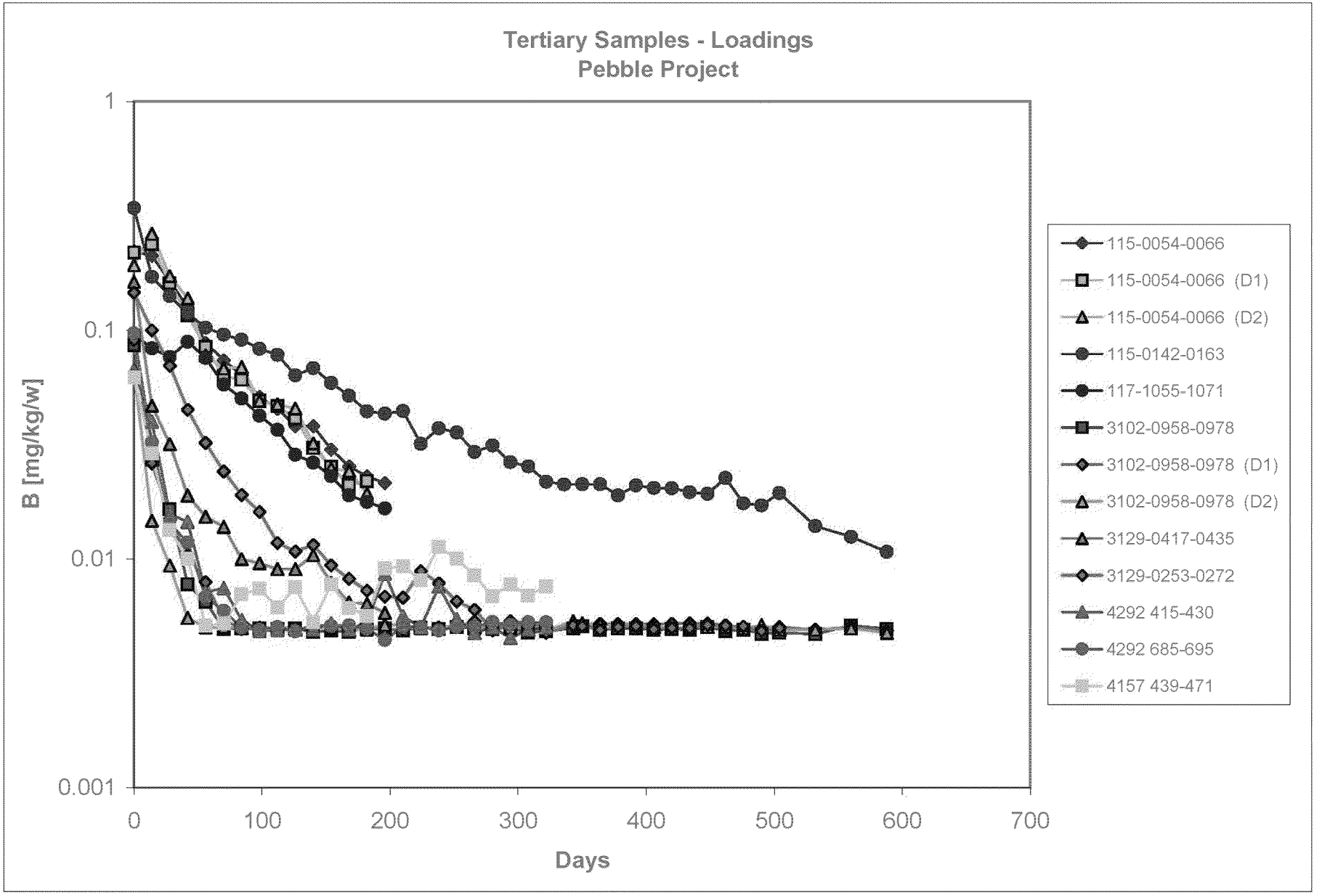

Tertiary Samples - Loadings
Pebble Project
Sb [mg/kg/w]
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

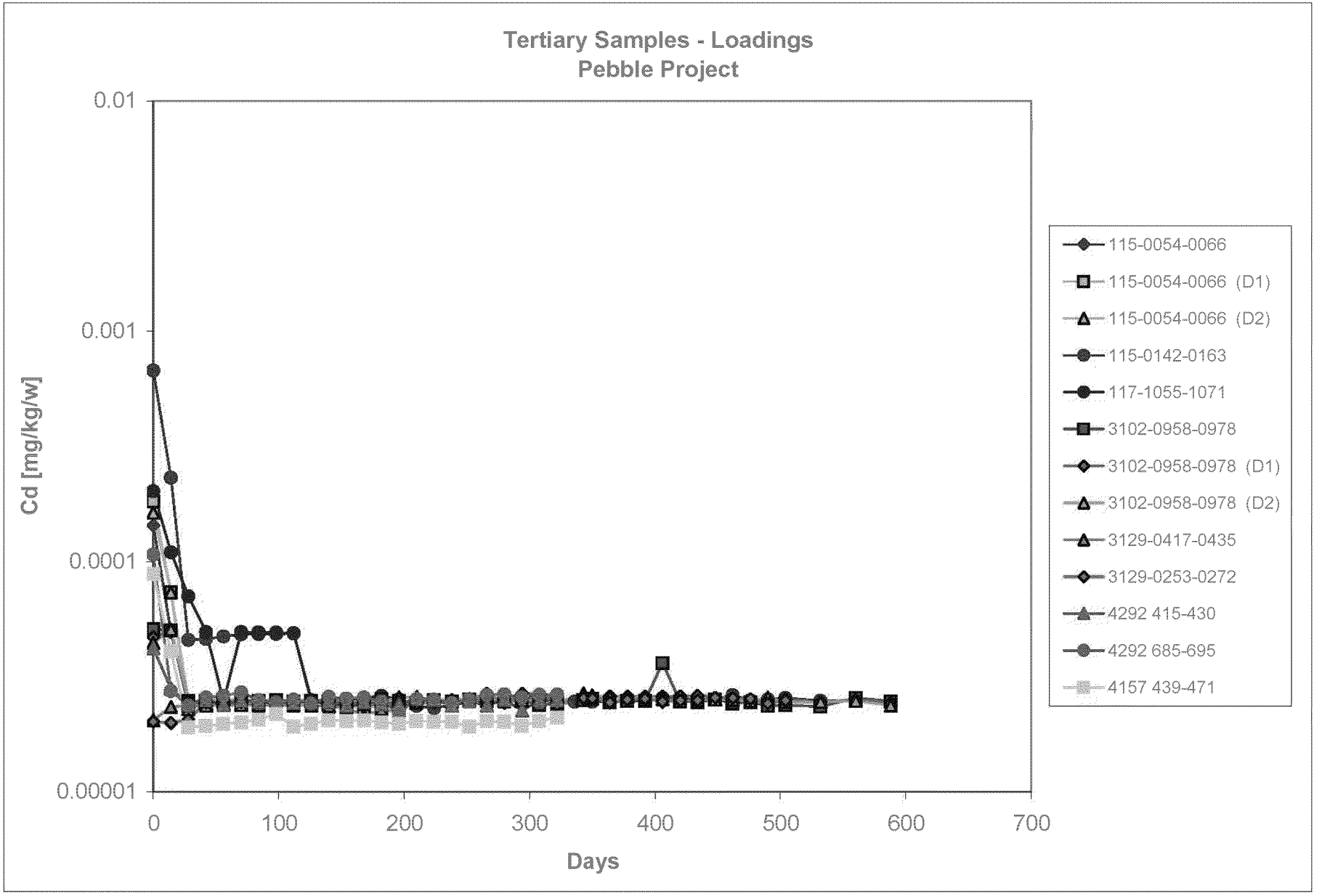

Tertiary Samples - Loadings
Pebble Project
As [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

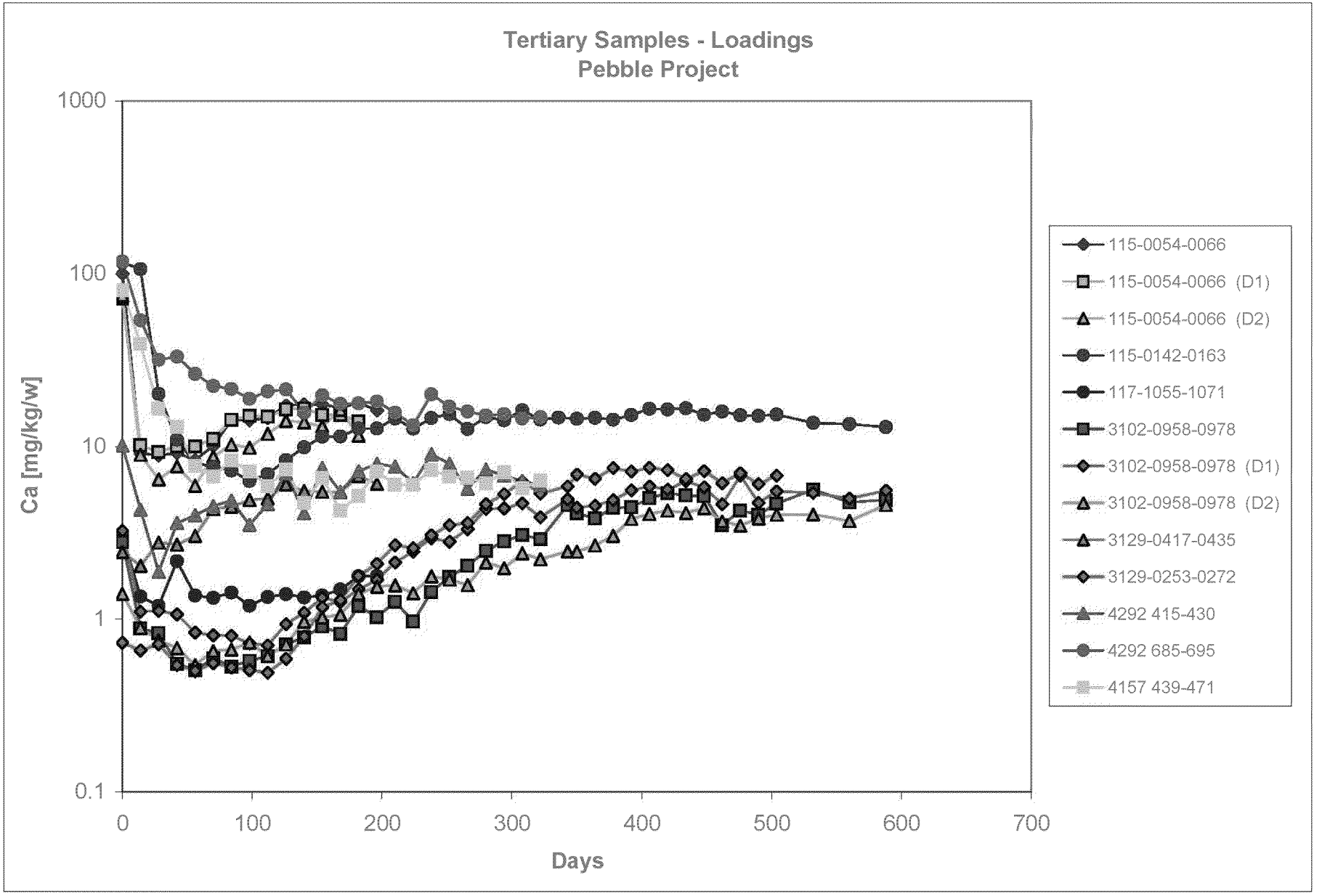

Tertiary Samples - Loadings
Pebble Project
Ba [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

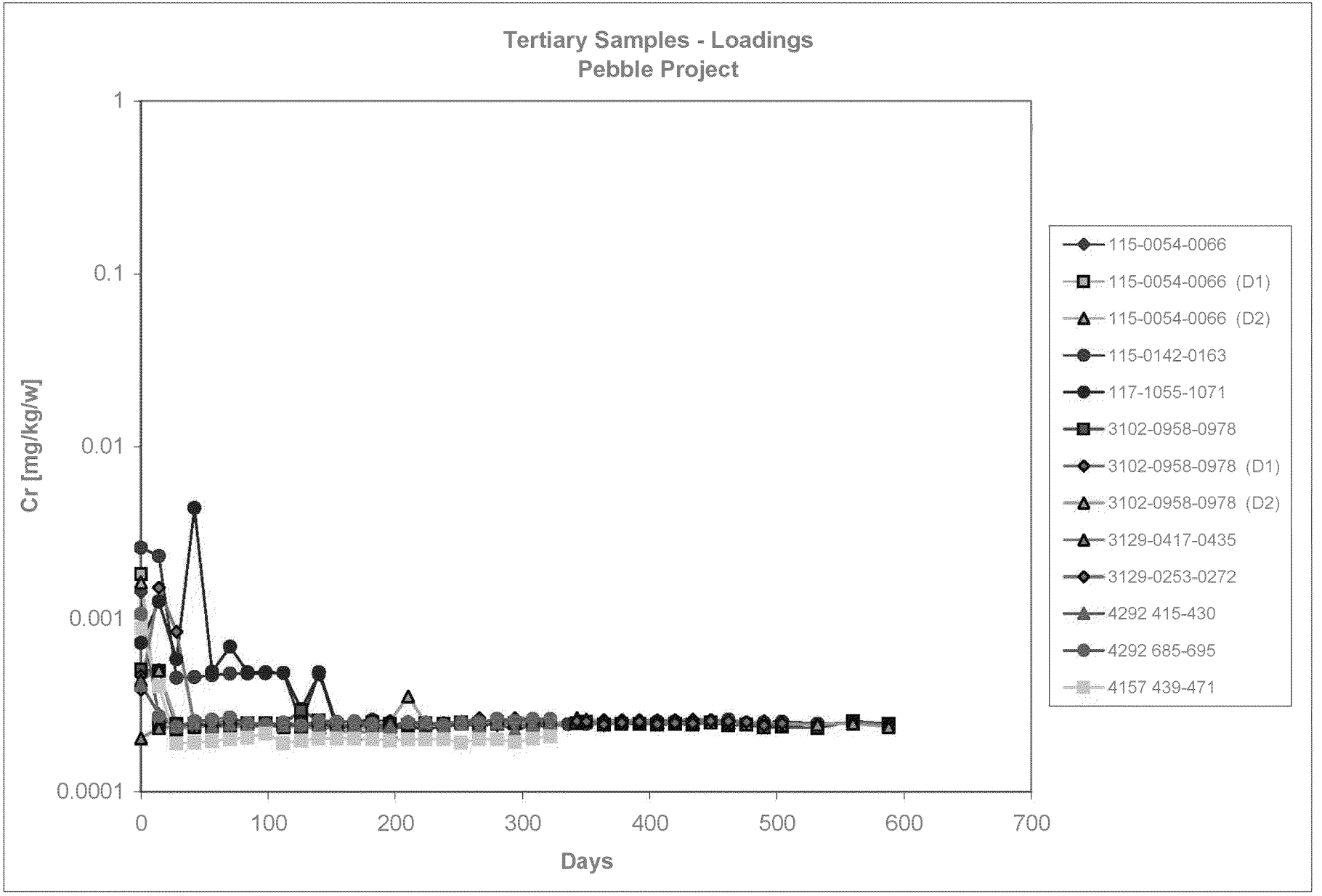

Tertiary Samples - Loadings
Pebble Project
Be [mg/kg/w]
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

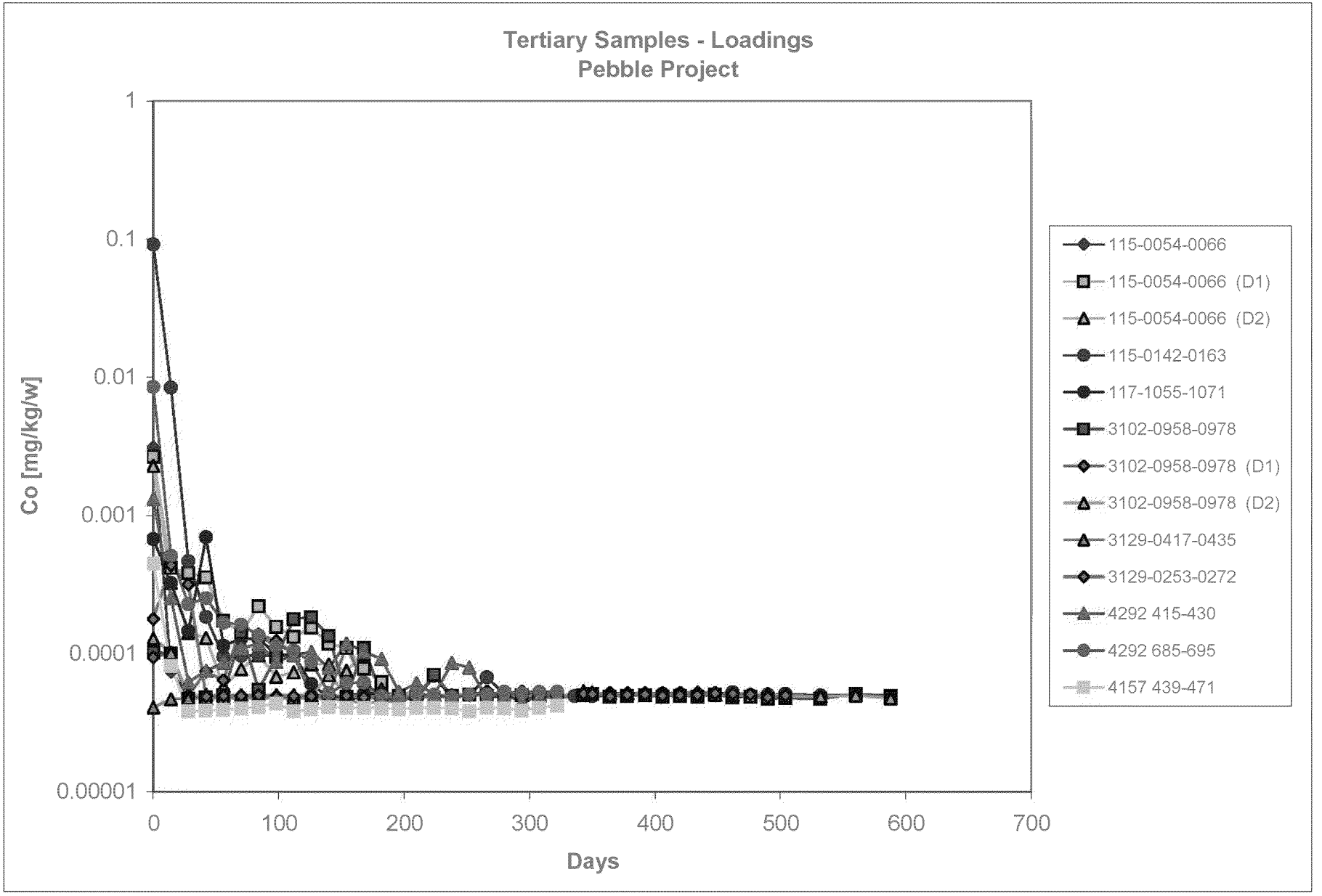

Tertiary Samples - Loadings
Pebble Project
Bi [mg/kg/w]
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

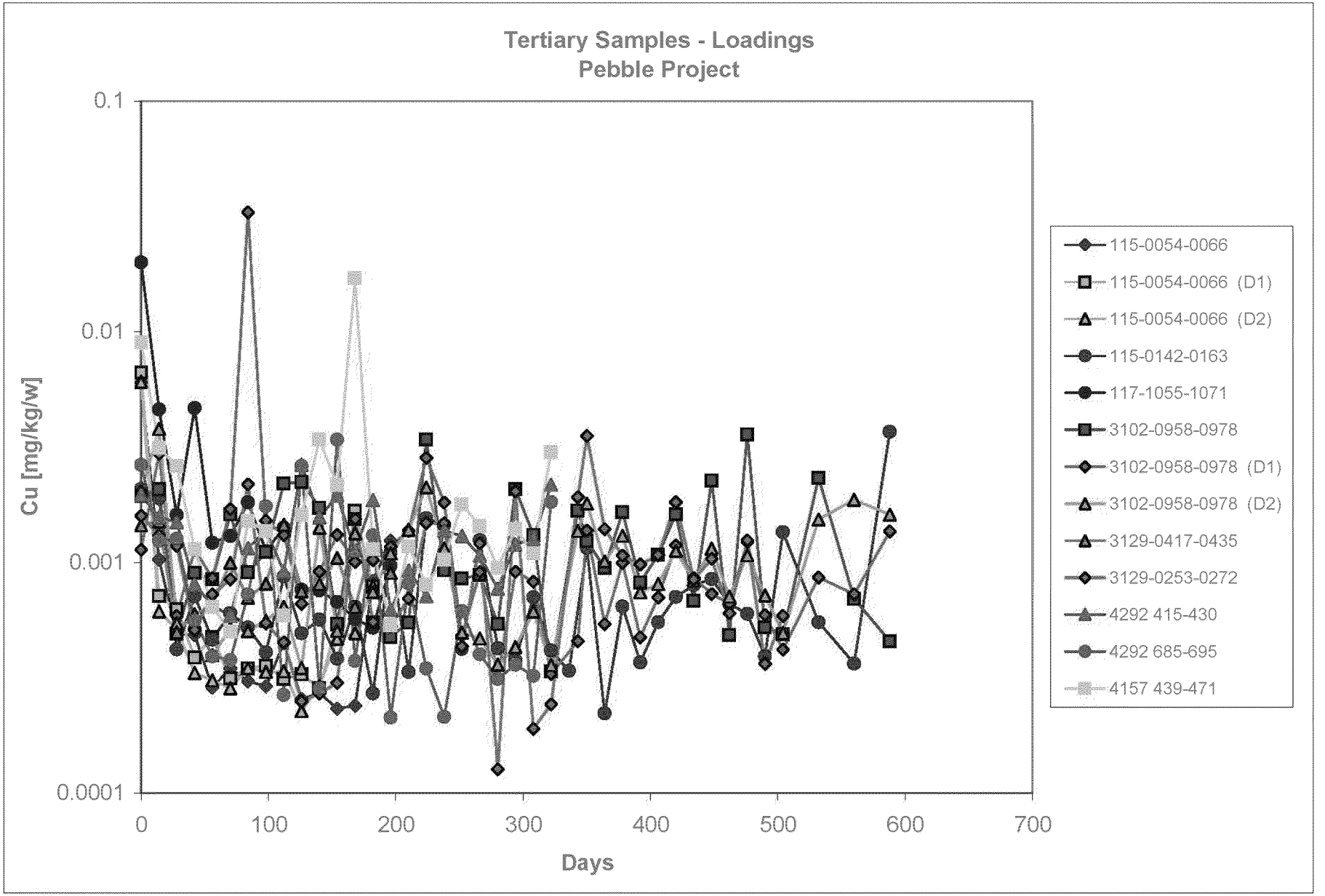

Tertiary Samples - Loadings
Pebble Project
B [mg/kg/w]
1
0.1
0.01
0.001
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

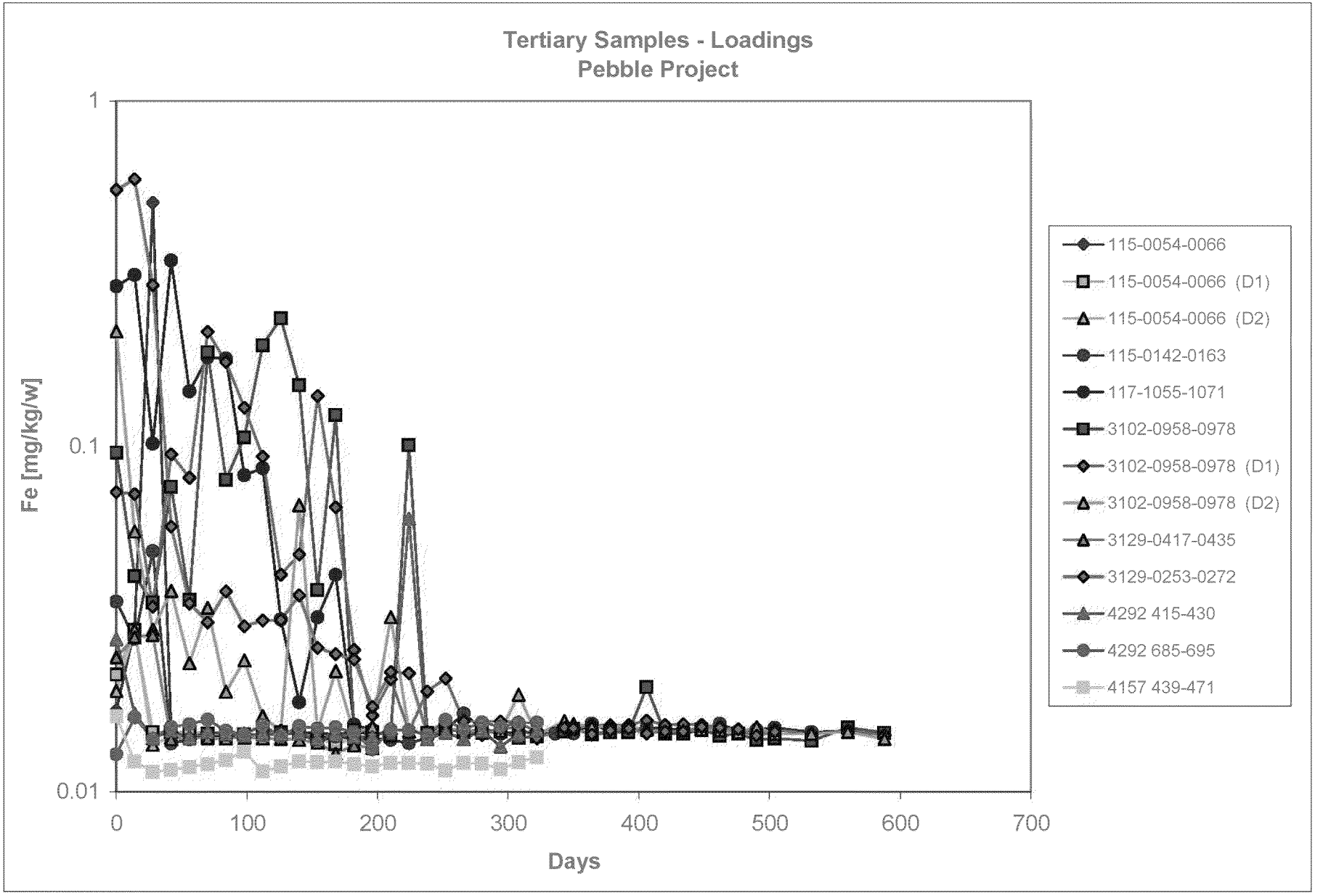

Tertiary Samples - Loadings
Pebble Project
Cd [mg/kg/w]
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

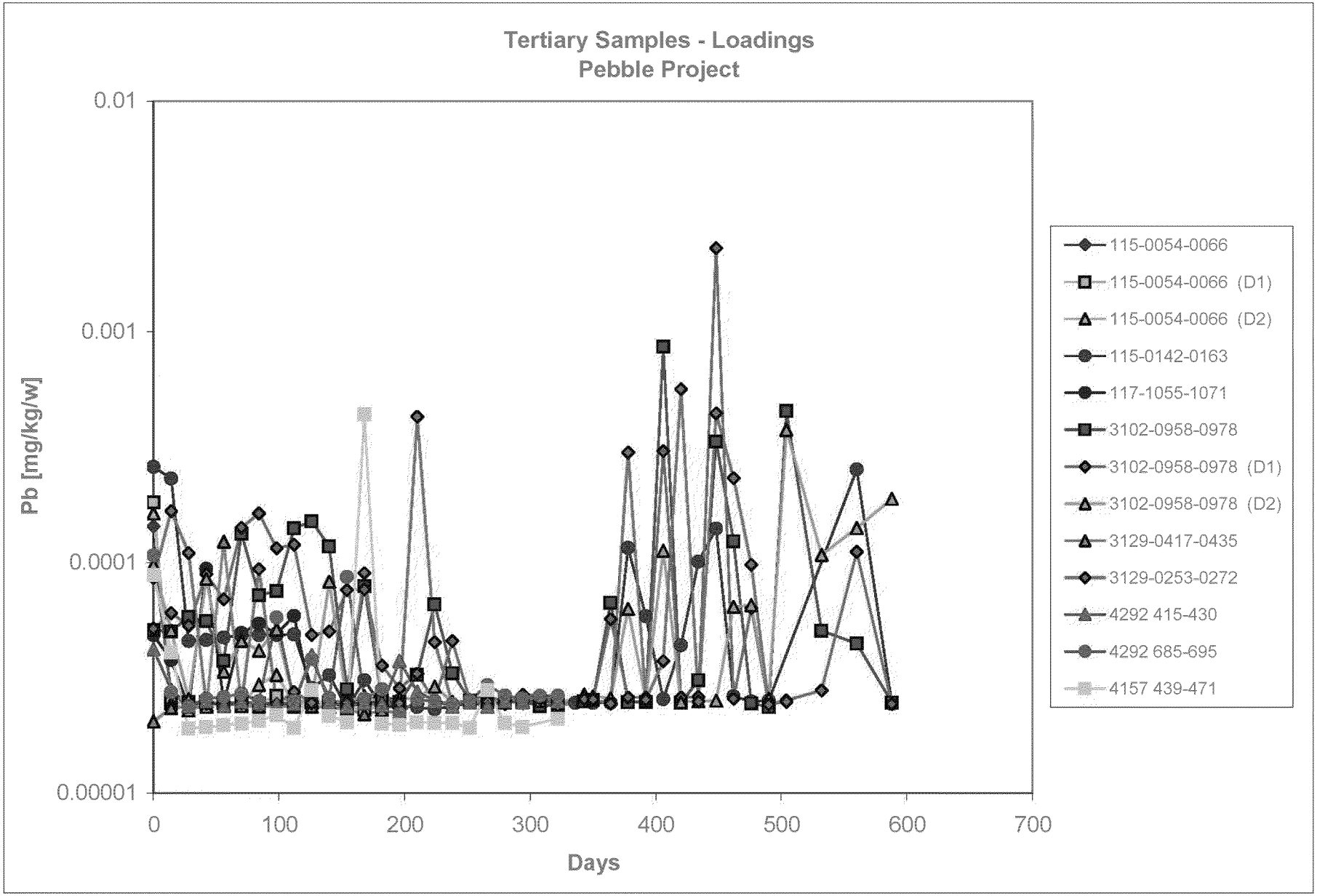

Tertiary Samples - Loadings
Pebble Project
Ca [mg/kg/w]
1000
100
10
1
0.1
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

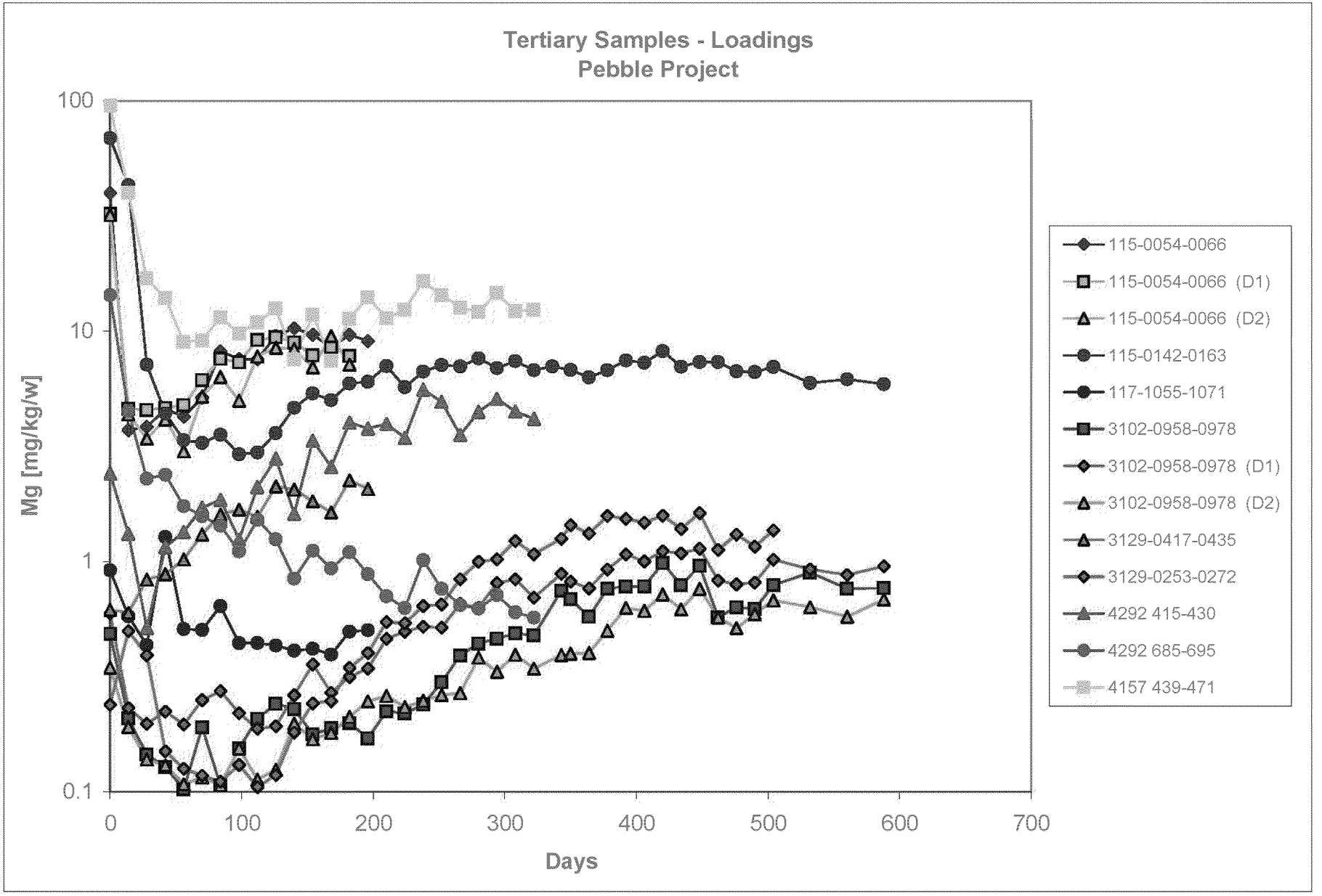

Tertiary Samples - Loadings
Pebble Project
Cr [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

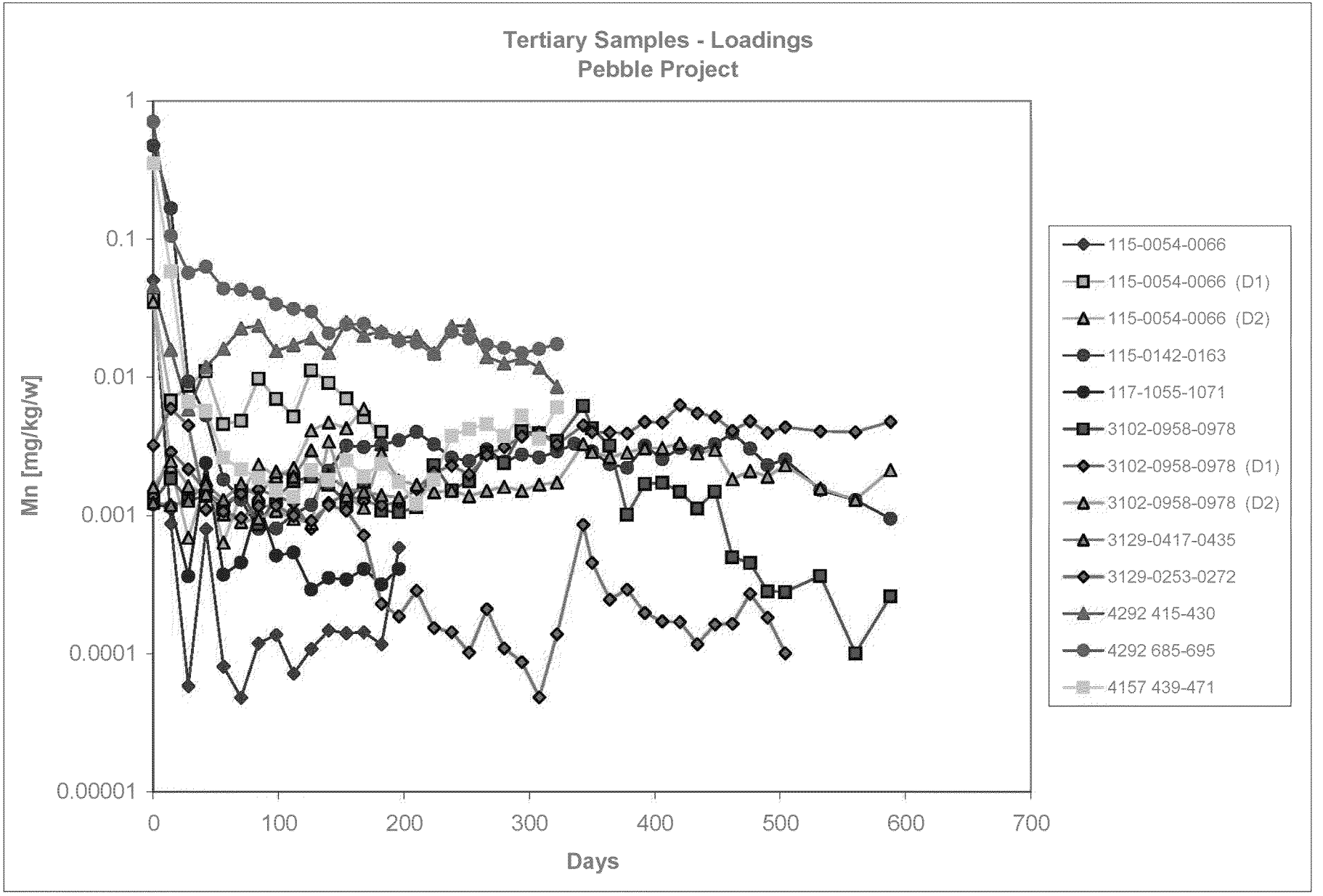

Tertiary Samples - Loadings
Pebble Project
Co [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

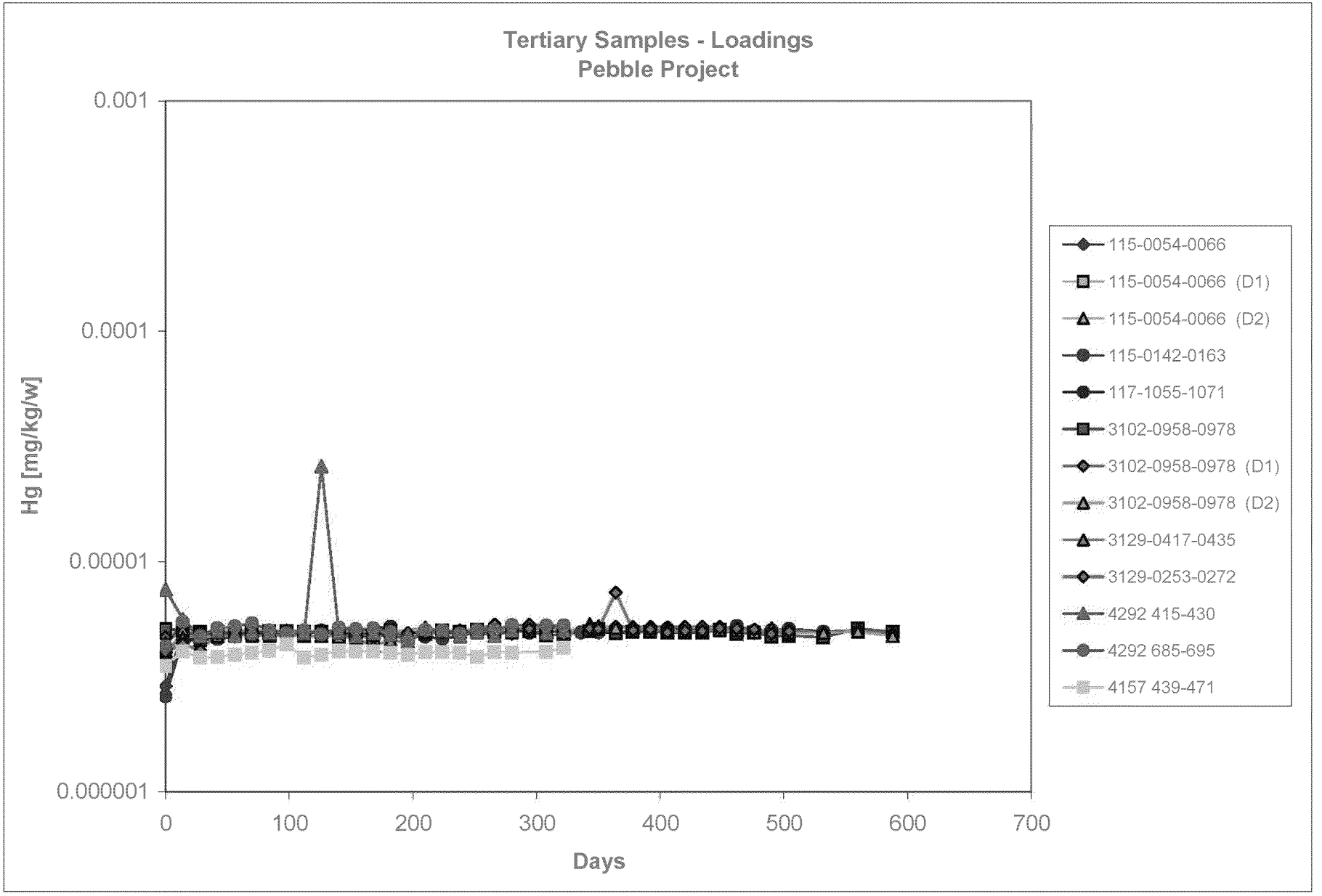

Tertiary Samples - Loadings
Pebble Project
Cu [mg/kg/w]
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

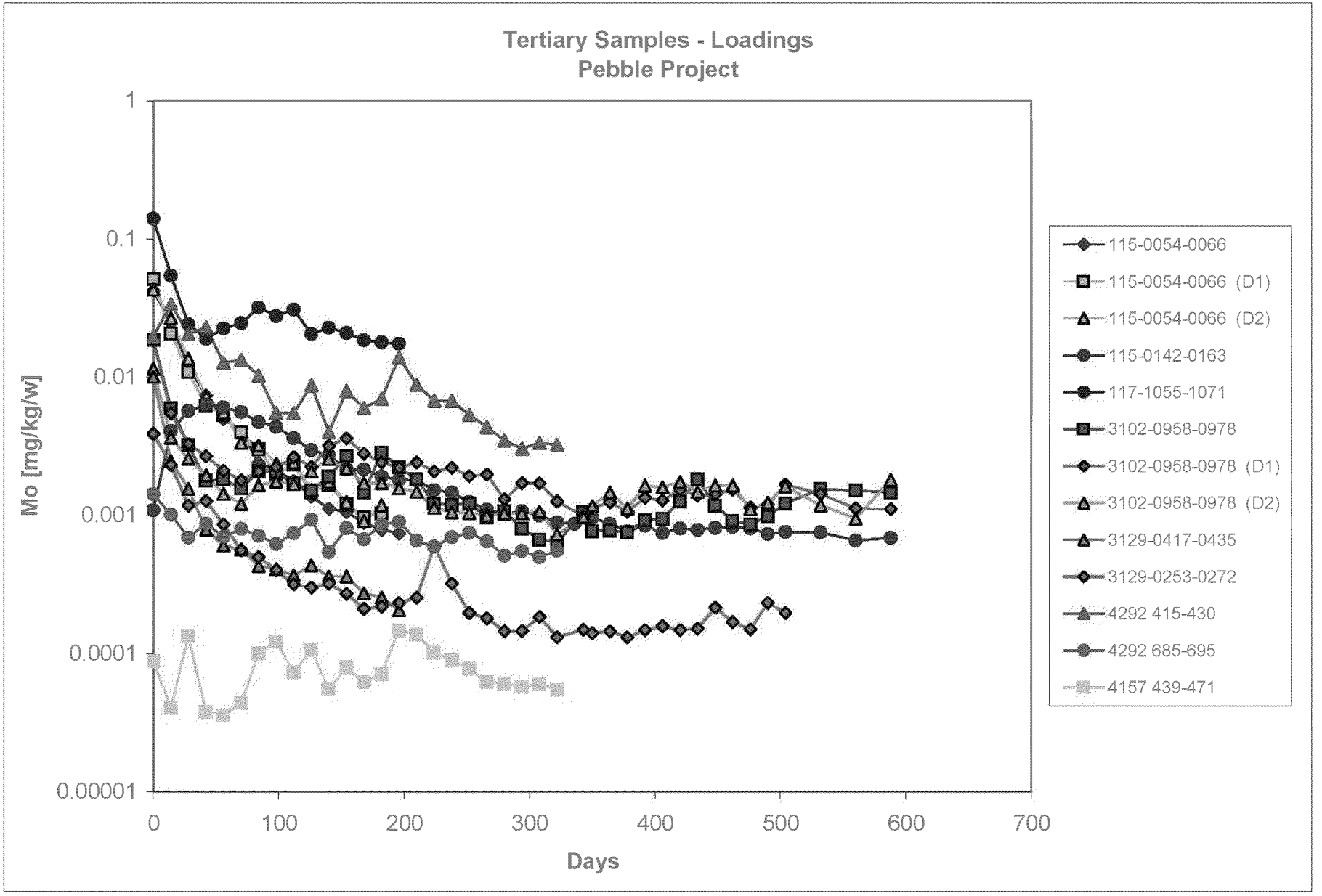

Tertiary Samples - Loadings
Pebble Project
Fe [mg/kg/w]
1
0.1
0.01
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

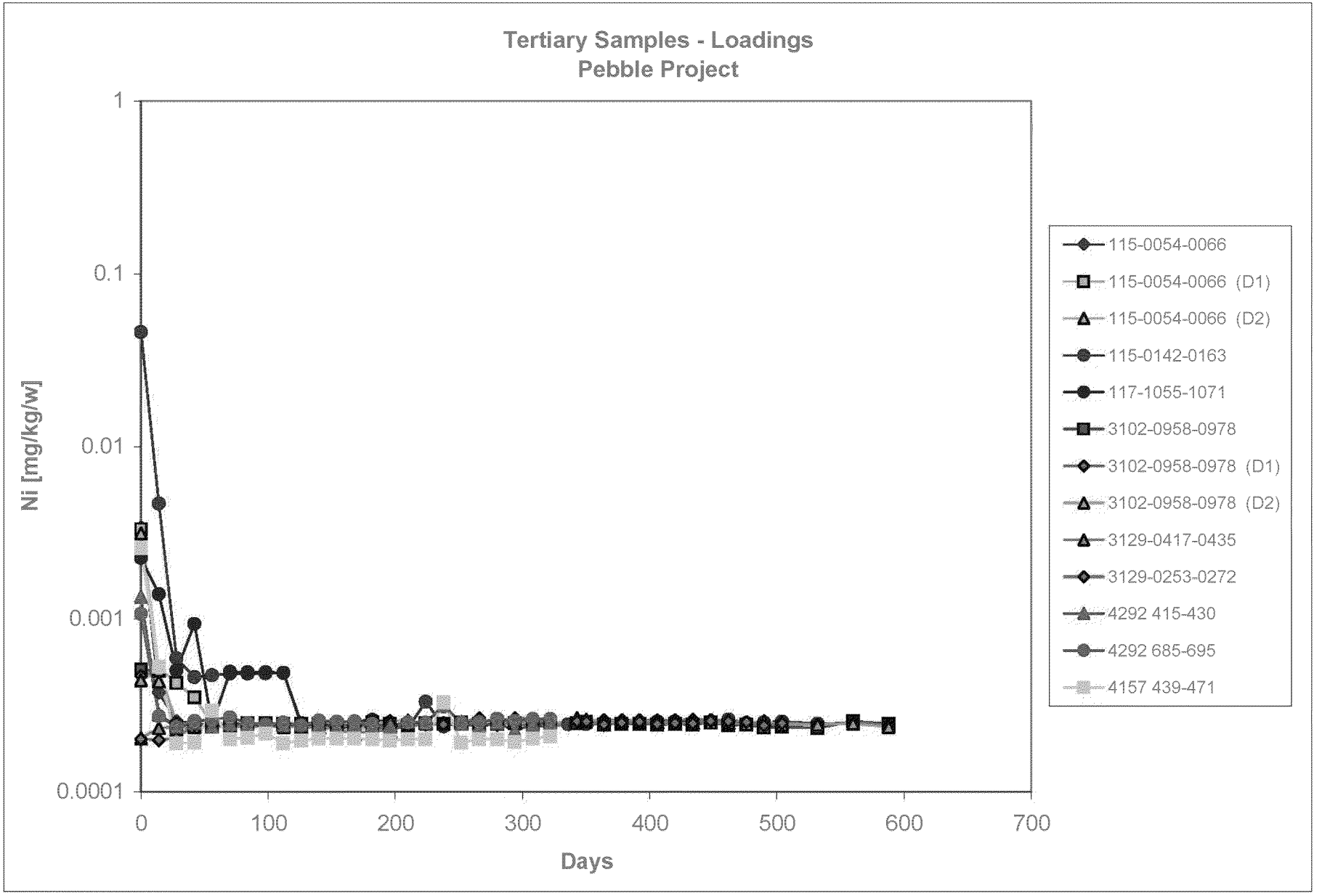

Tertiary Samples - Loadings
Pebble Project
Pb [mg/kg/w]
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

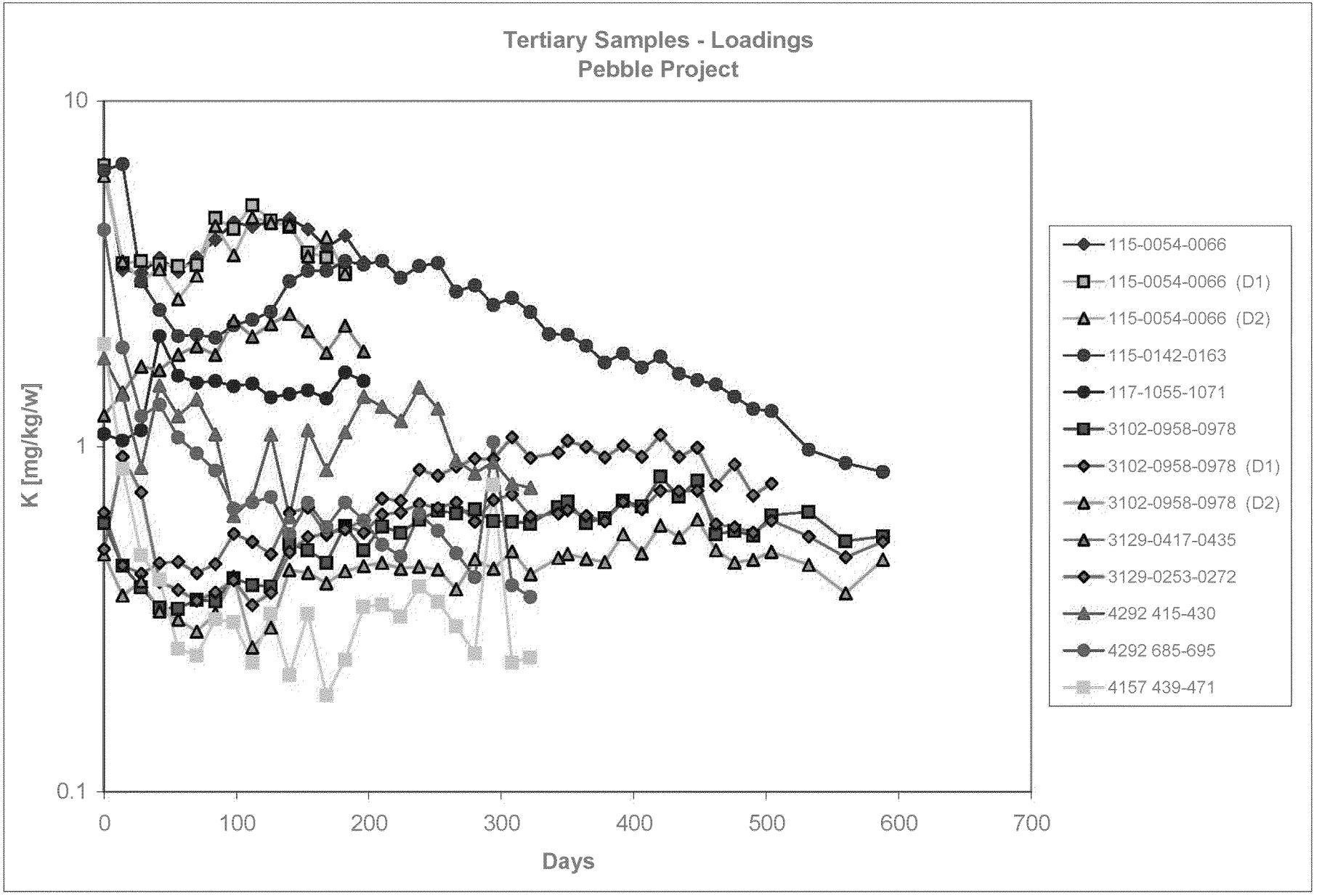

Tertiary Samples - Loadings
Pebble Project
Mg [mg/kg/w]
100
10
1
0.1
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

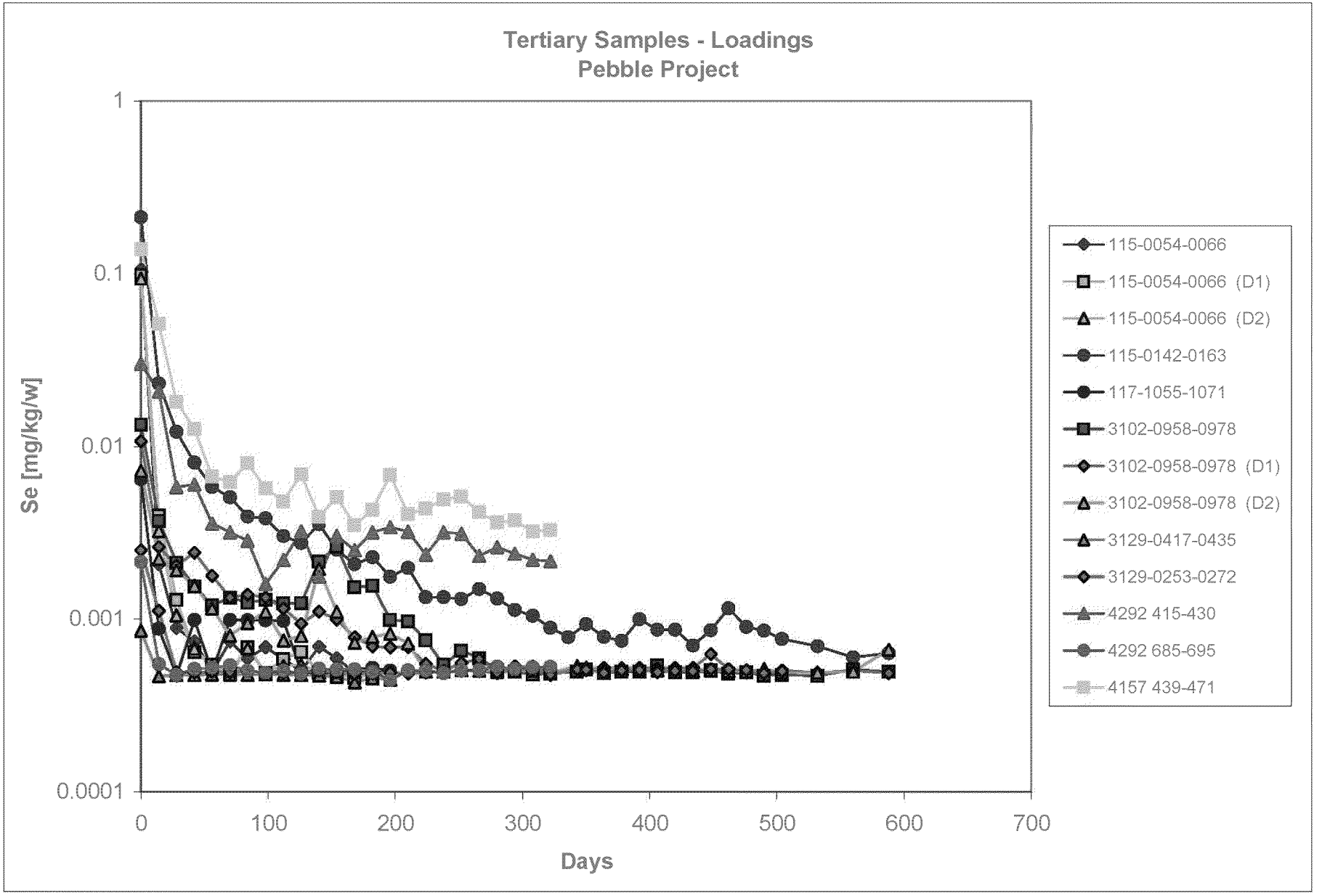

Tertiary Samples - Loadings
Pebble Project
Mn [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

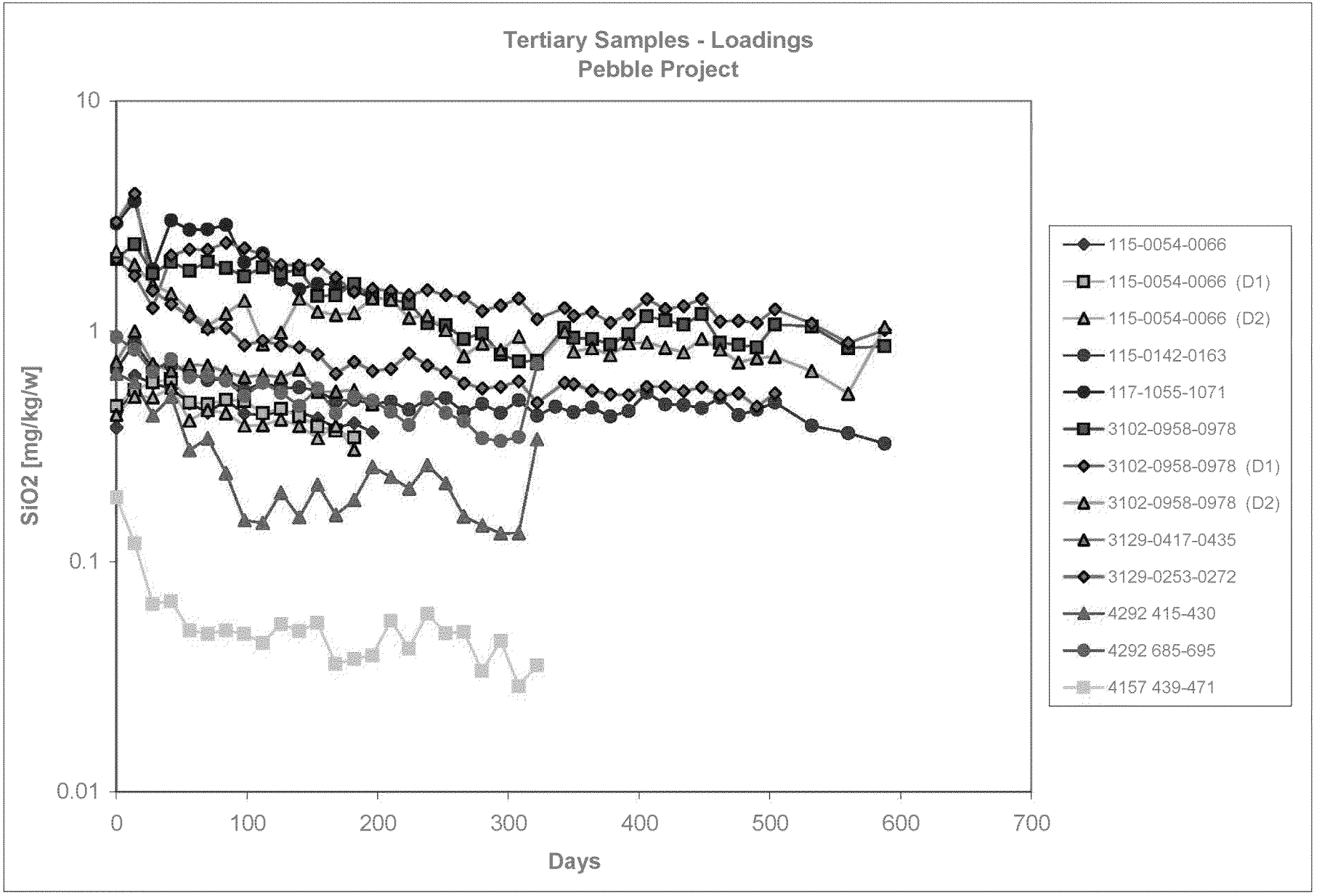

Tertiary Samples - Loadings
Pebble Project
Hg [mg/kg/w]
0.001
0.0001
0.00001
0.000001
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

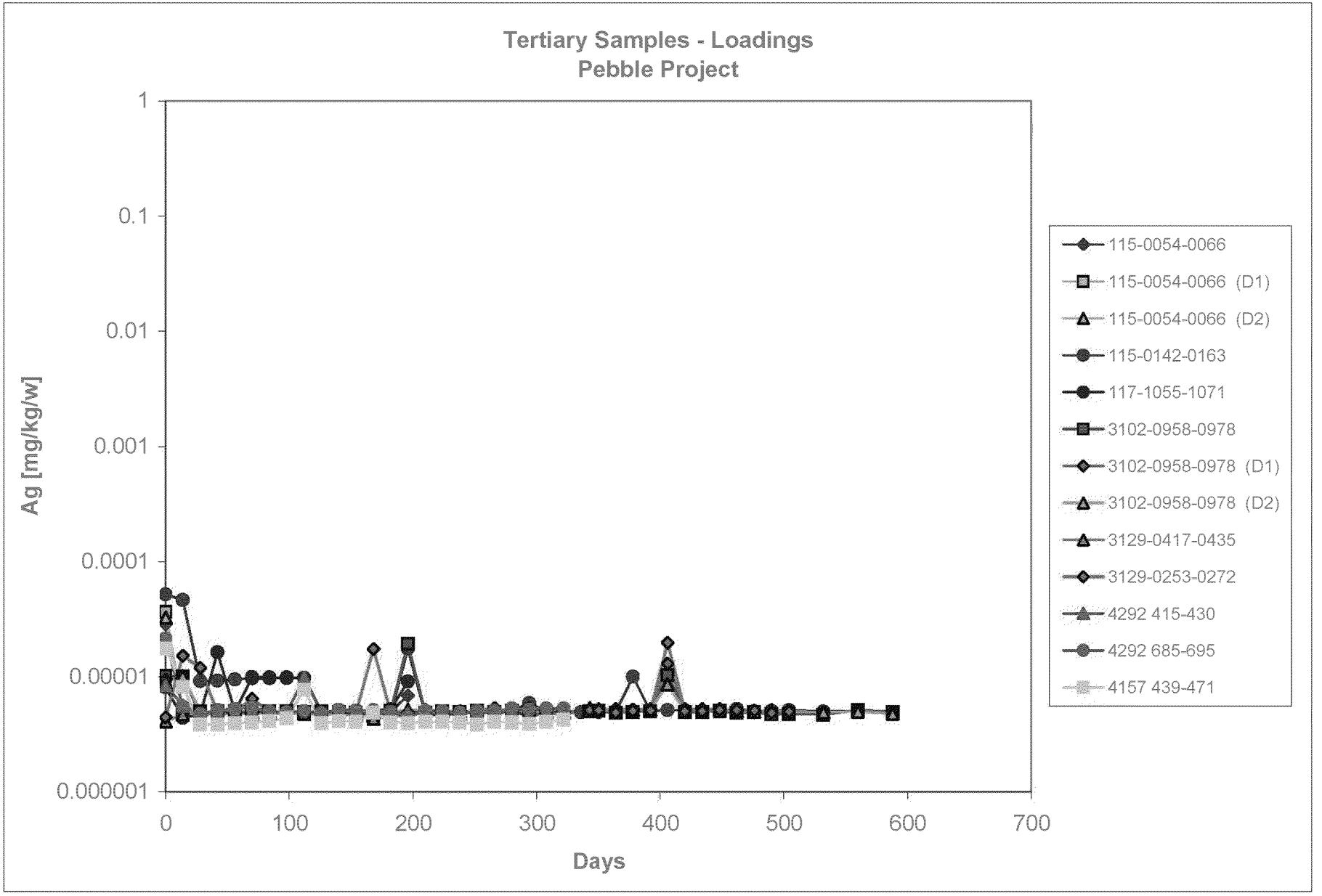

Tertiary Samples - Loadings
Pebble Project
Mo [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

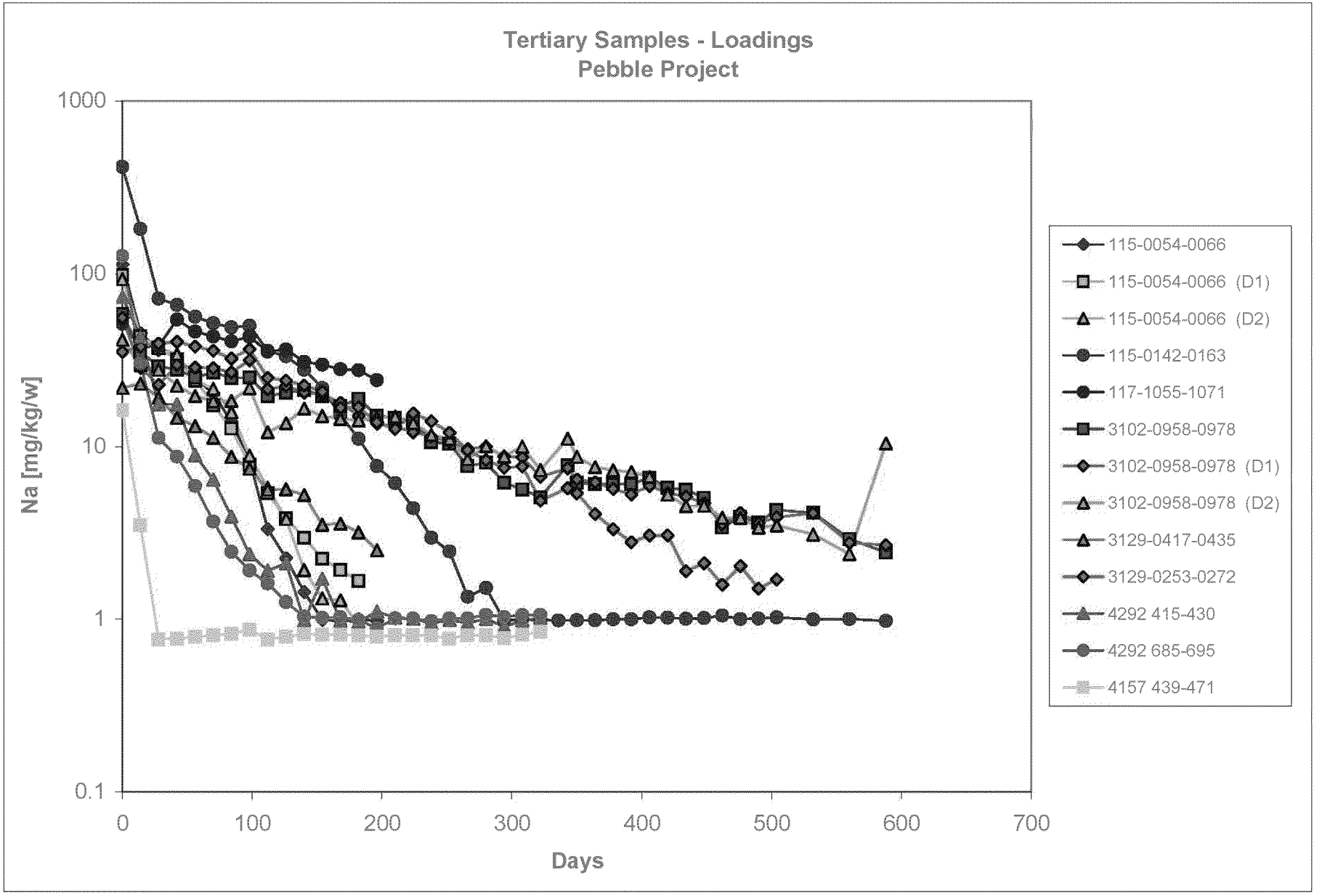

Tertiary Samples - Loadings
Pebble Project
Ni [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

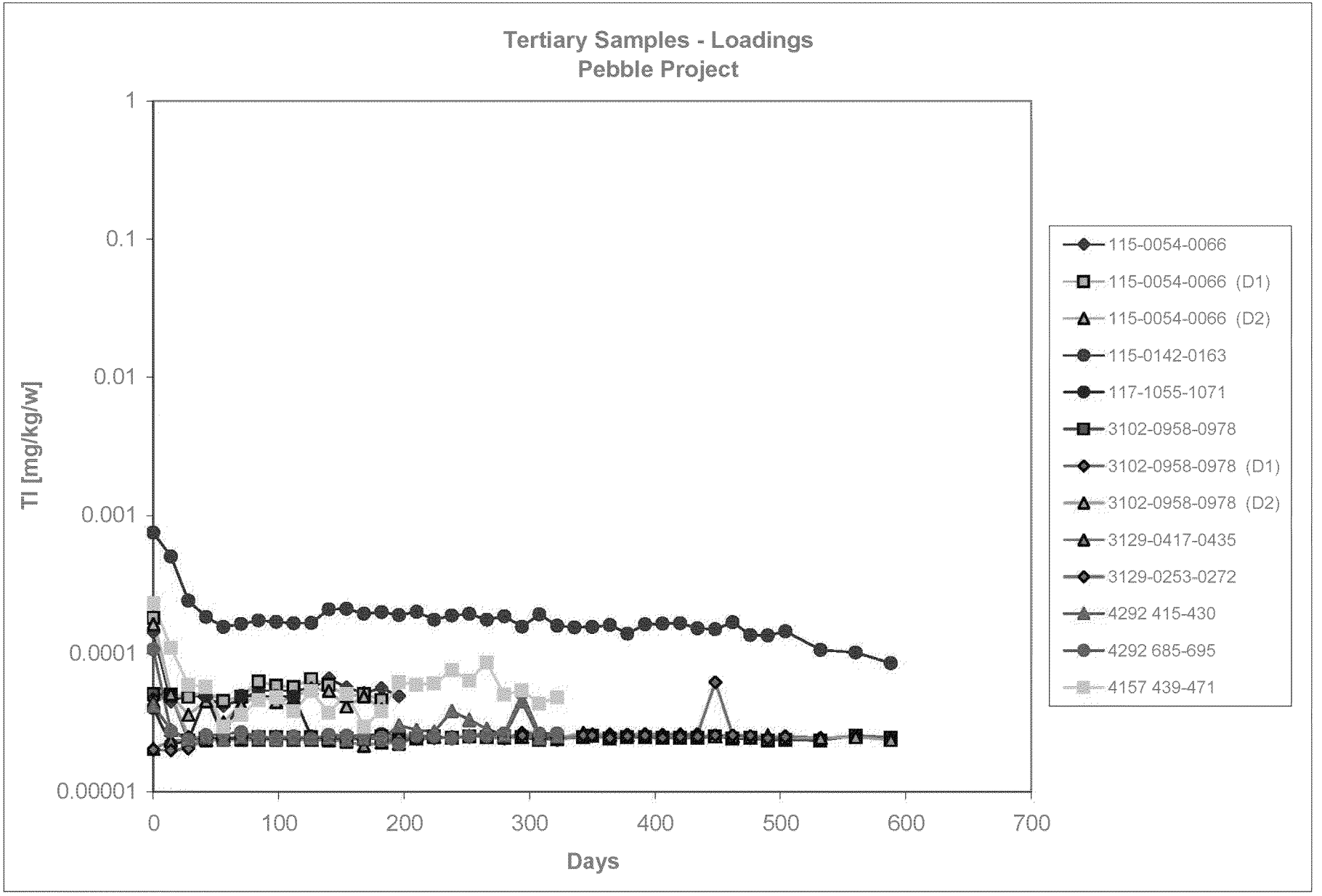

Tertiary Samples - Loadings
Pebble Project
K [mg/kg/w]
10
1
0.1
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

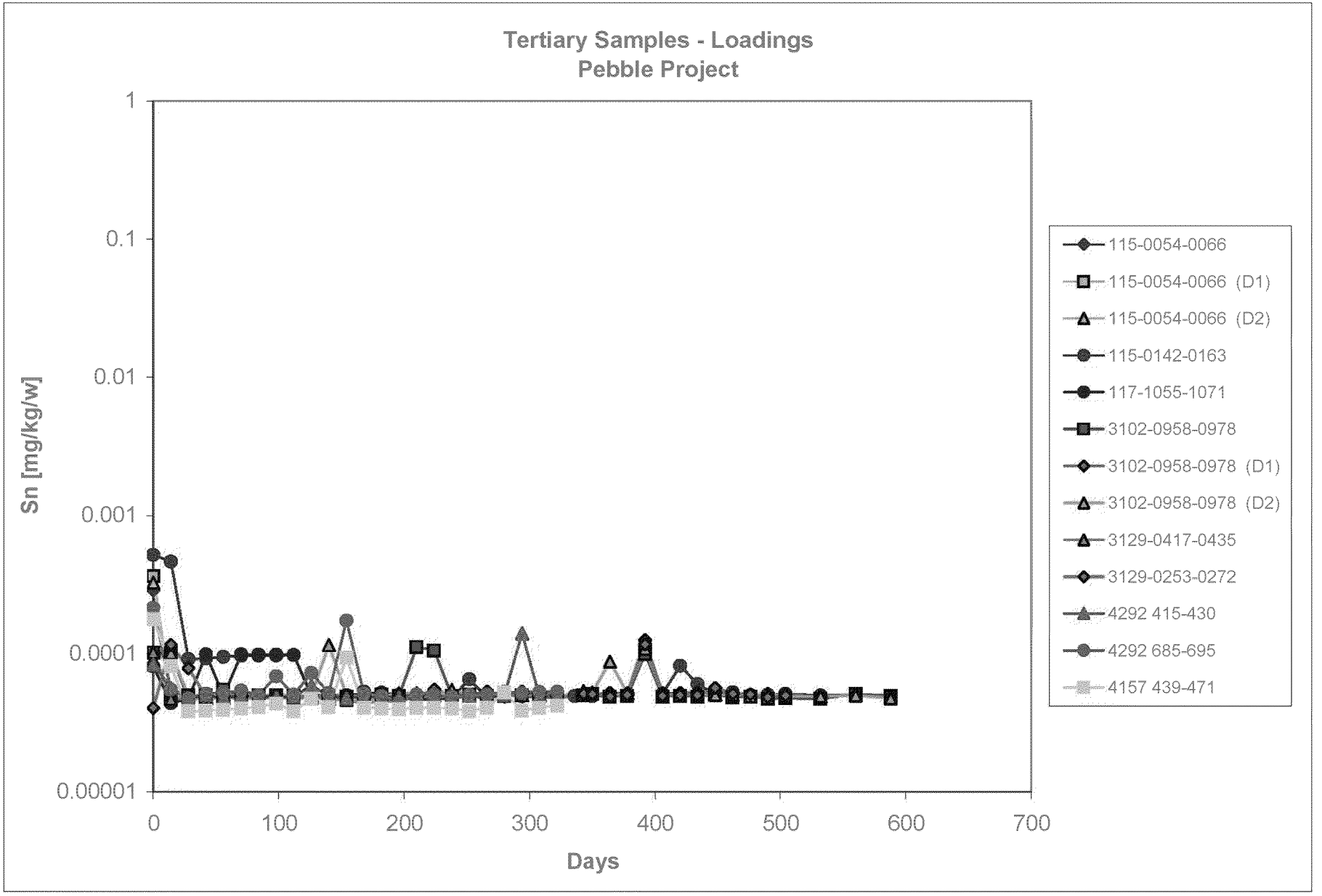

Tertiary Samples - Loadings
Pebble Project
Se [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

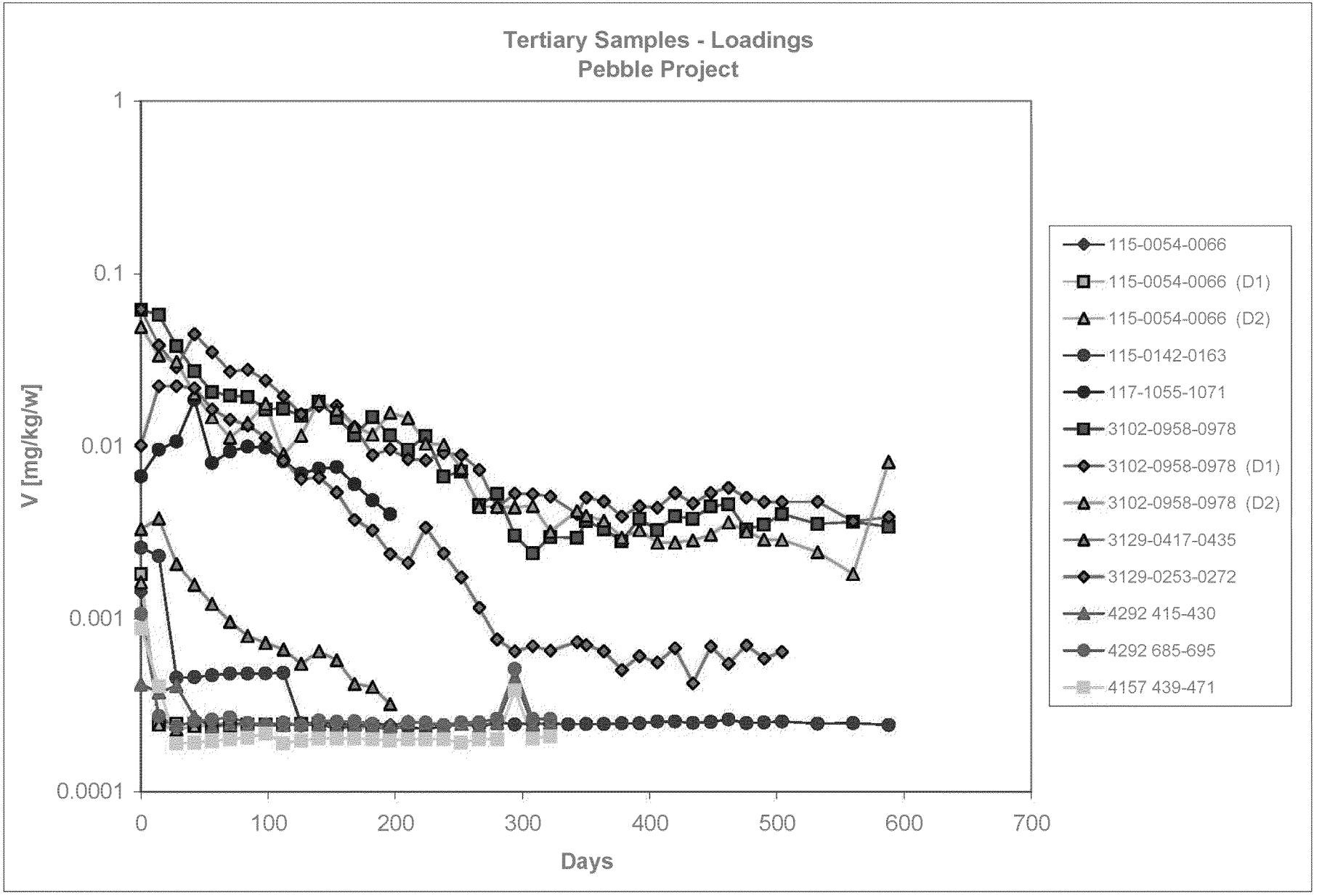

Tertiary Samples - Loadings
Pebble Project
SiO2 [mg/kg/w]
10
1
0.1
0.01
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

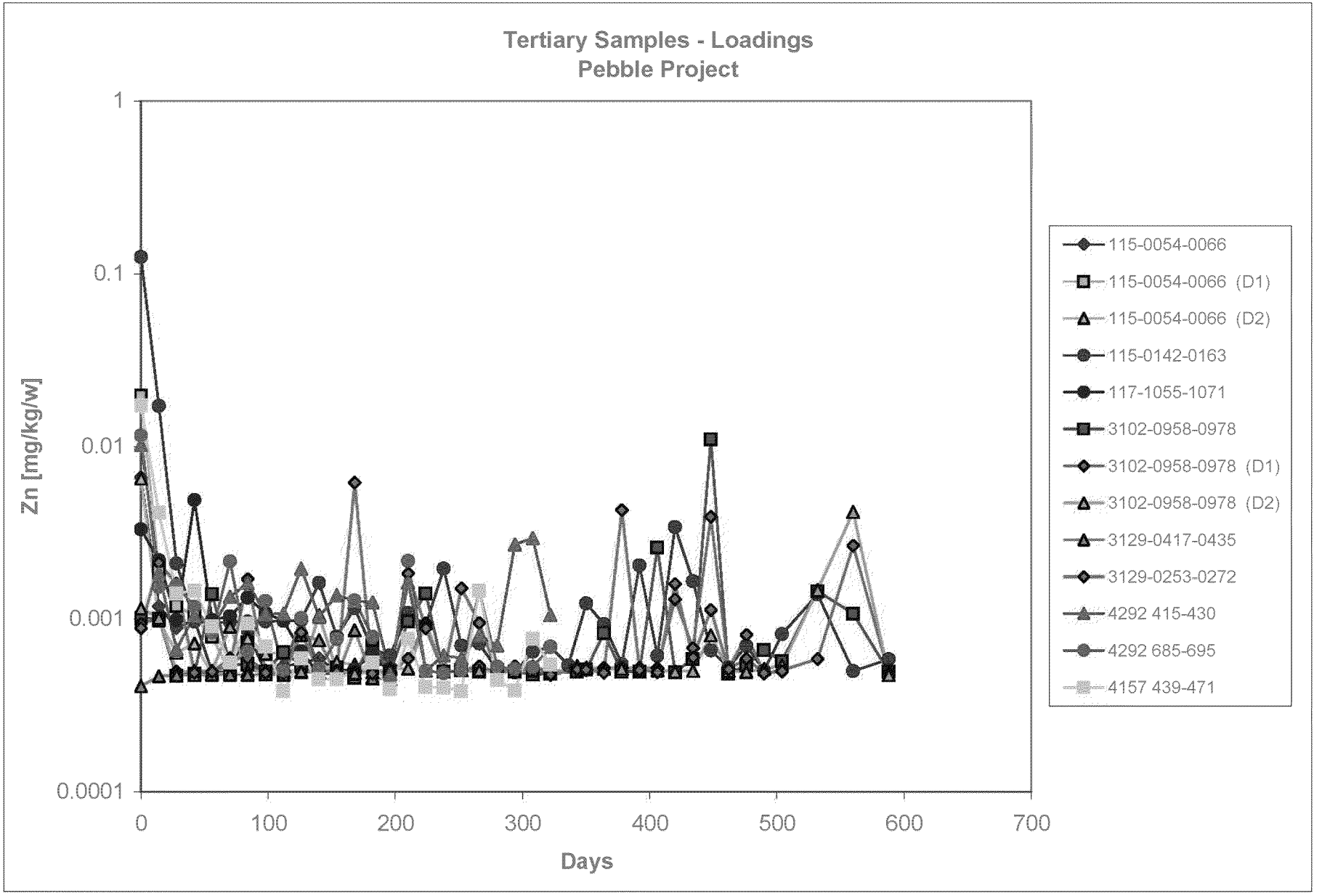

Tertiary Samples - Loadings
Pebble Project
Ag [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0.00001
0.000001
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471


Tertiary Samples - Loadings
Pebble Project
Na [mg/kg/w]
1000
100
10
1
0.1
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

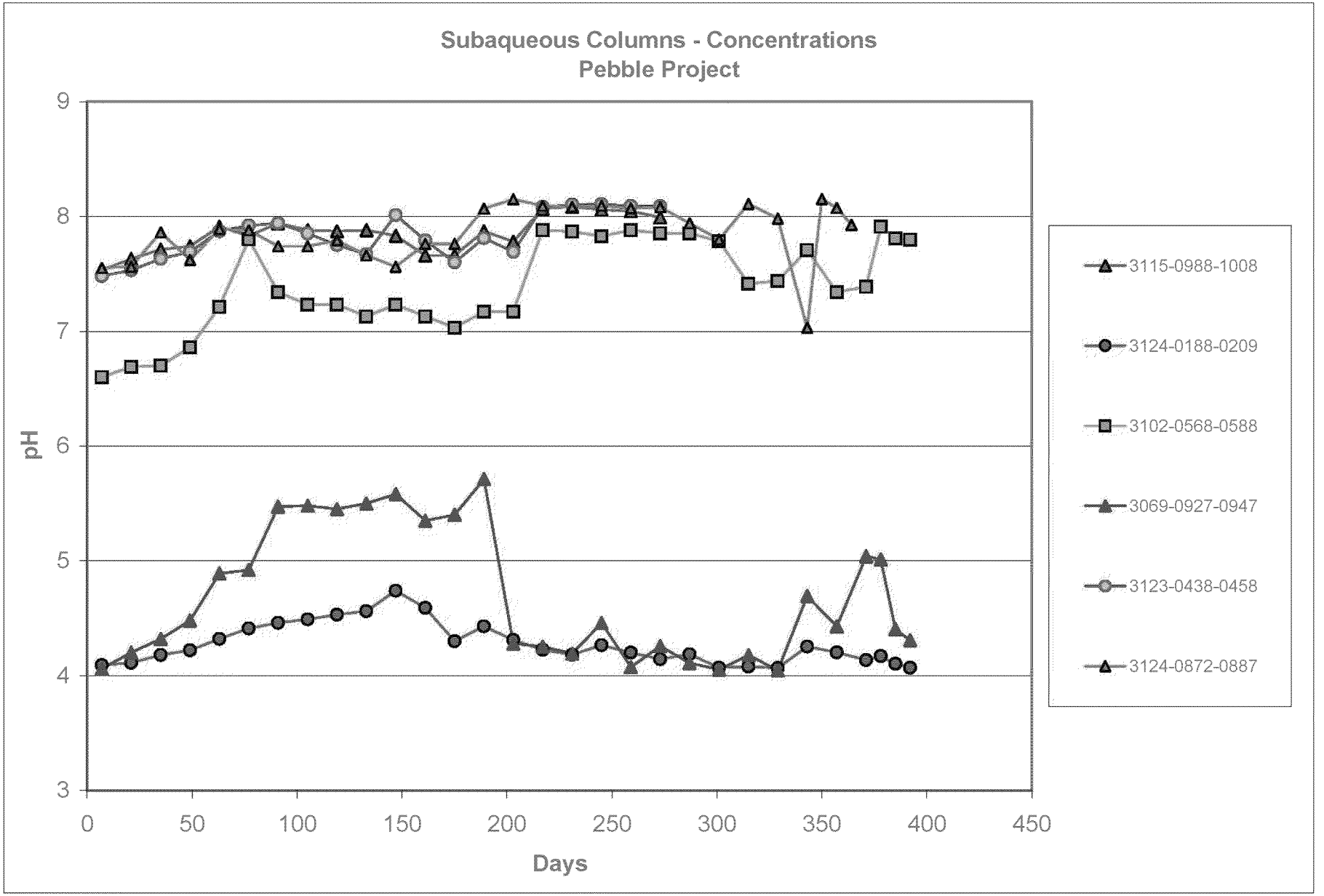

Tertiary Samples - Loadings
Pebble Project
Tl [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

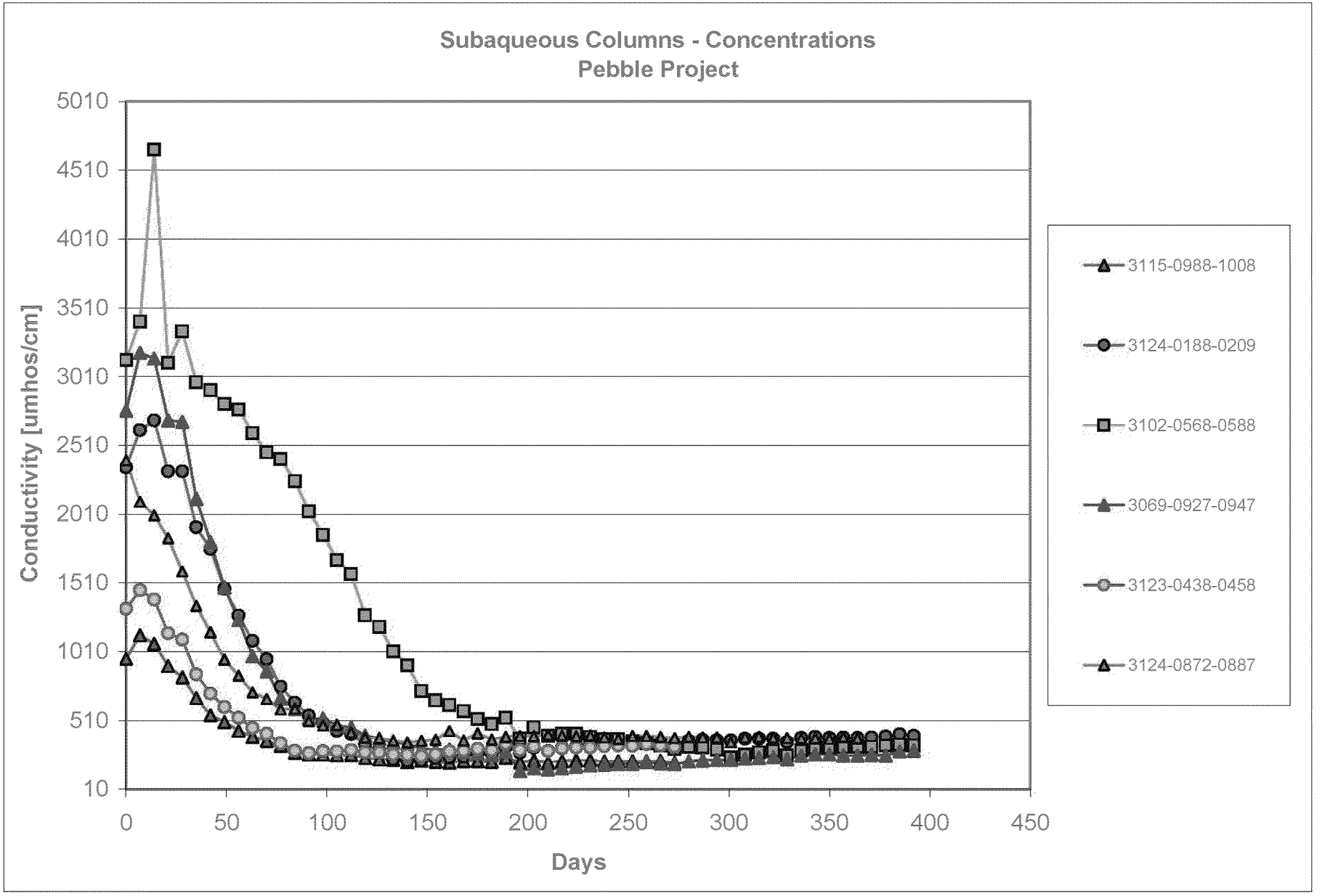

Tertiary Samples - Loadings
Pebble Project
Sn [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471


Tertiary Samples - Loadings
Pebble Project
V [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

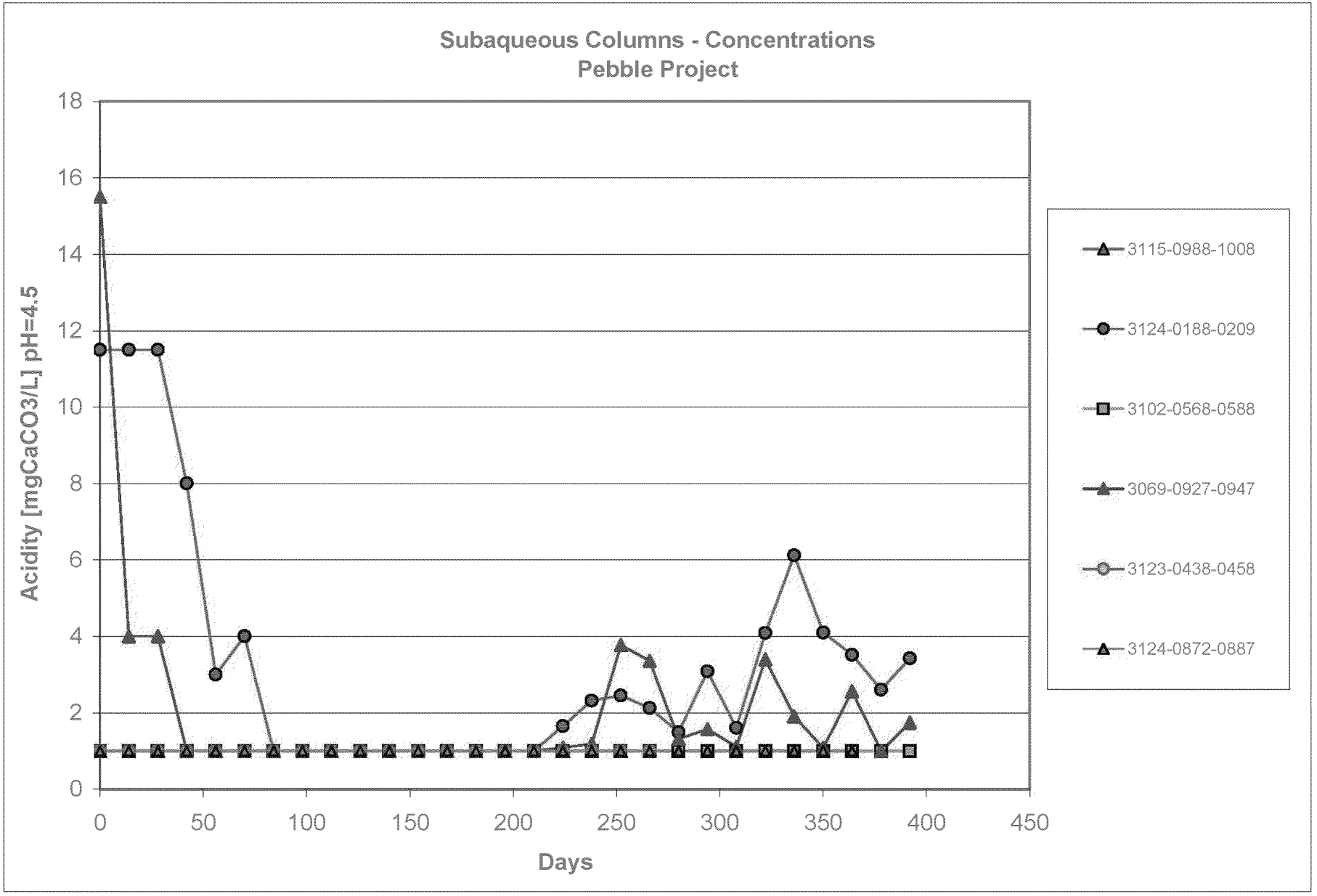

Tertiary Samples - Loadings
Pebble Project
Zn [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
115-0054-0066
115-0054-0066 (D1)
115-0054-0066 (D2)
115-0142-0163
117-1055-1071
3102-0958-0978
3102-0958-0978 (D1)
3102-0958-0978 (D2)
3129-0417-0435
3129-0253-0272
4292 415-430
4292 685-695
4157 439-471

Attachment D
Graphs for Pre-Tertiary Subaqueous Rock Columns

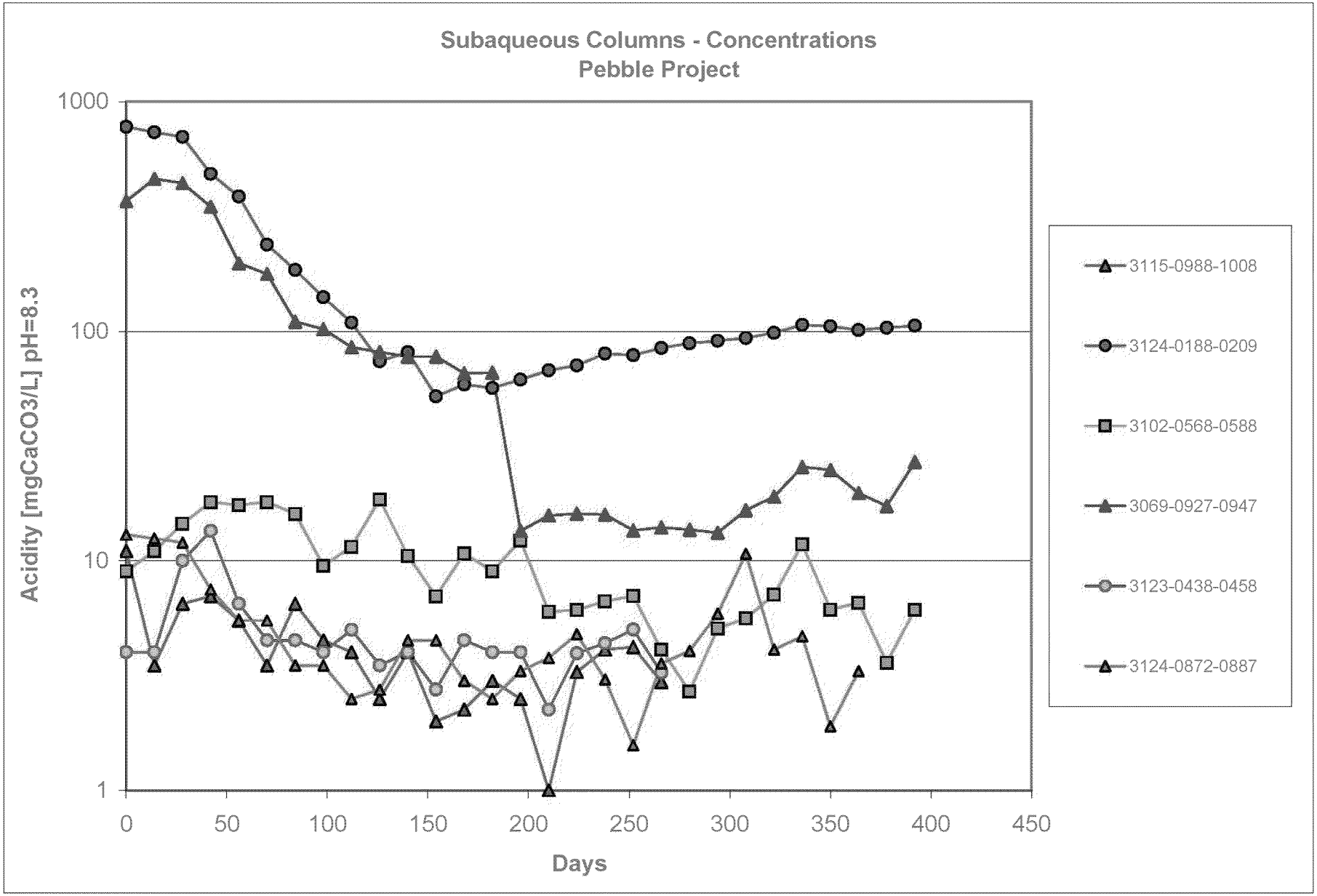

Subaqueous Columns - Concentrations
Pebble Project
pH
Days
9
8
7
6
5
4
3
0
50
100
150
200
250
300
350
400
450
3115-0988-1008
3124-0188-0209
3102-0568-0588
3069-0927-0947
3123-0438-0458
3124-0872-0887



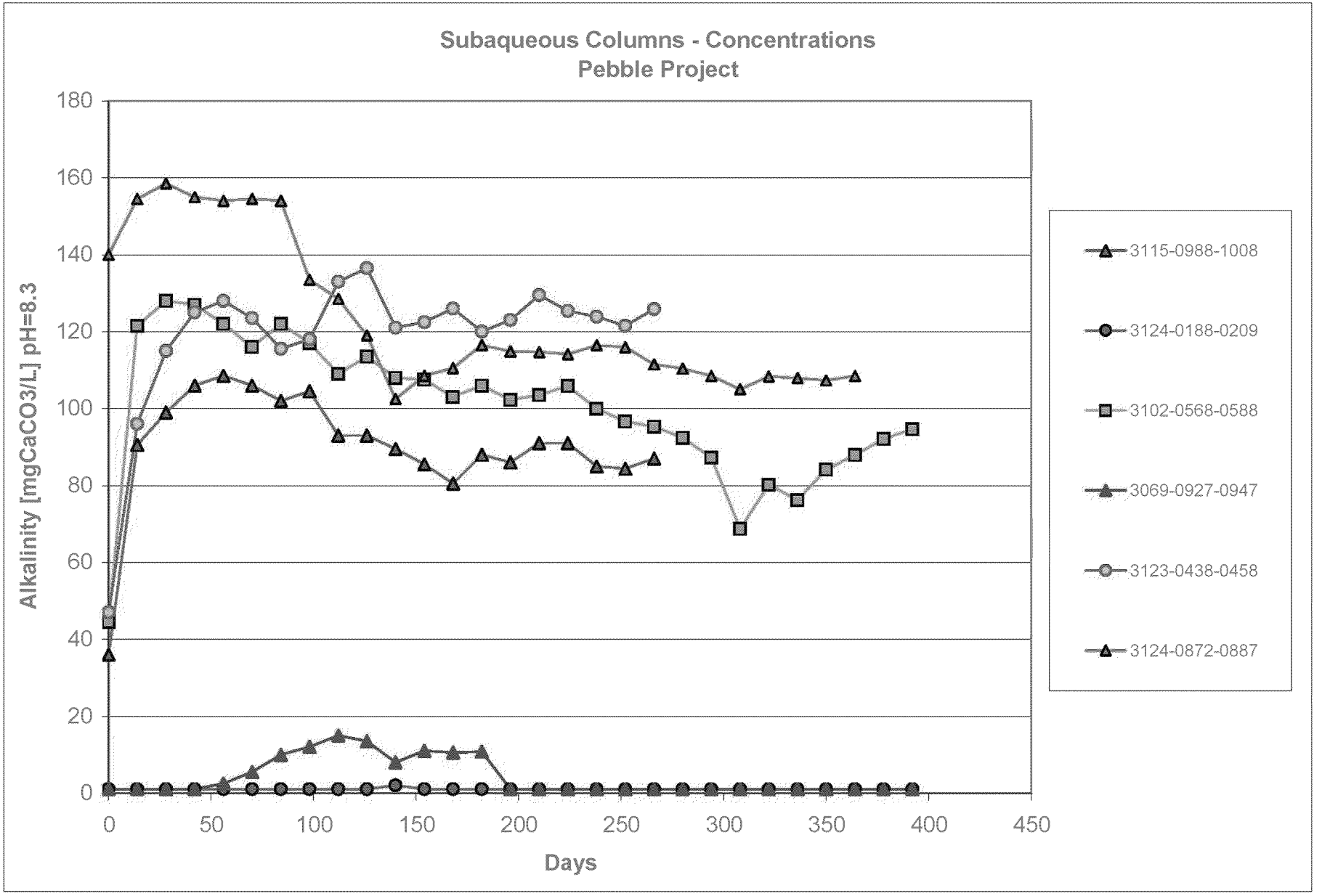
EPA-7609-0005804-0125

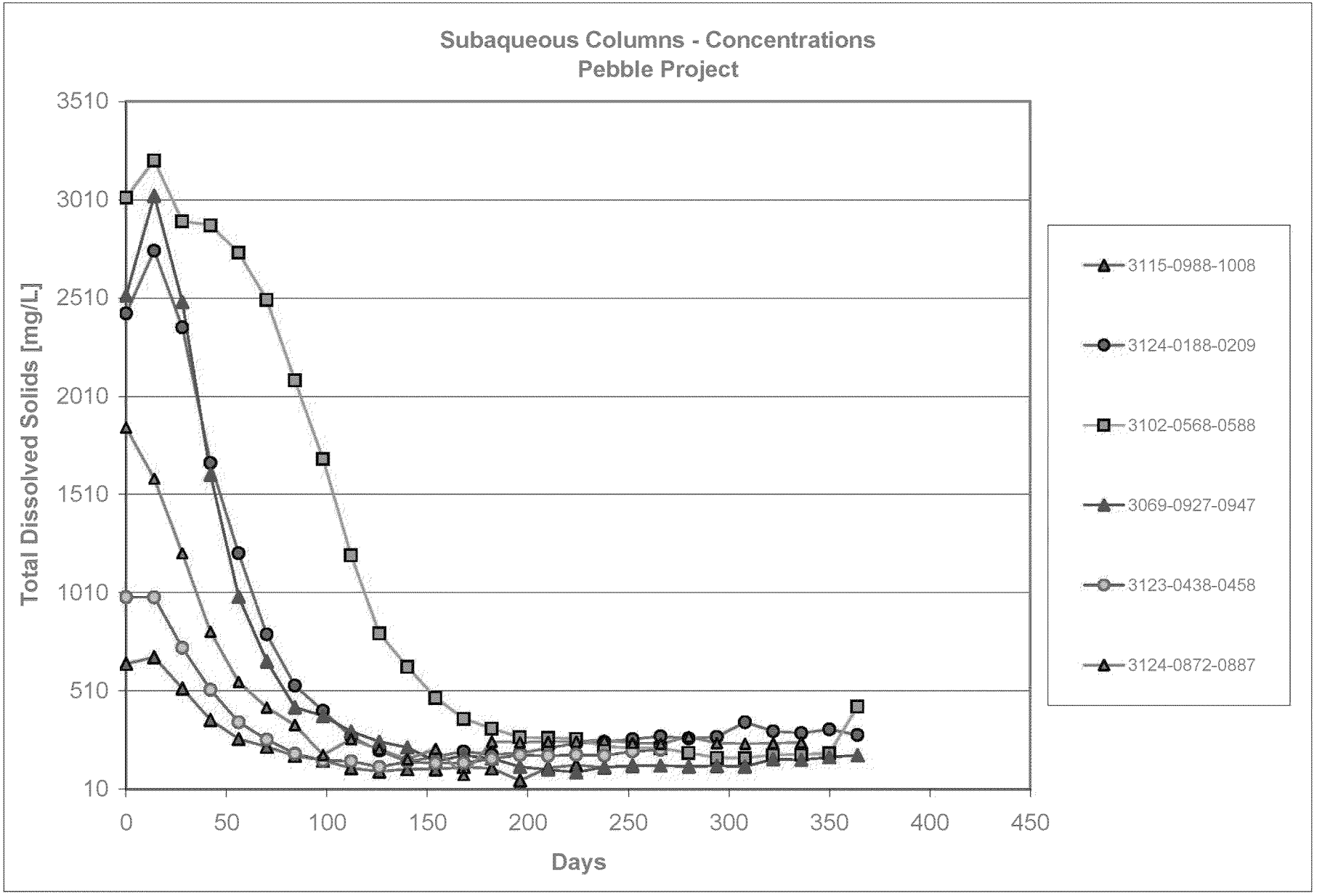


EPA-7609-0005804-0126

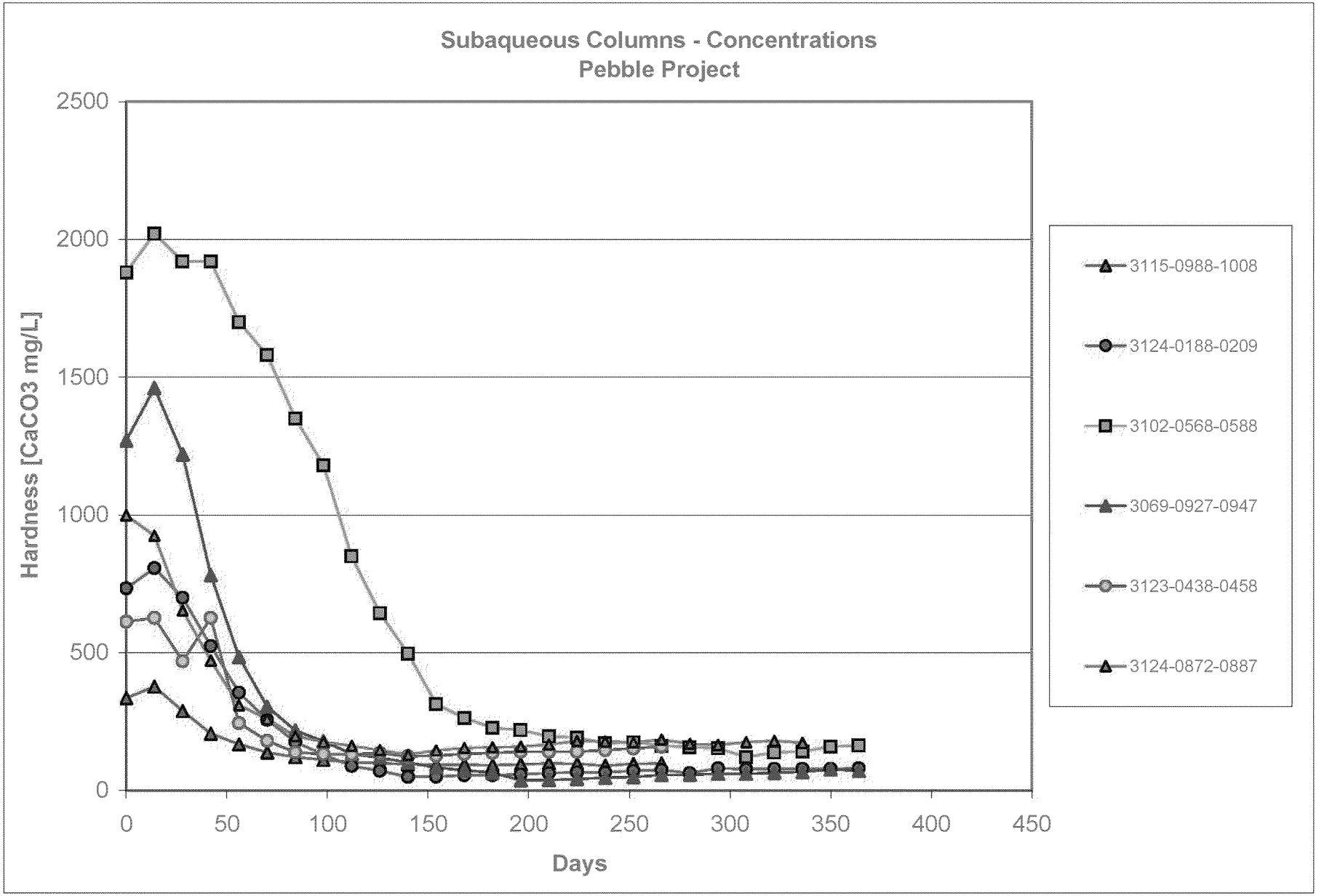


EPA-7609-0005804-0127

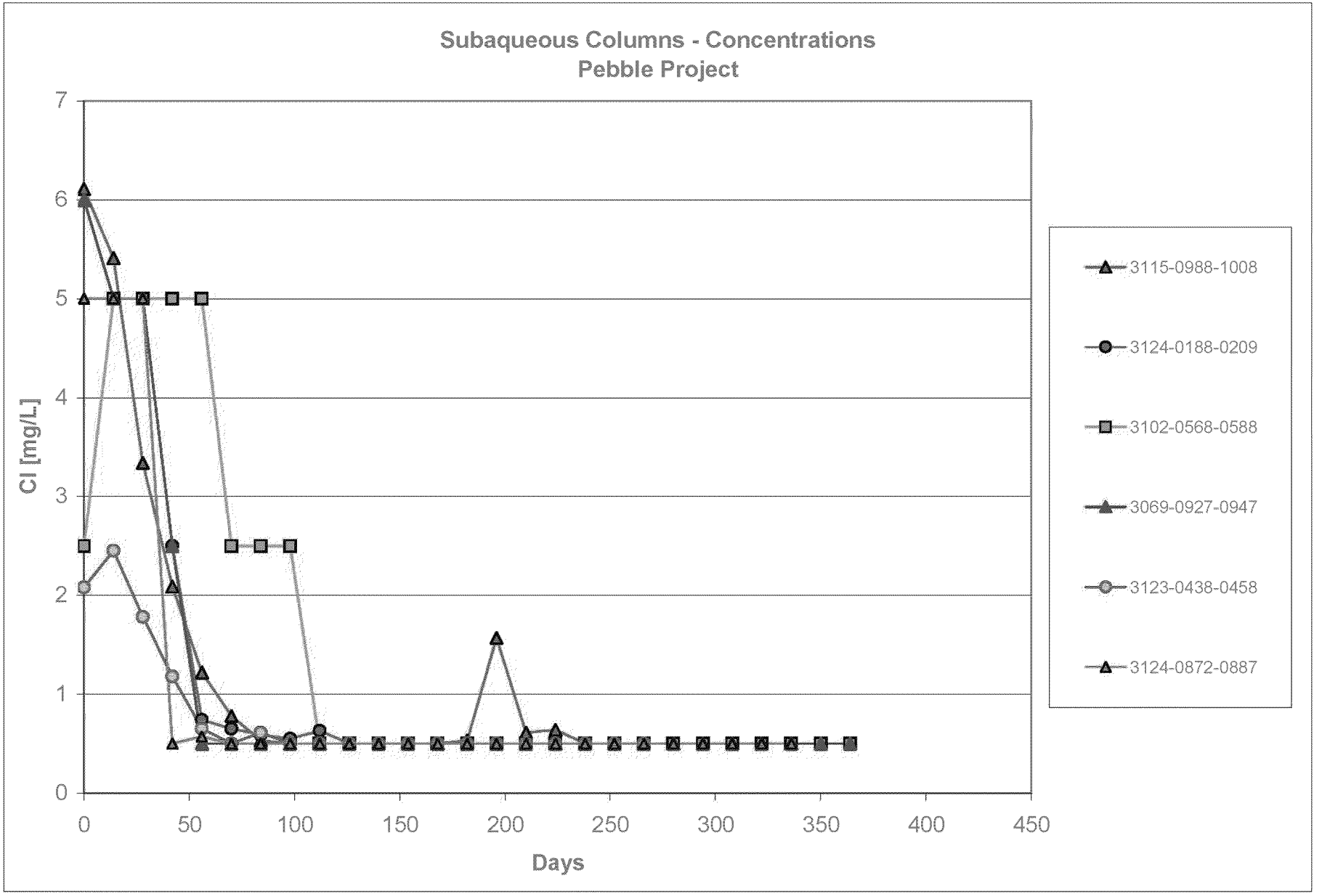

Subaqueous Columns - Concentrations
Pebble Project
Alkalinity [mgCaCO3/L] pH=8.3
Days
0
20
40
60
80
100
120
140
160
180
0
50
100
150
200
250
300
350
400
450
3115-0988-1008
3124-0188-0209
3102-0568-0588
3069-0927-0947
3123-0438-0458
3124-0872-0887



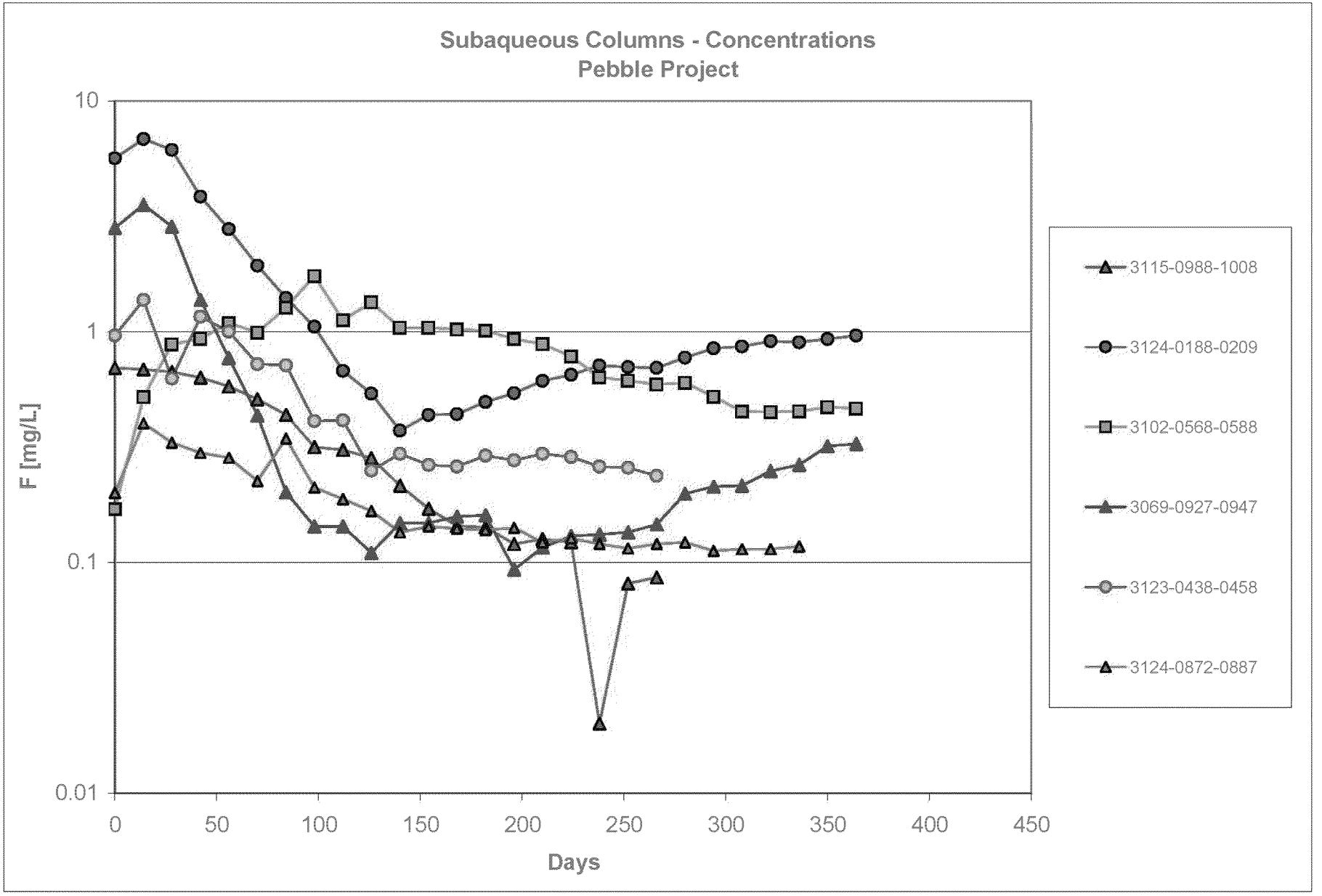
EPA-7609-0005804-0129



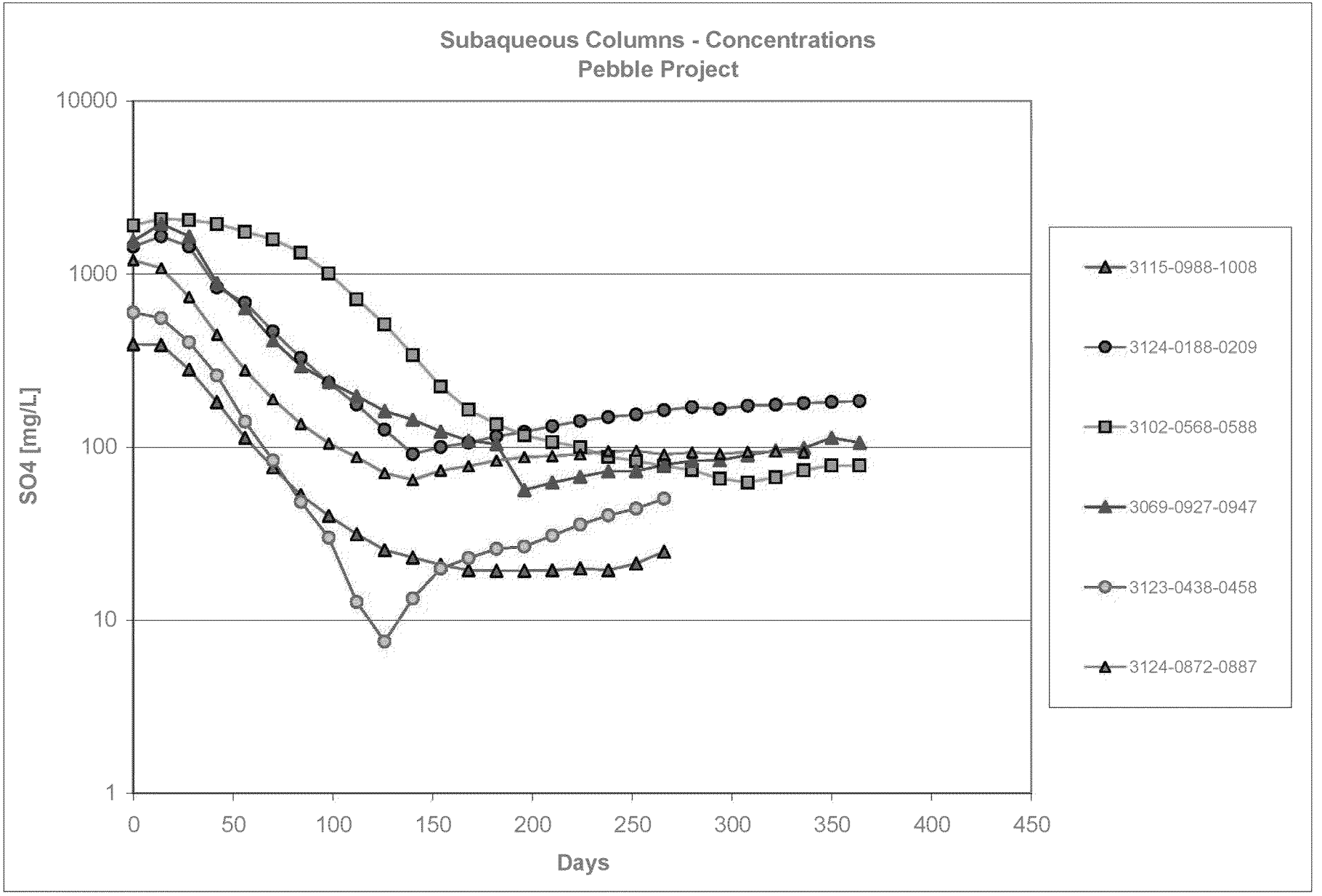
EPA-7609-0005804-0130



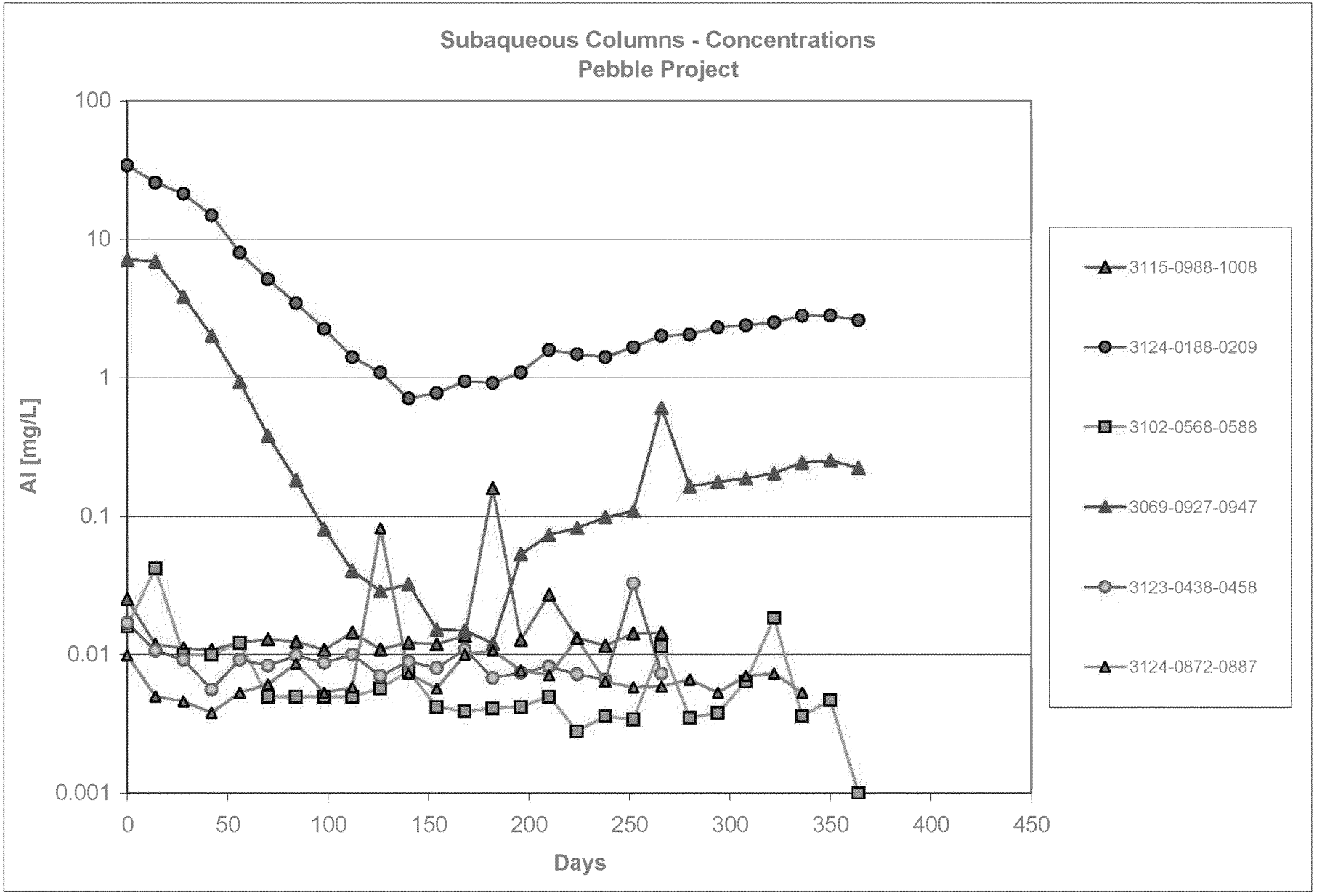
EPA-7609-0005804-0131



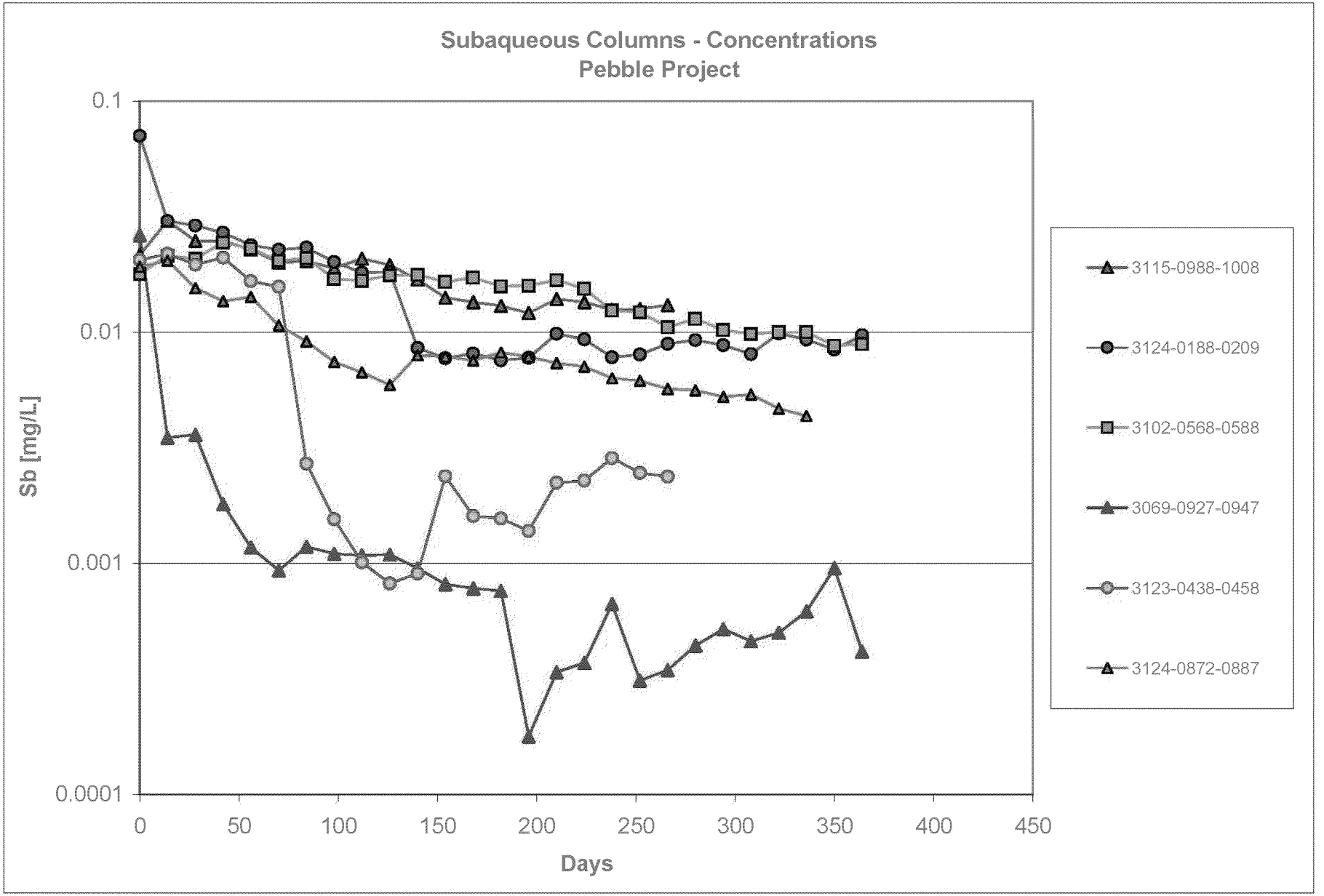
EPA-7609-0005804-0132



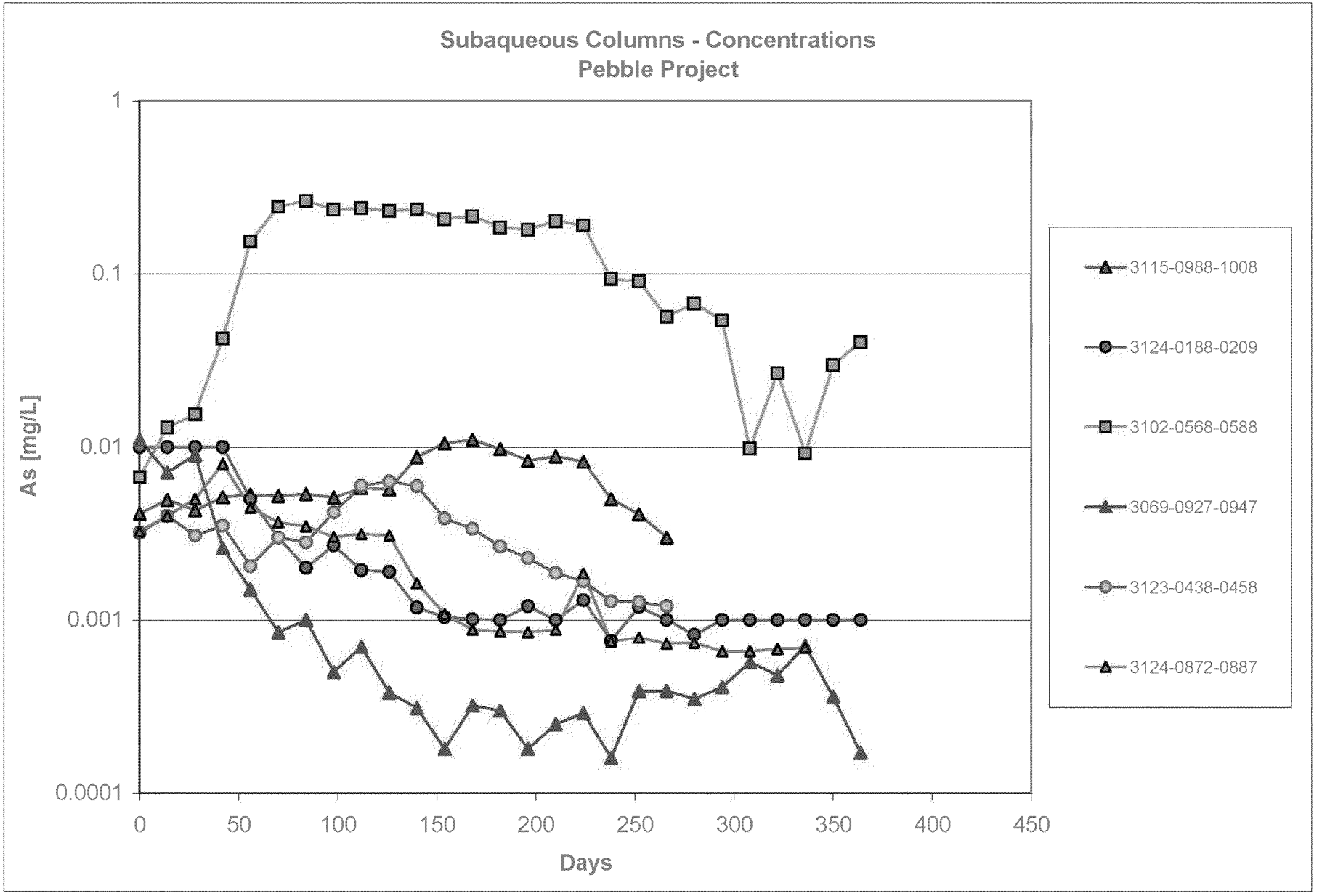
EPA-7609-0005804-0133



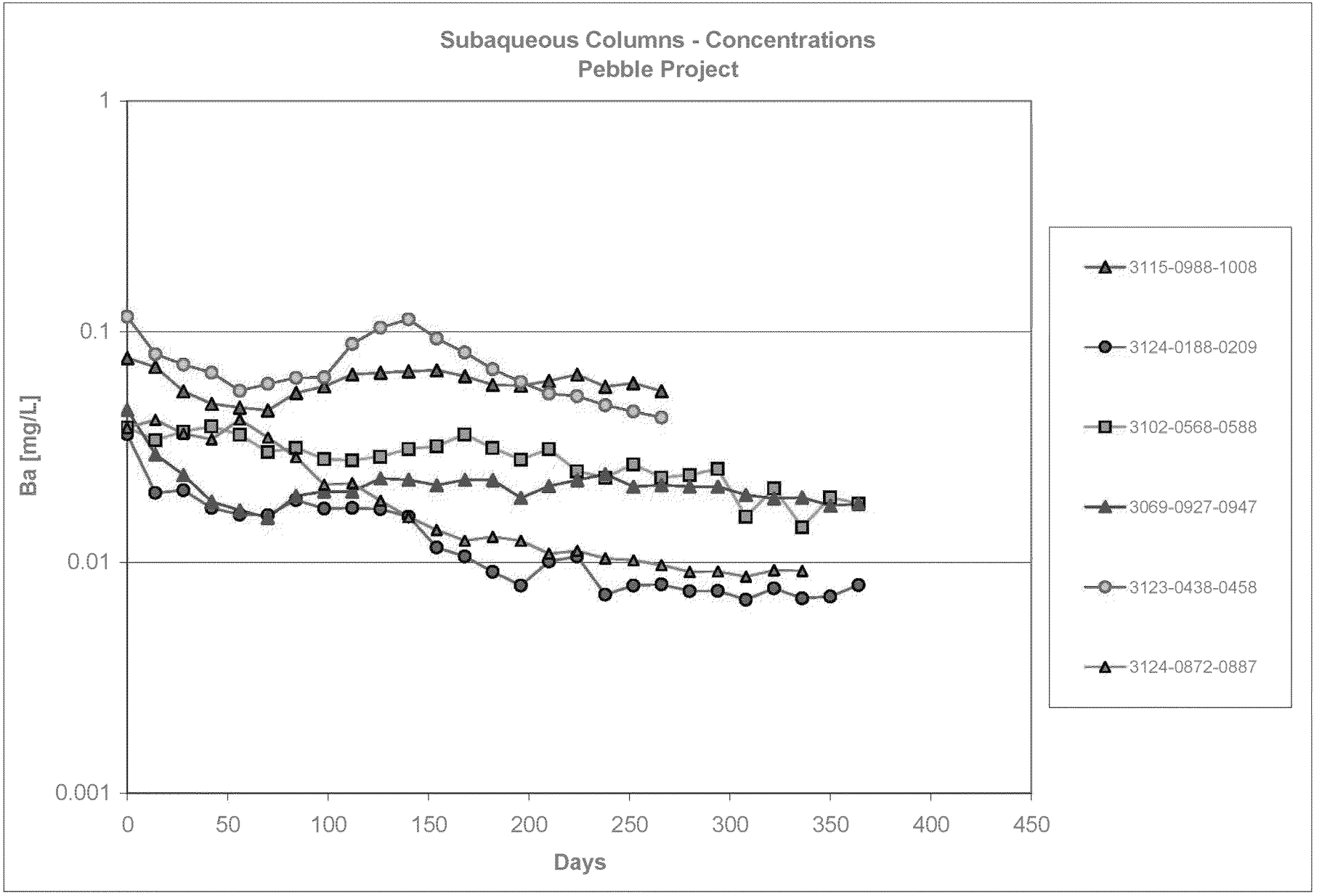
EPA-7609-0005804-0134



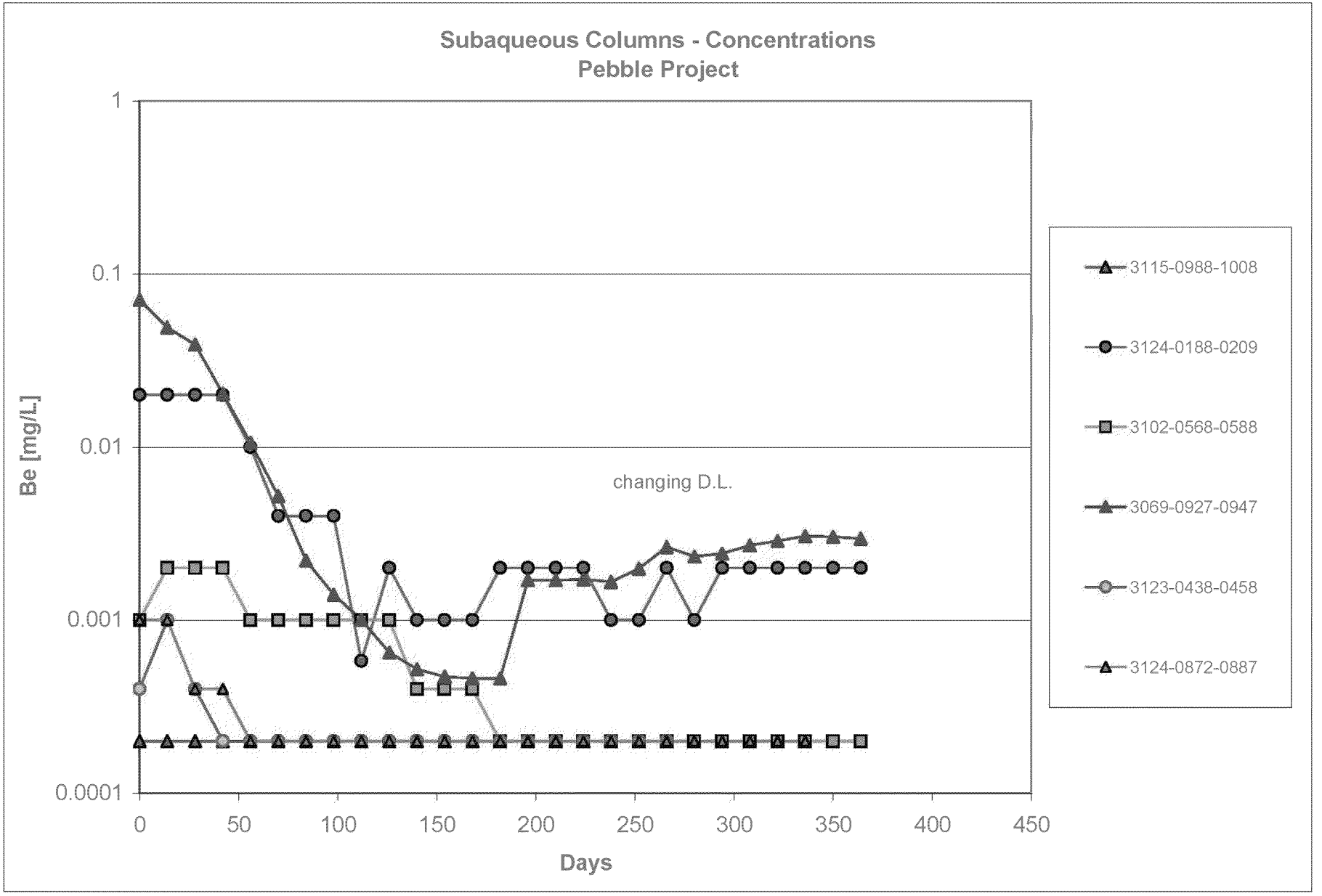
EPA-7609-0005804-0135



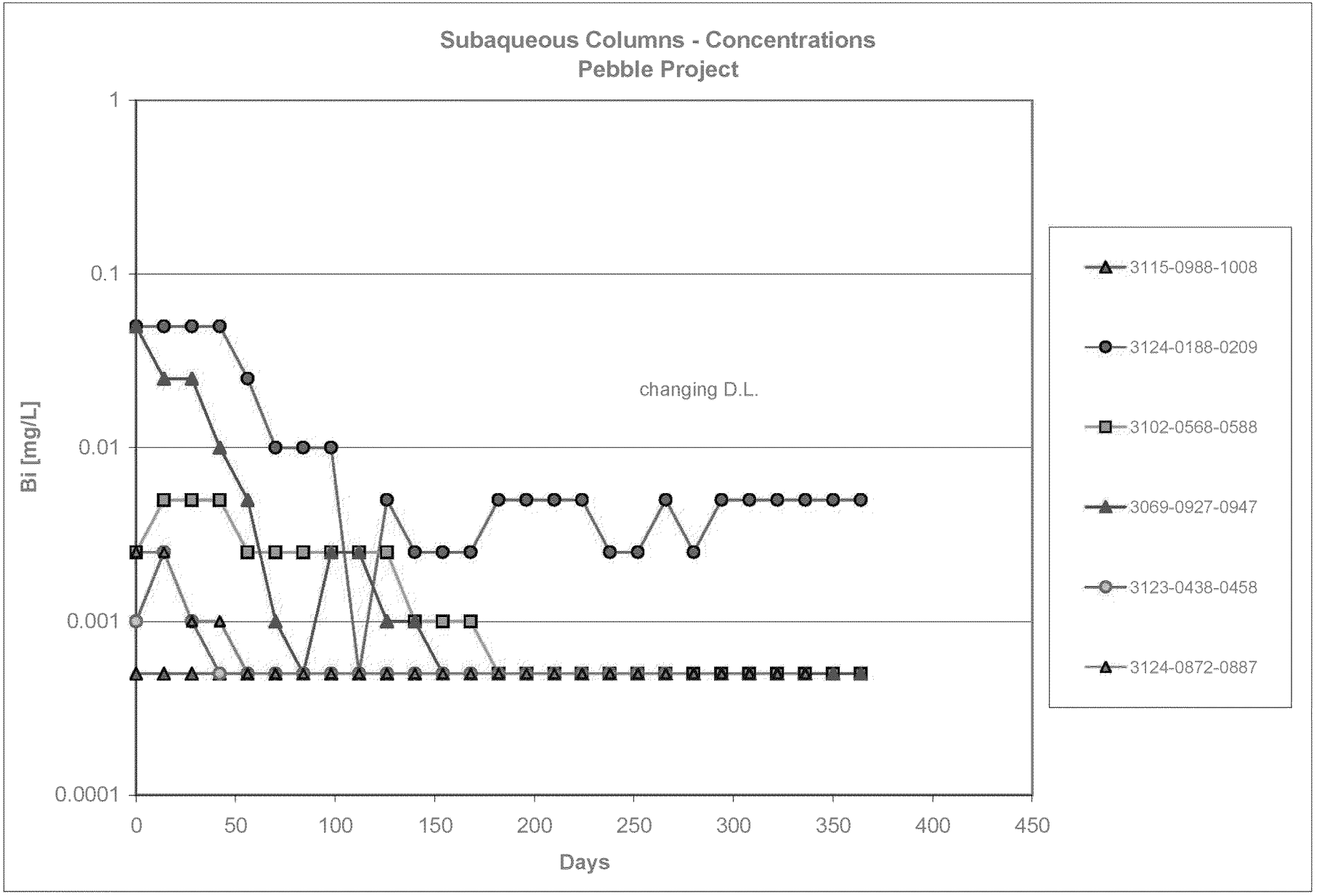
EPA-7609-0005804-0136



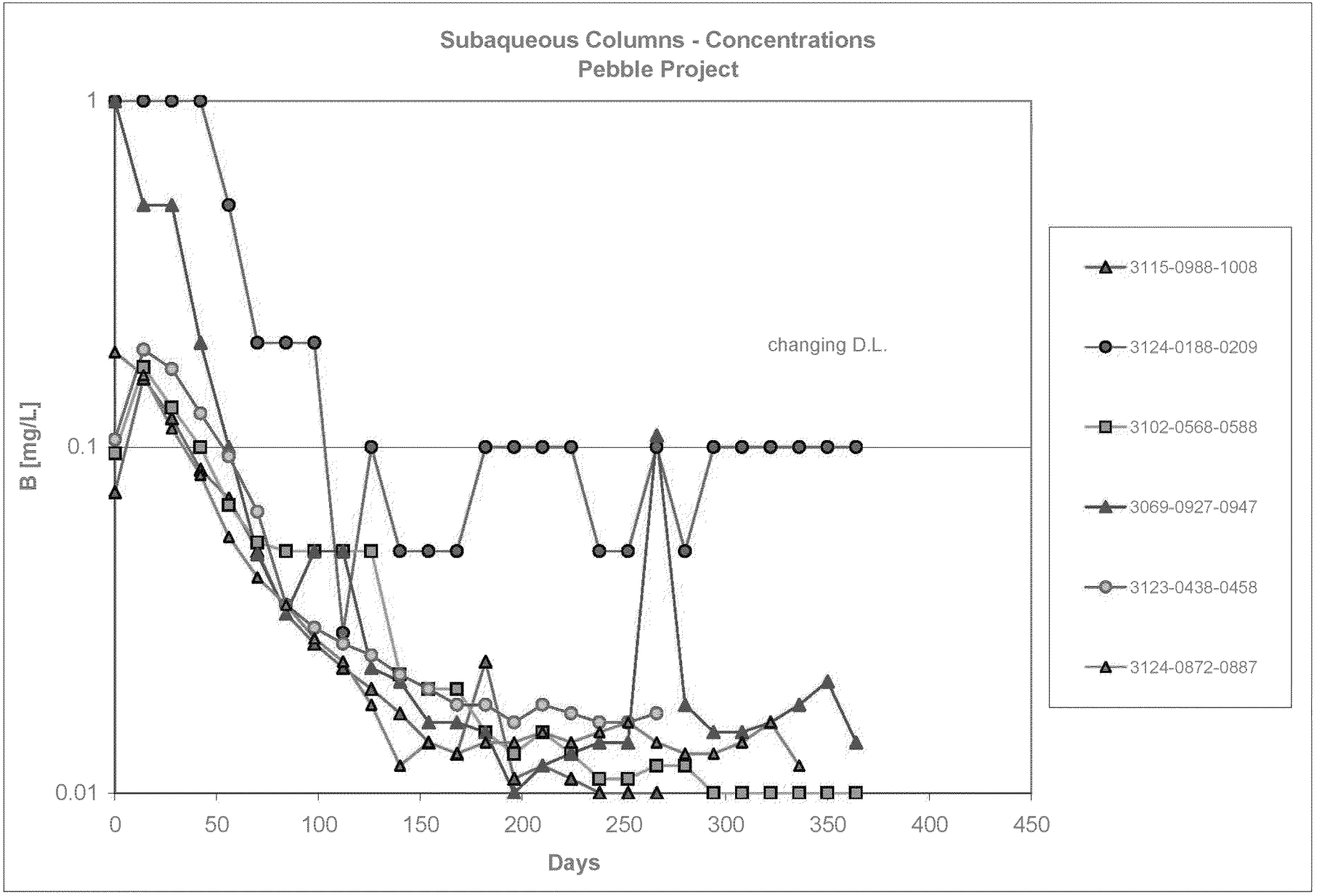
EPA-7609-0005804-0137



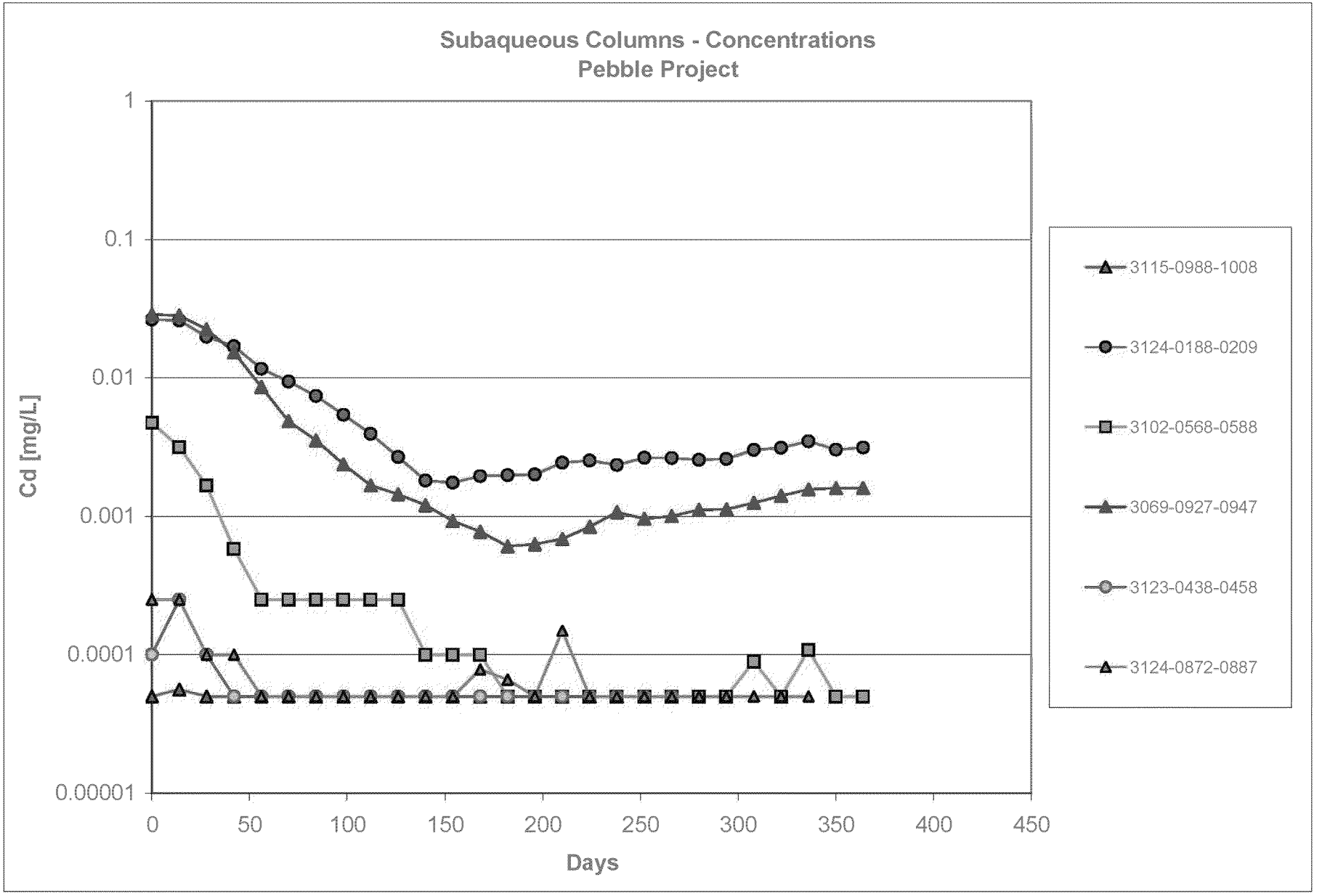
EPA-7609-0005804-0138



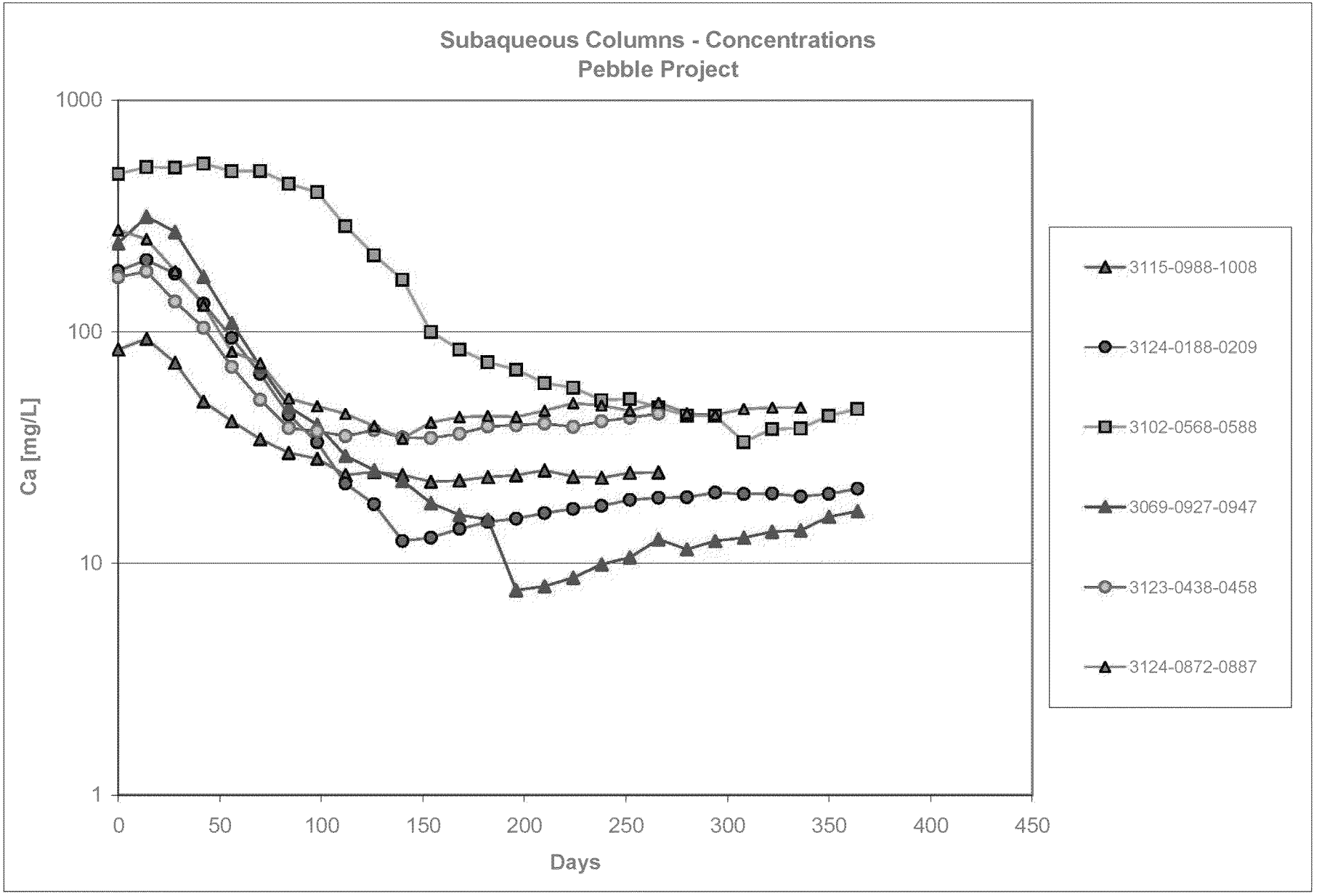
EPA-7609-0005804-0139



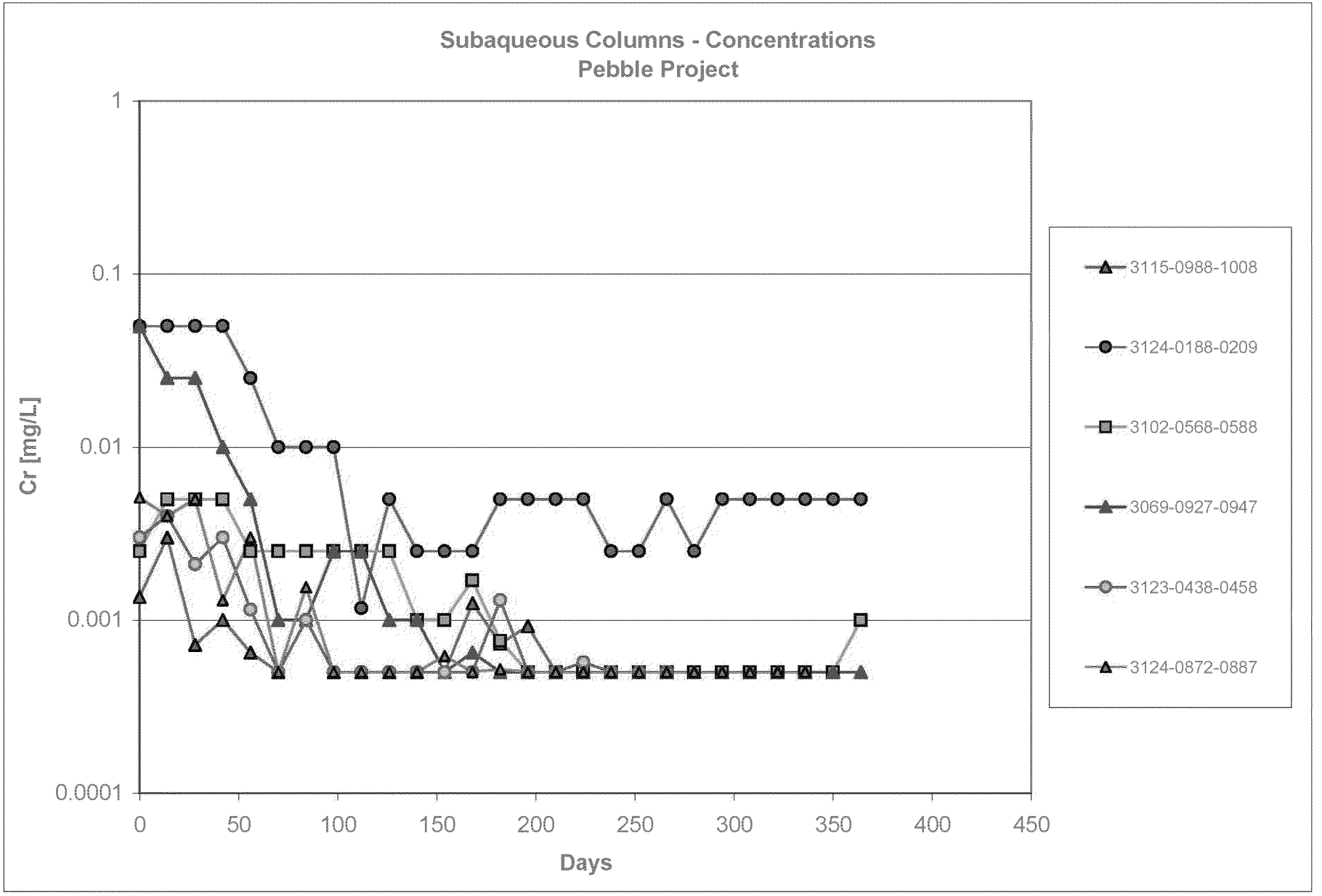
EPA-7609-0005804-0140



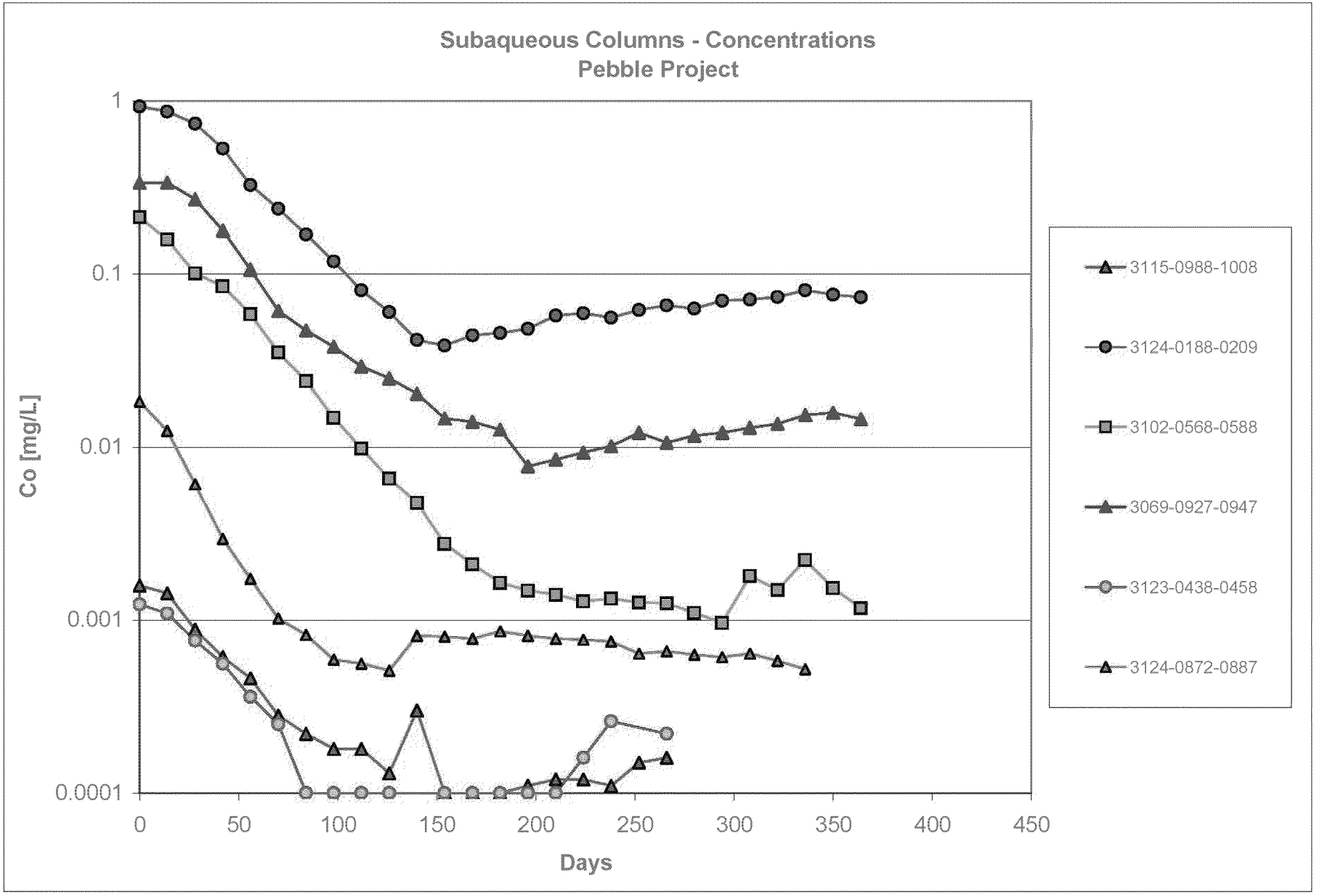
EPA-7609-0005804-0141



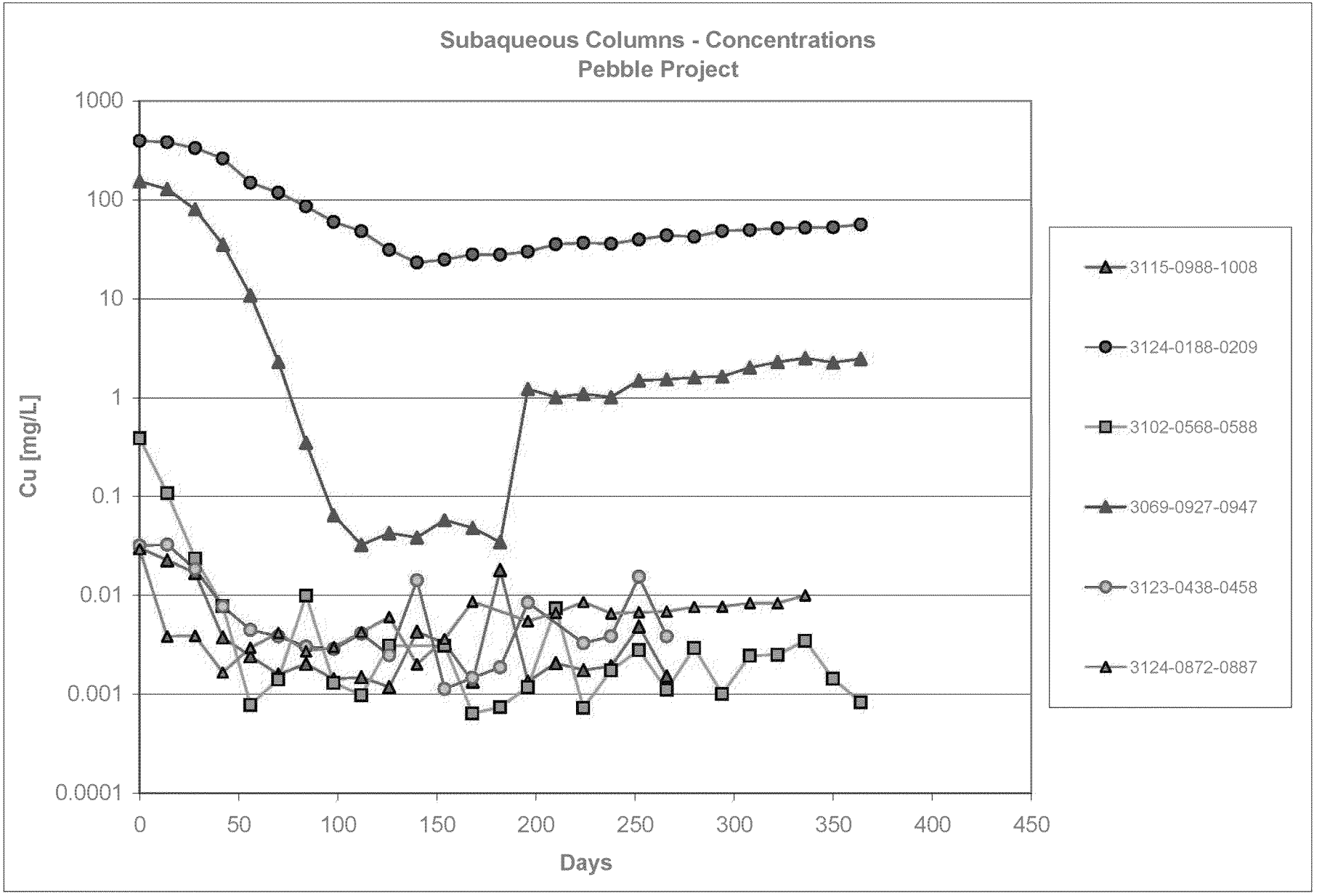
EPA-7609-0005804-0142



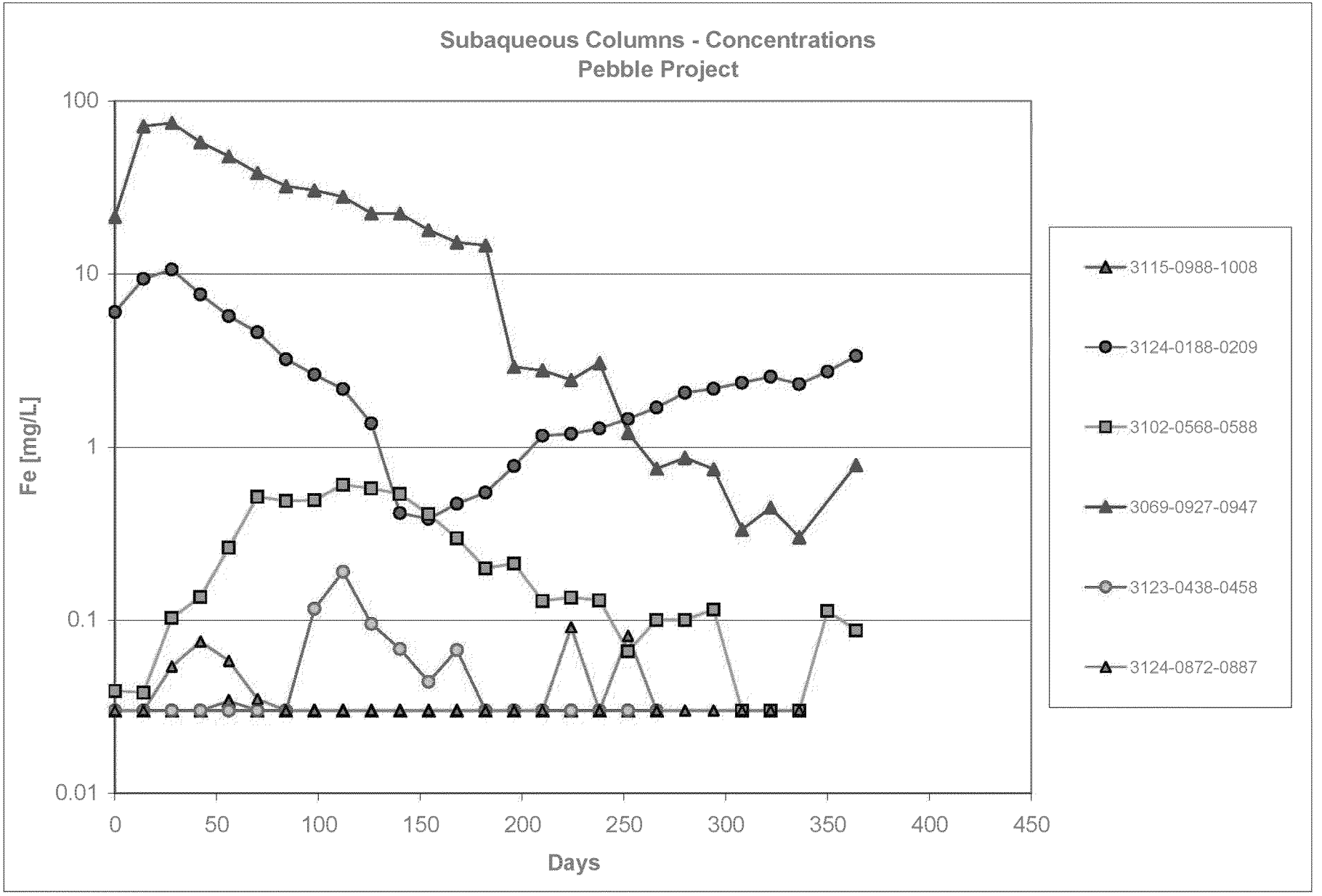
EPA-7609-0005804-0143



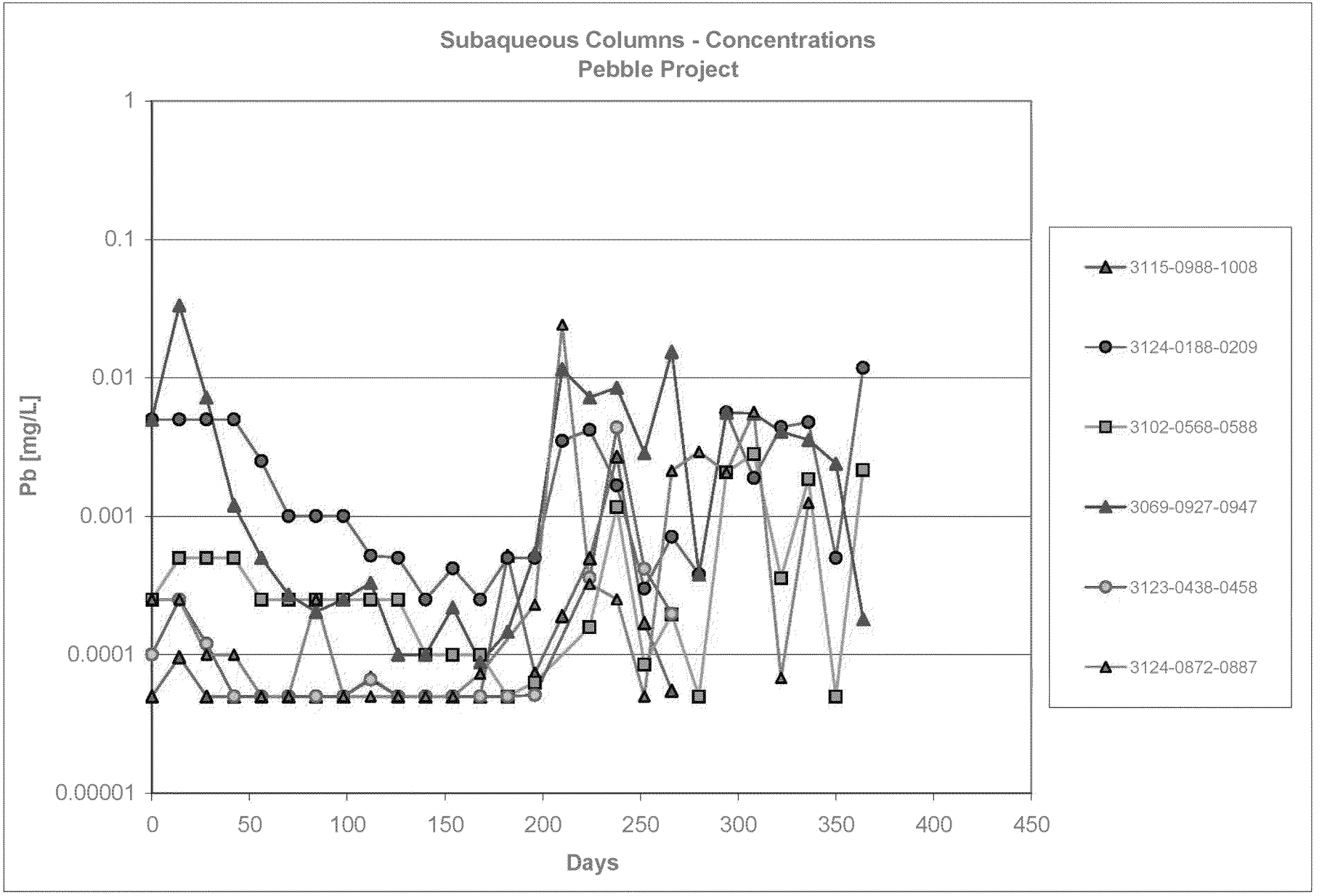
EPA-7609-0005804-0144



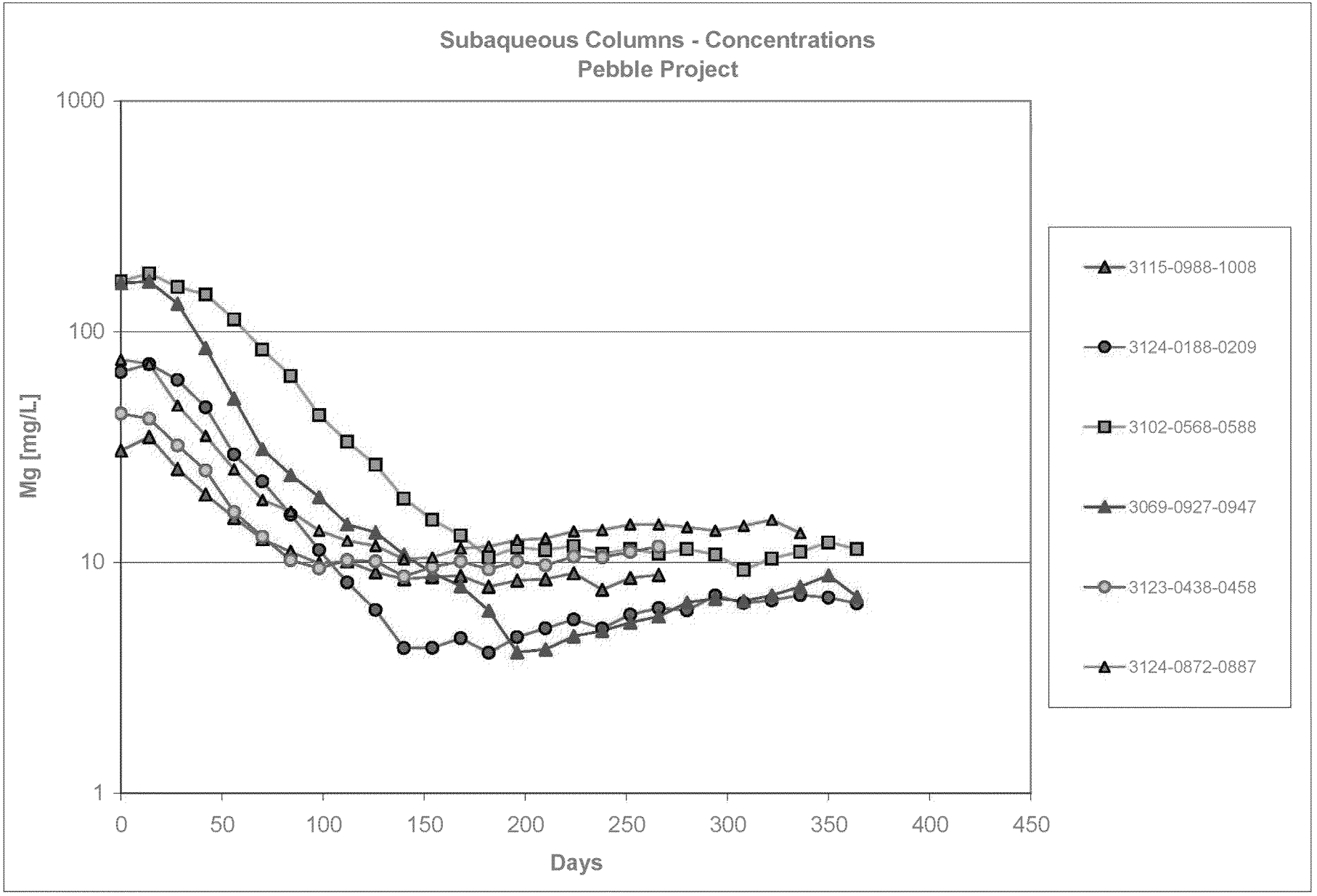
EPA-7609-0005804-0145



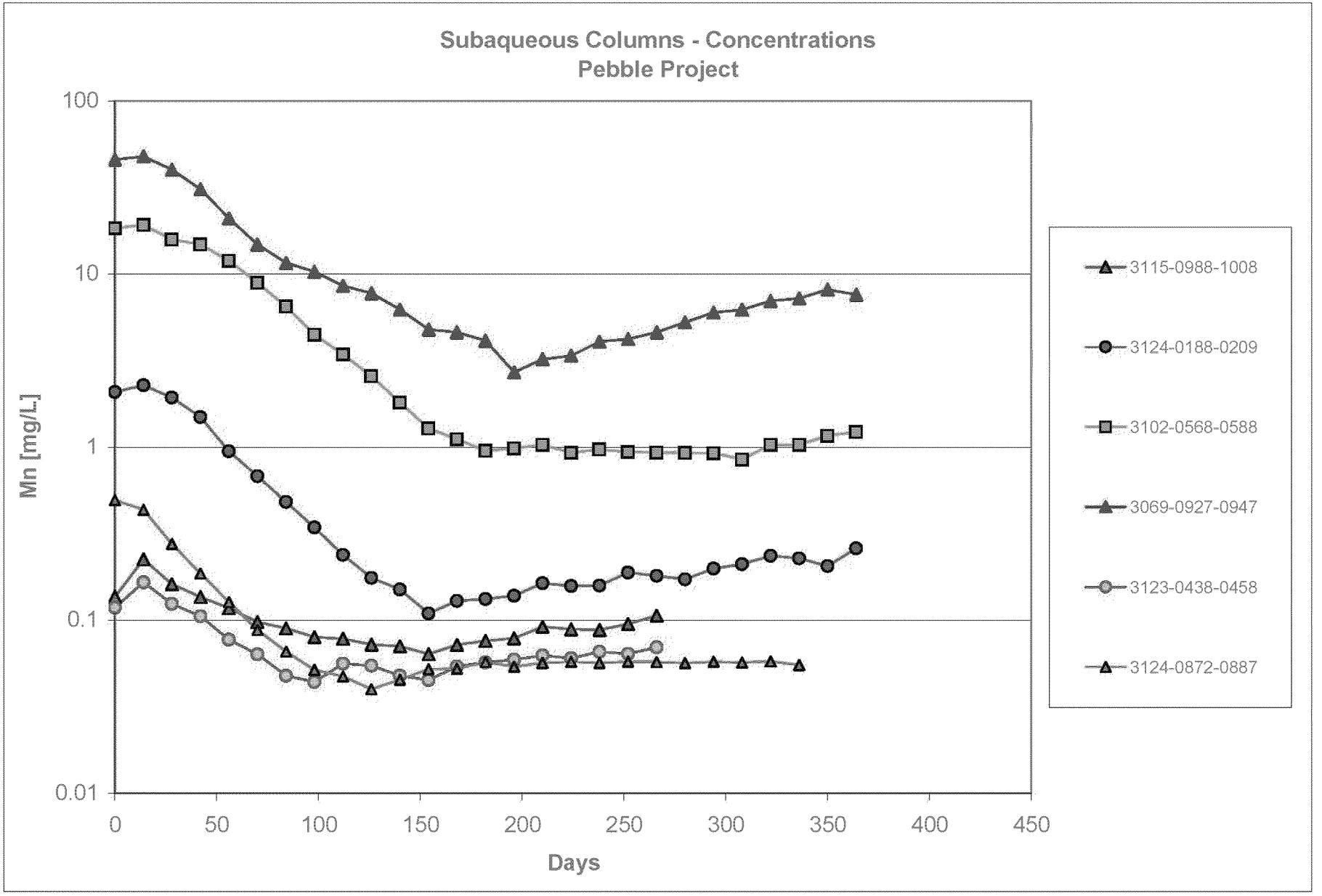
EPA-7609-0005804-0146



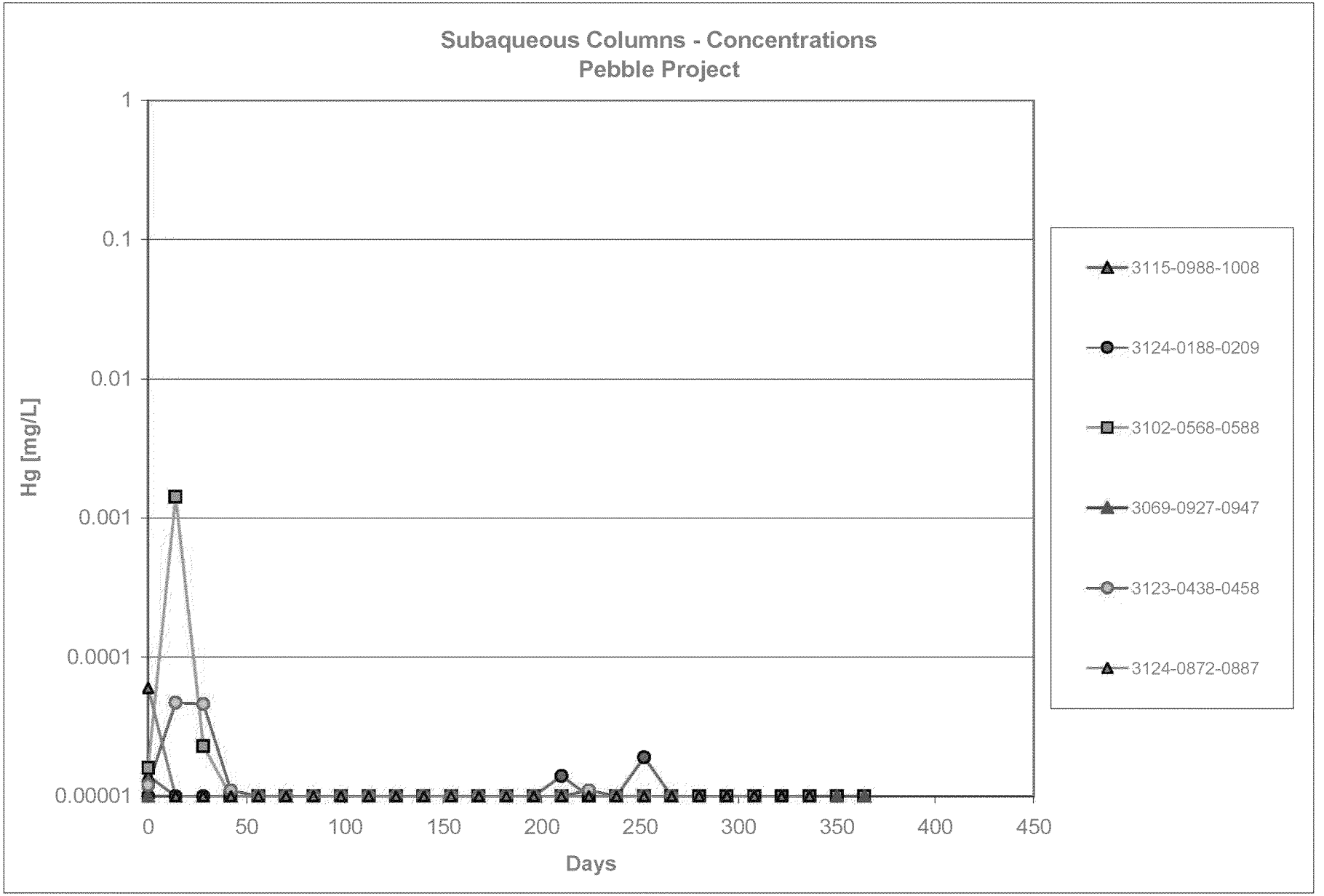
EPA-7609-0005804-0147



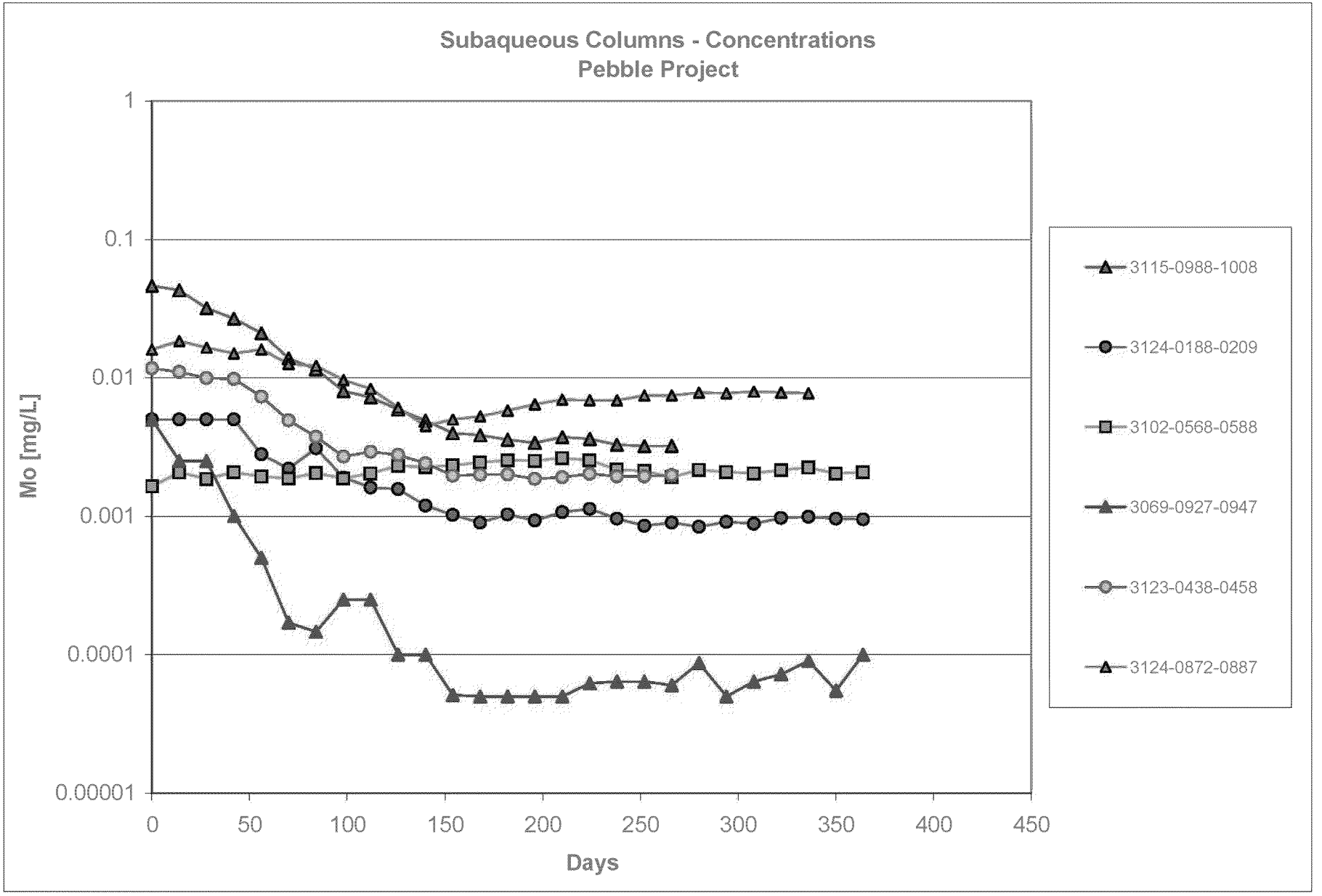
EPA-7609-0005804-0148

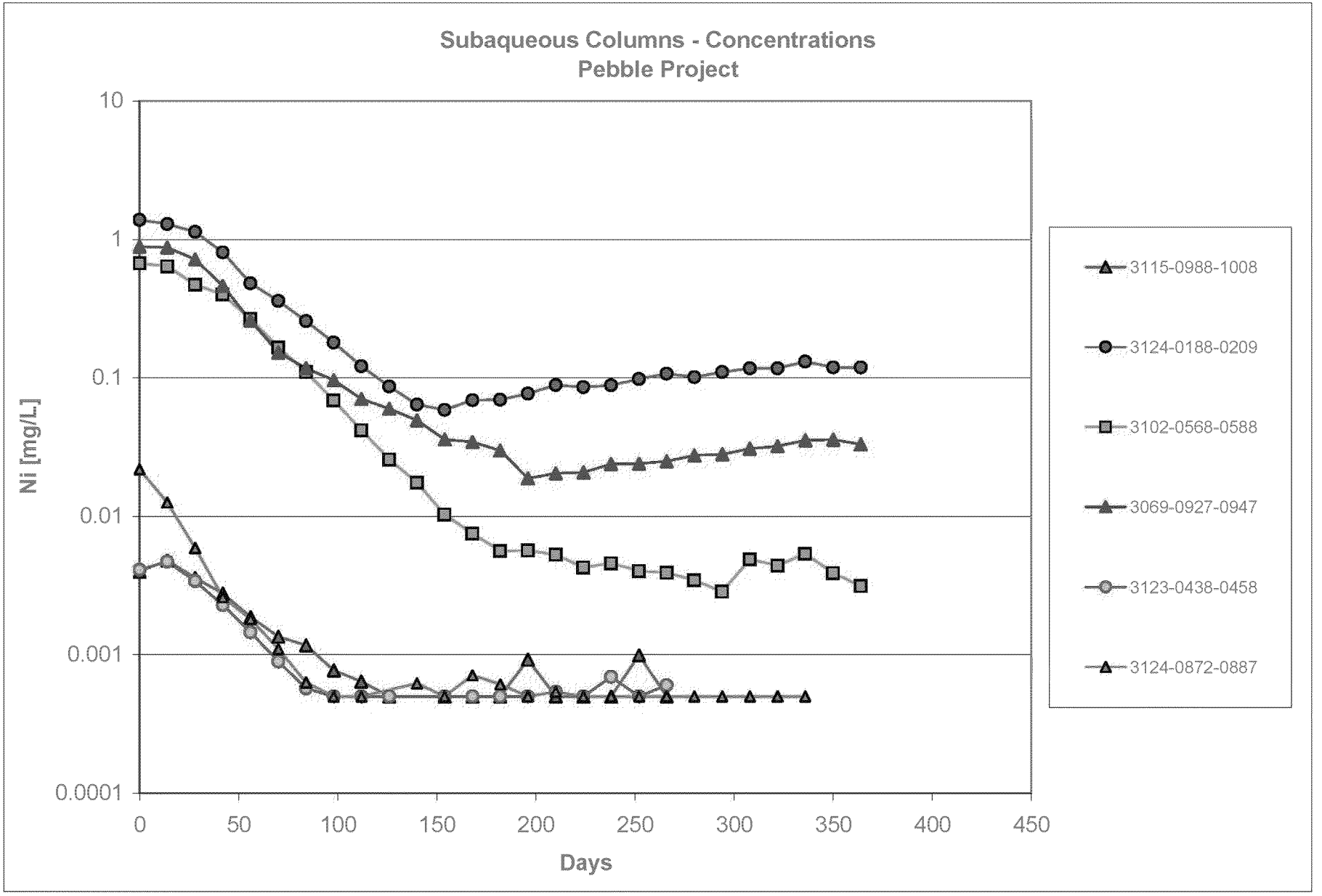


EPA-7609-0005804-0149

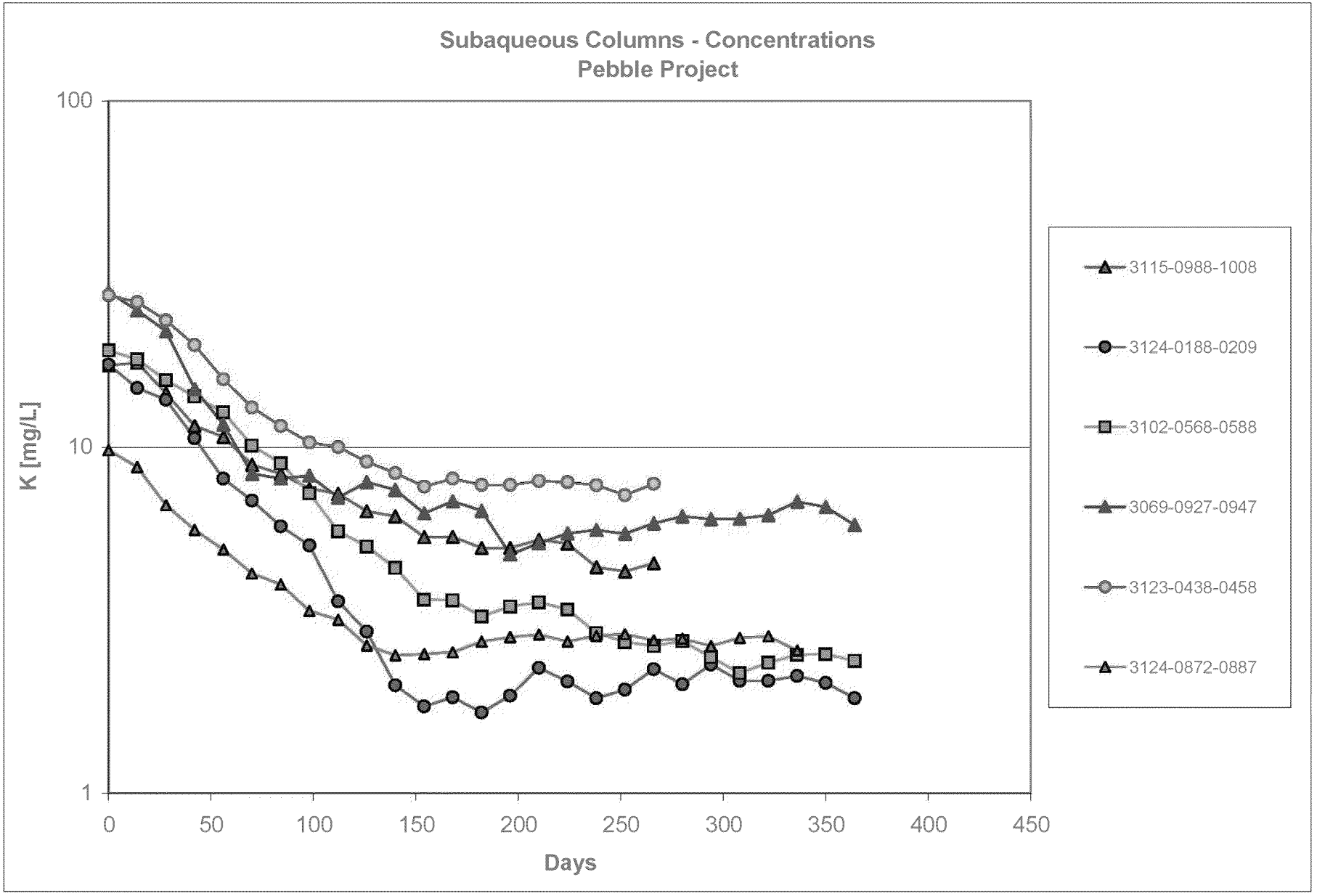


EPA-7609-0005804-0150

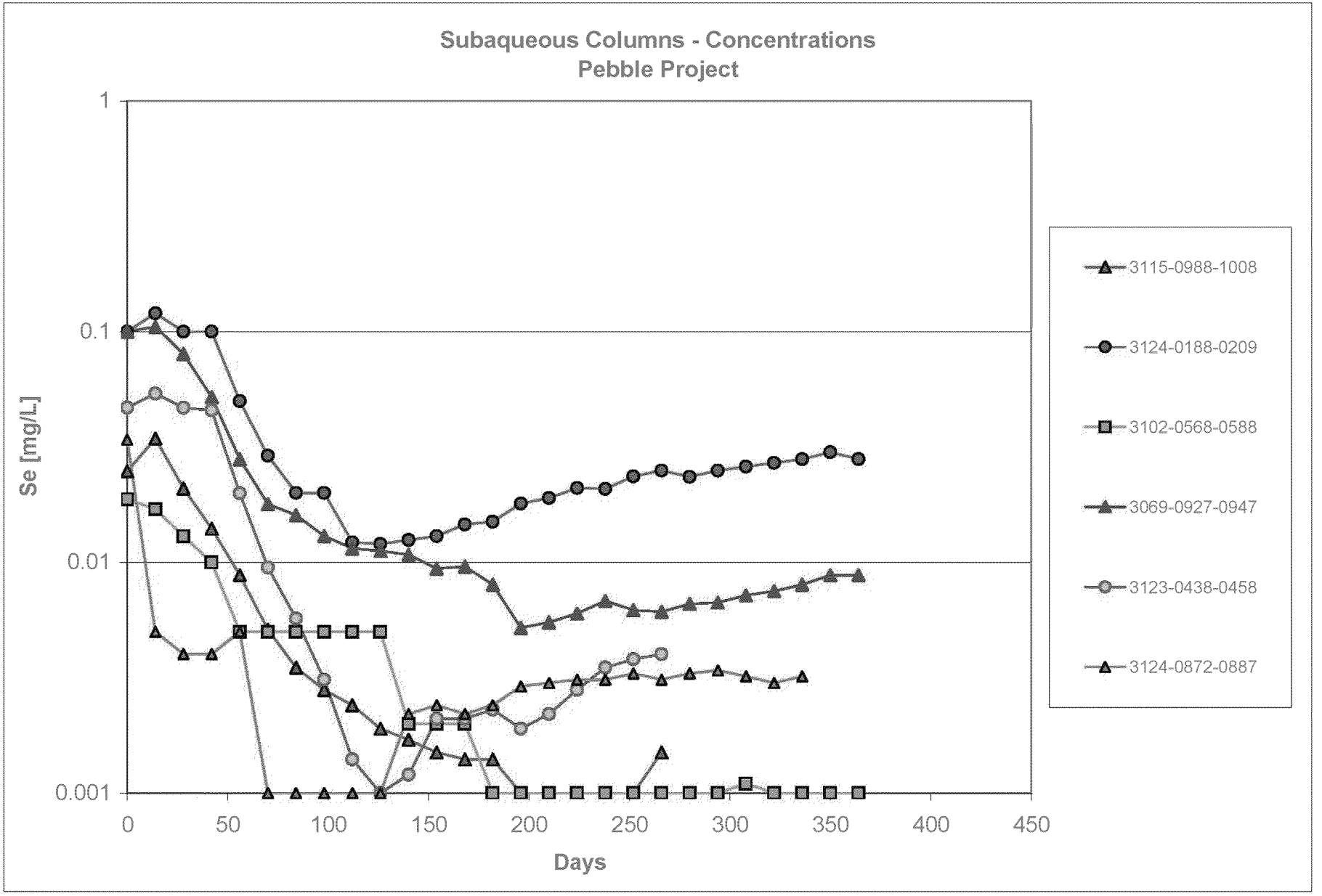

Subaqueous Columns - Concentrations
Pebble Project
Mo [mg/L]
1
0.1
0.01
0.001
0.0001
0.00001
0
50
100
150
200
250
300
350
400
450
Days
3115-0988-1008
3124-0188-0209
3102-0568-0588
3069-0927-0947
3123-0438-0458
3124-0872-0887



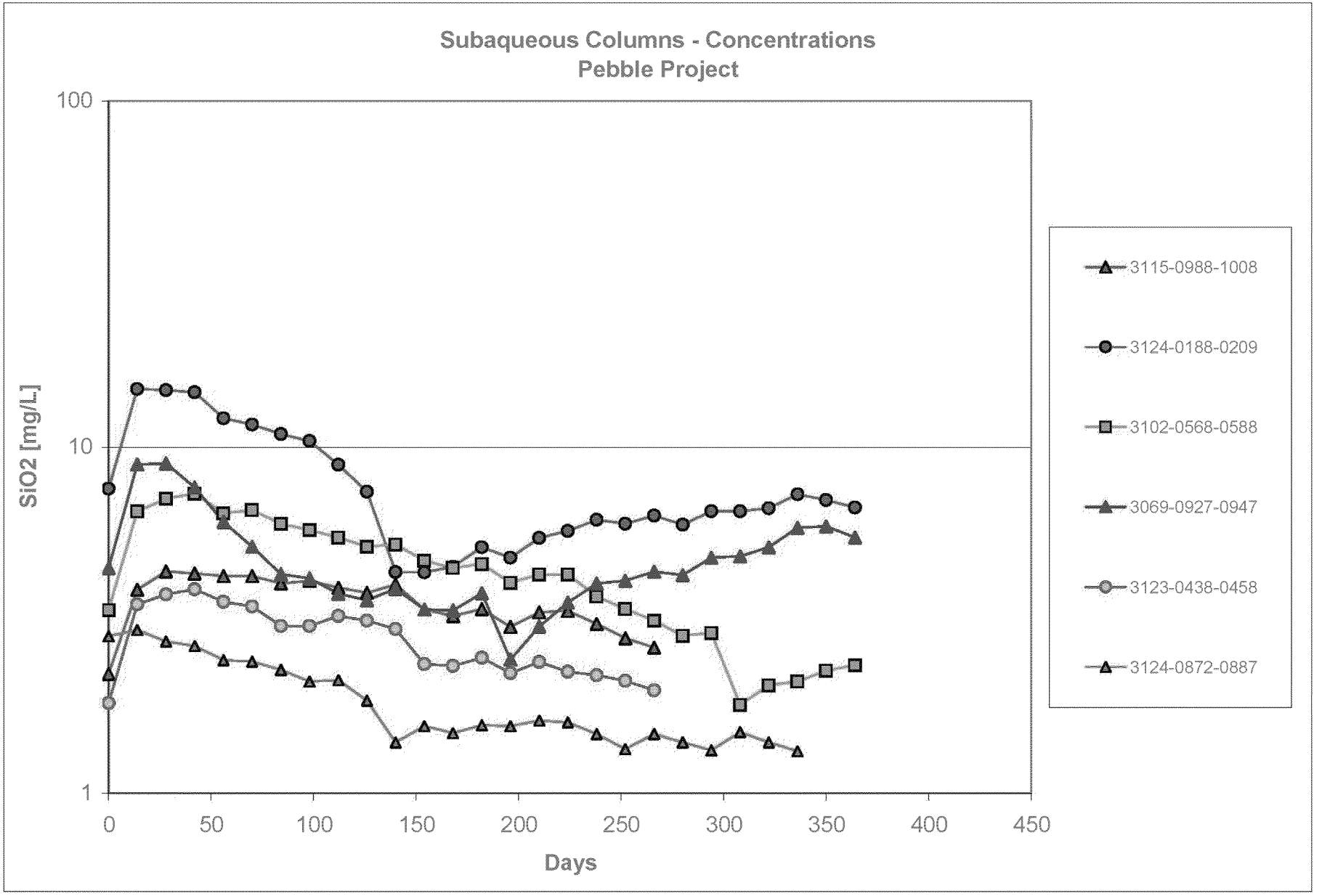
EPA-7609-0005804-0152



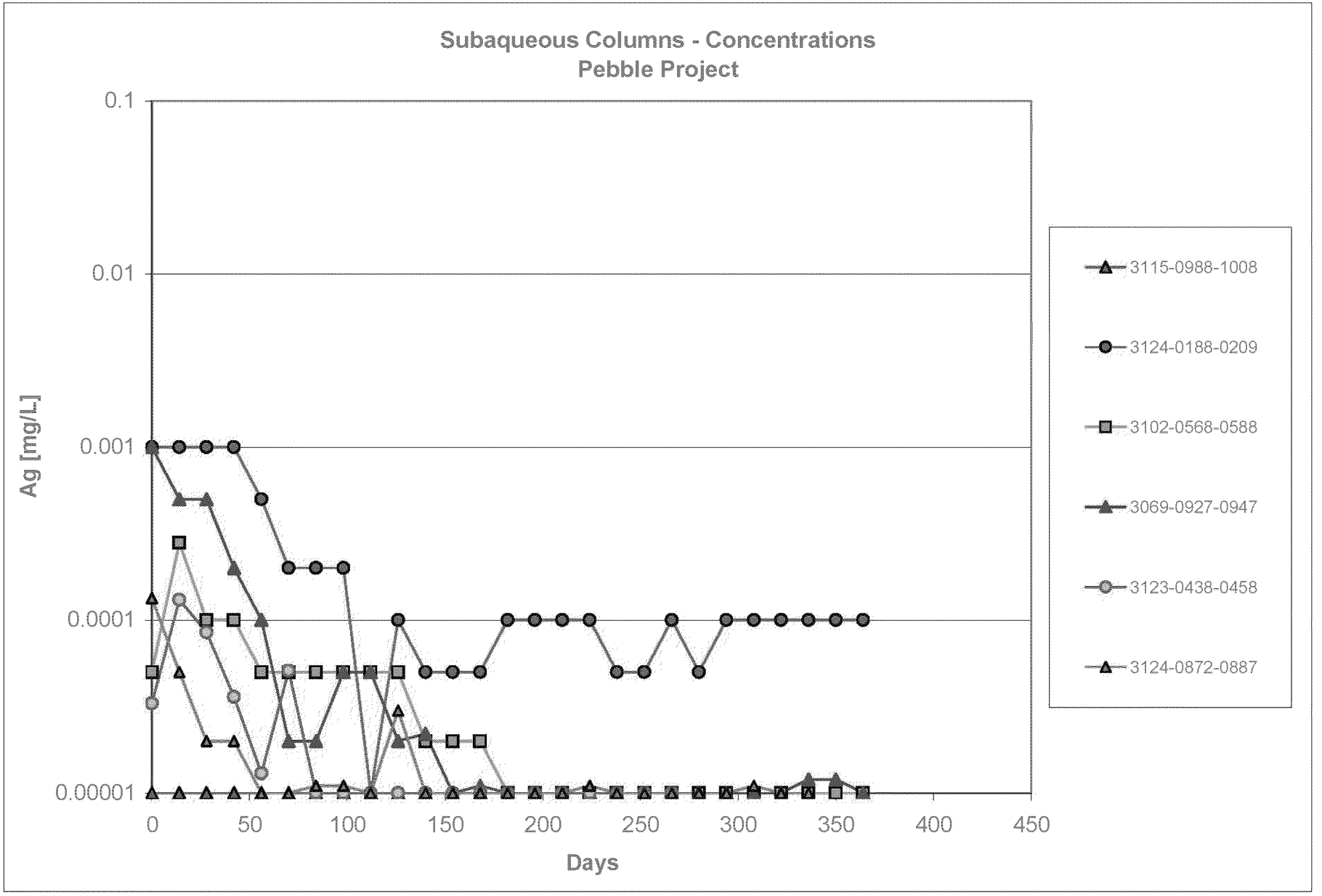
EPA-7609-0005804-0153



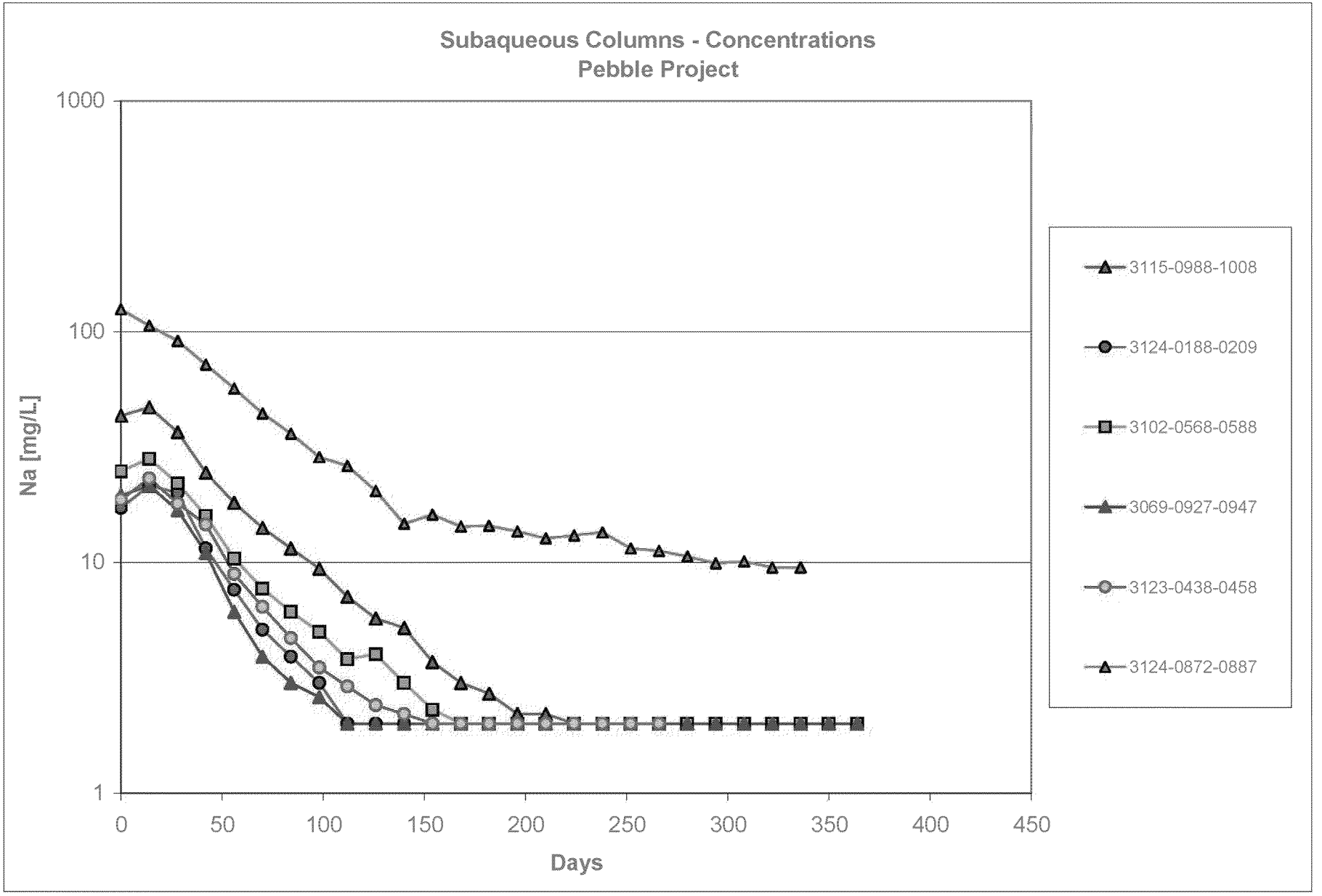
EPA-7609-0005804-0154



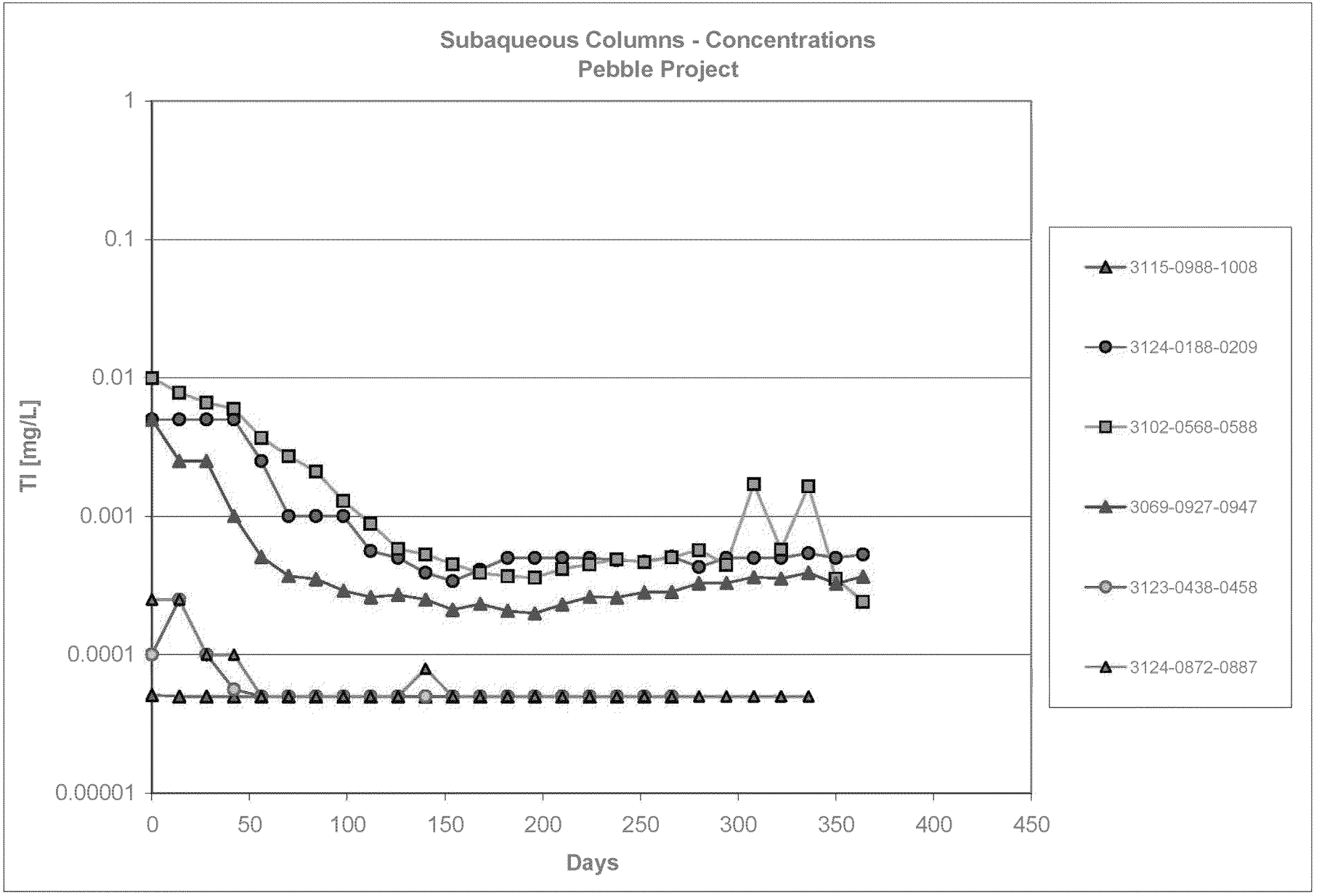
EPA-7609-0005804-0155



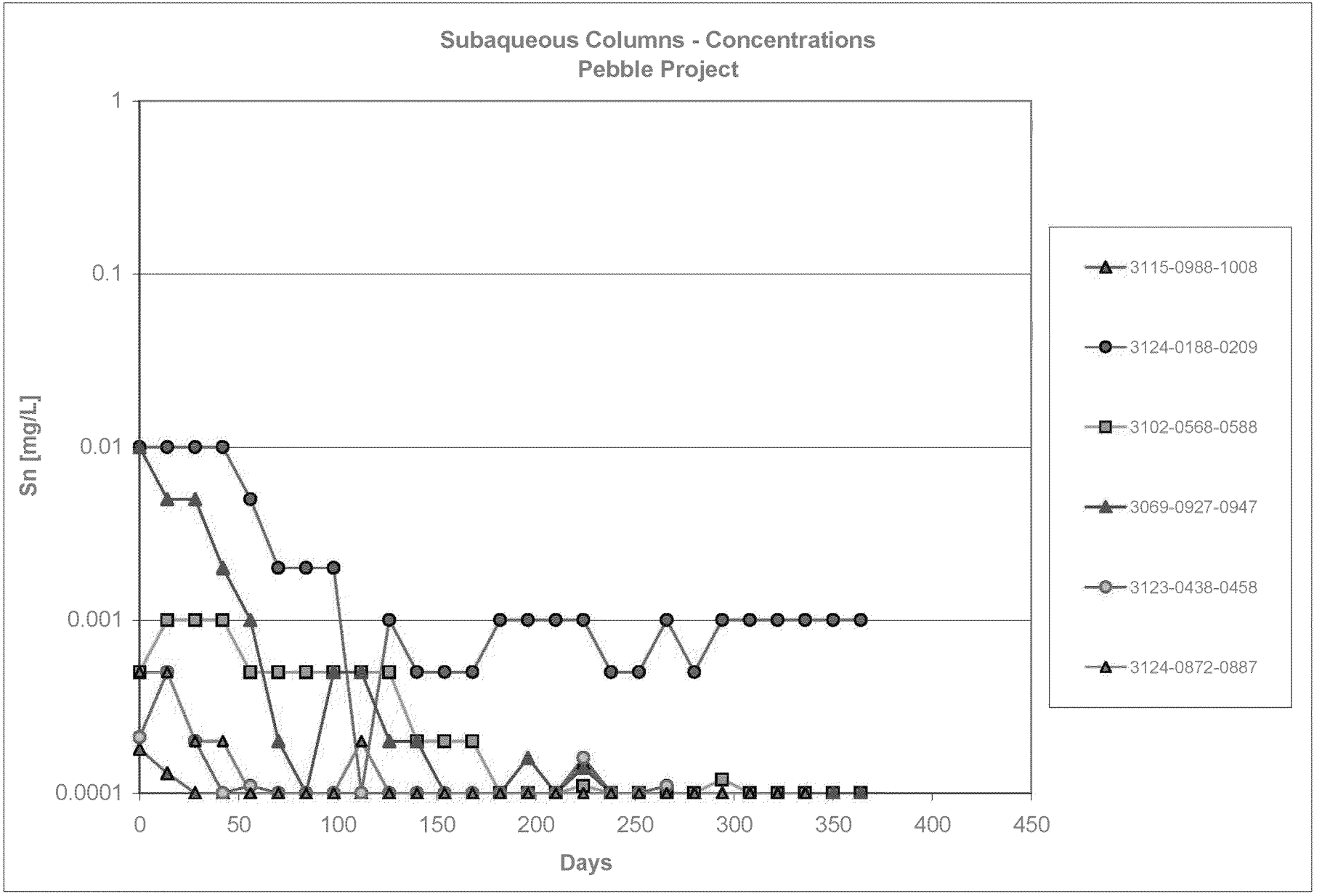
EPA-7609-0005804-0156



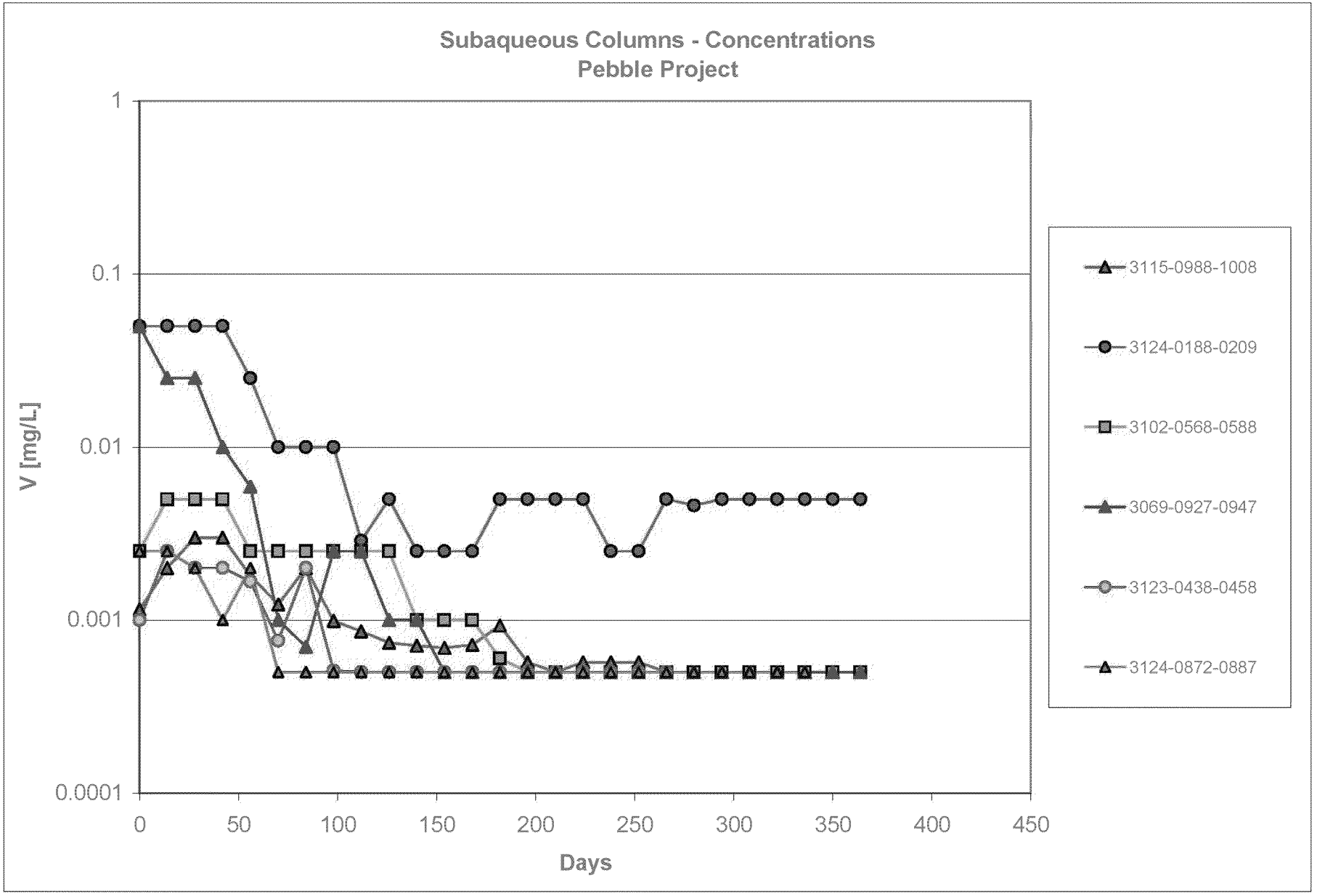
EPA-7609-0005804-0157



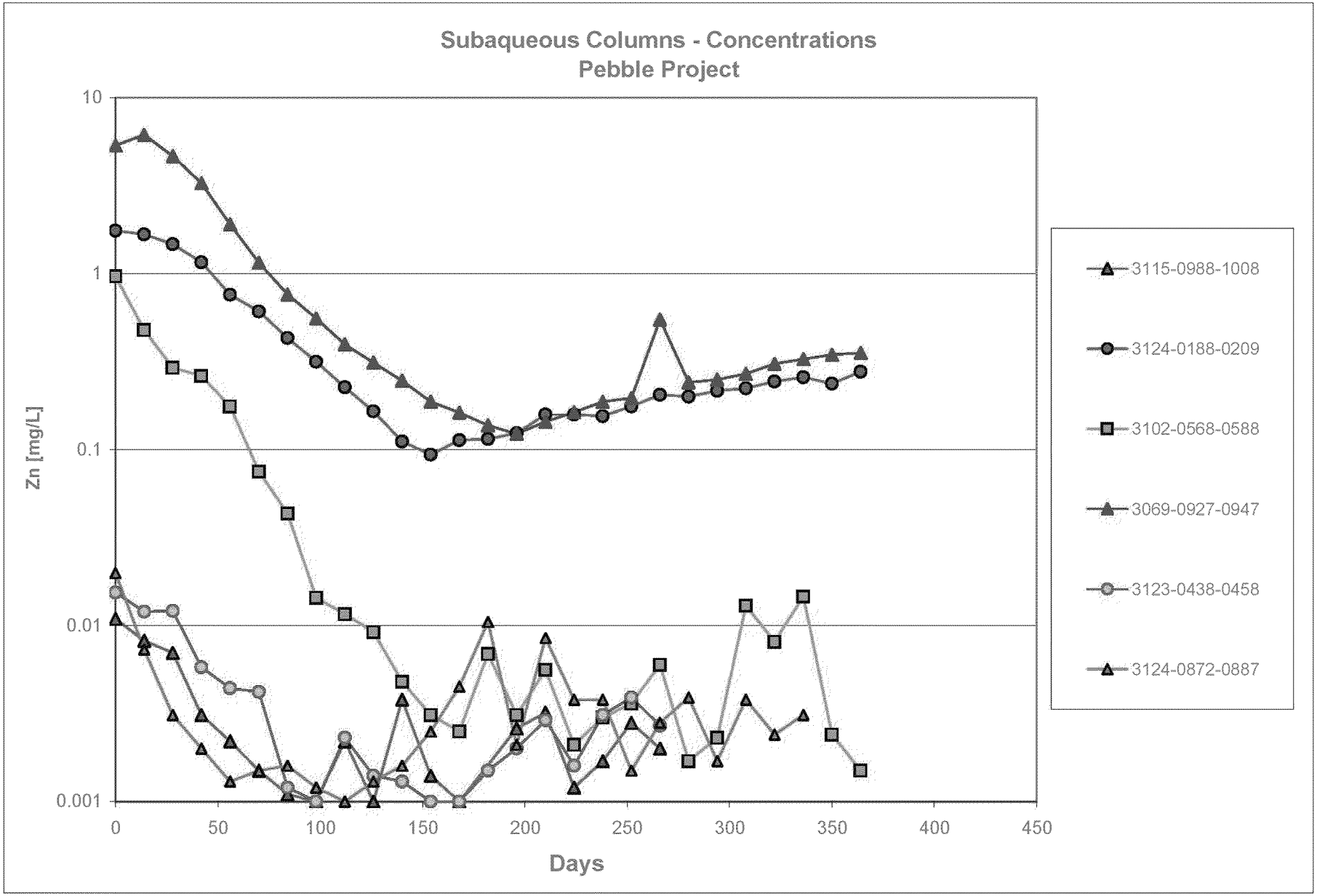
EPA-7609-0005804-0158



EPA-7609-0005804-0159

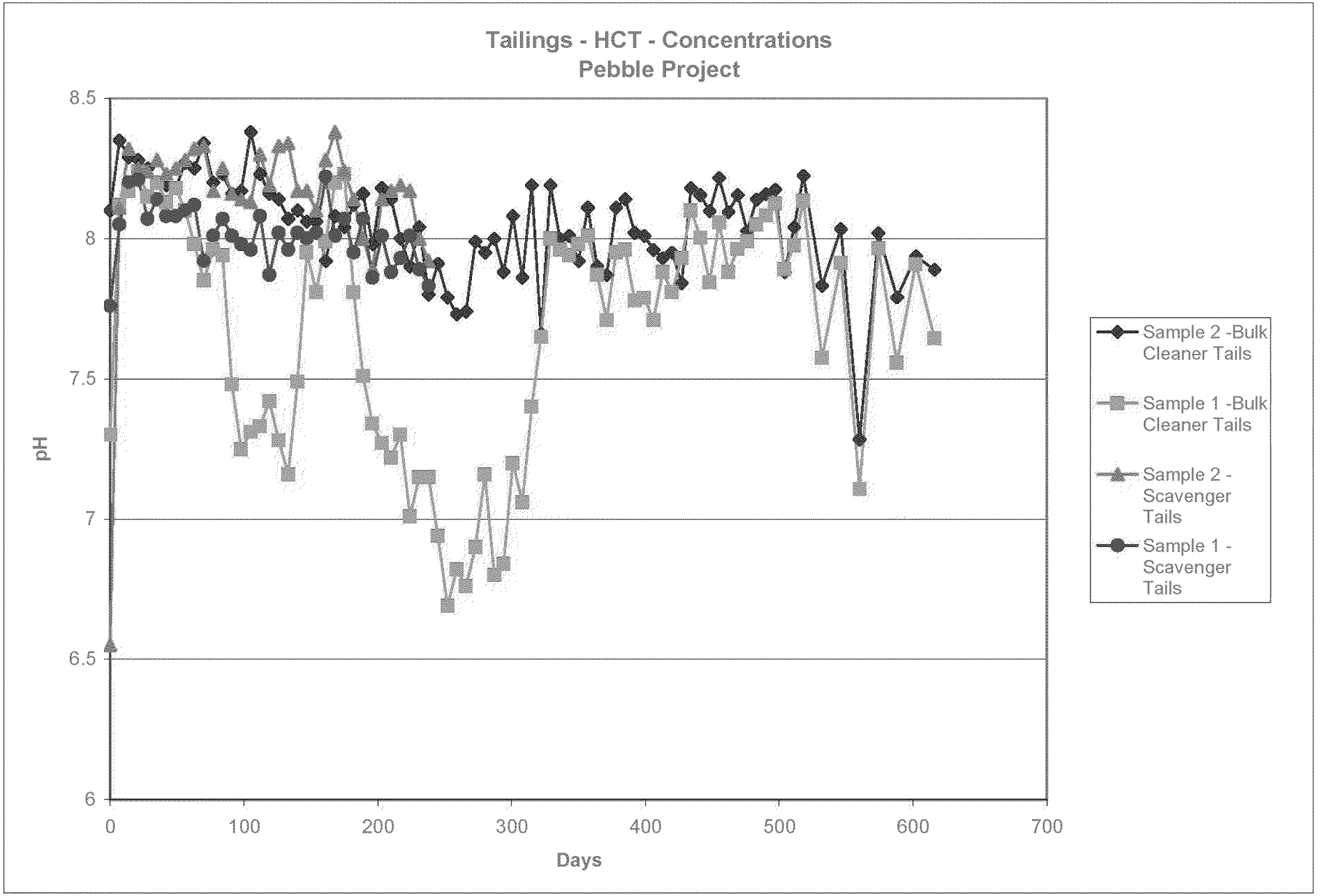


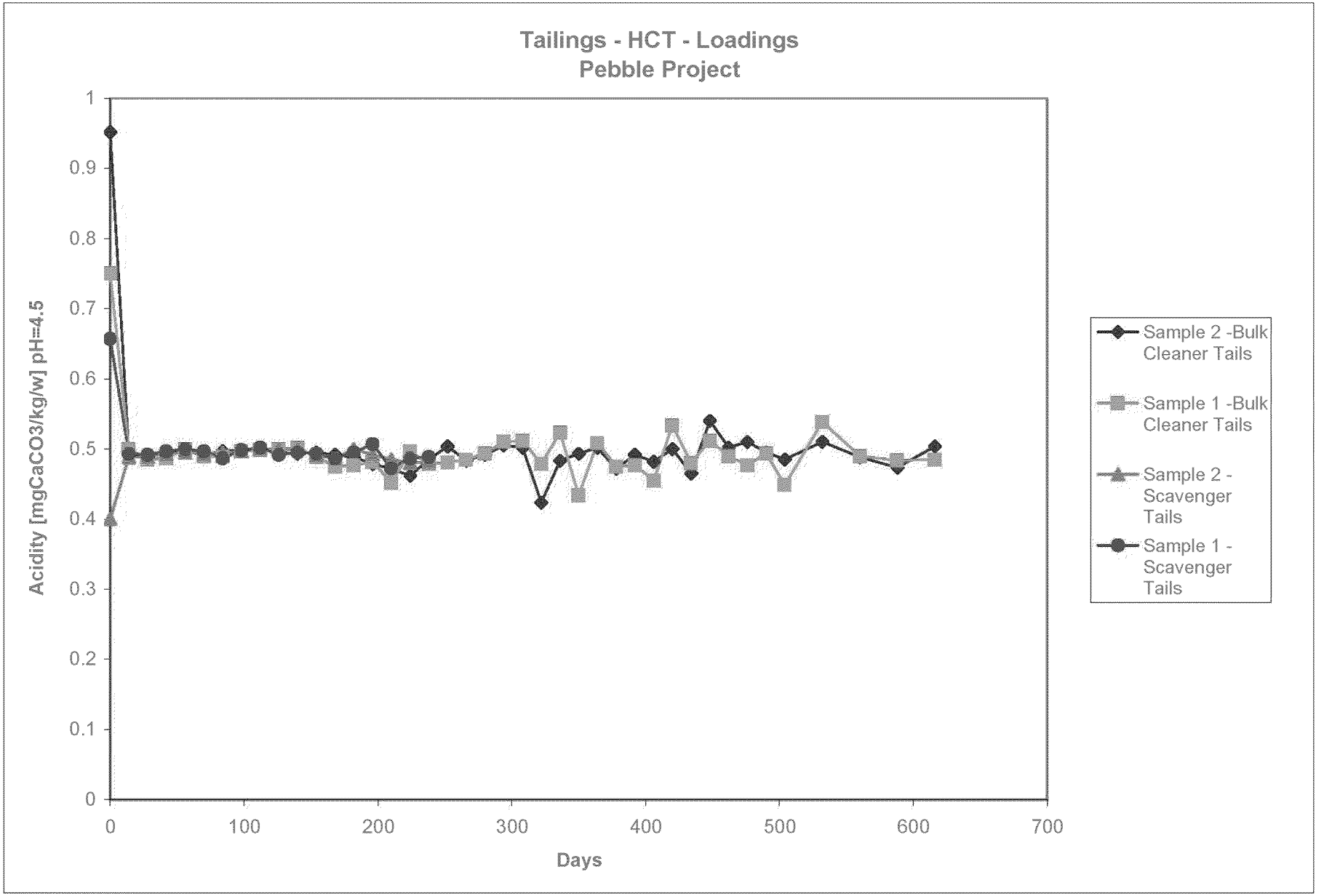
EPA-7609-0005804-0160

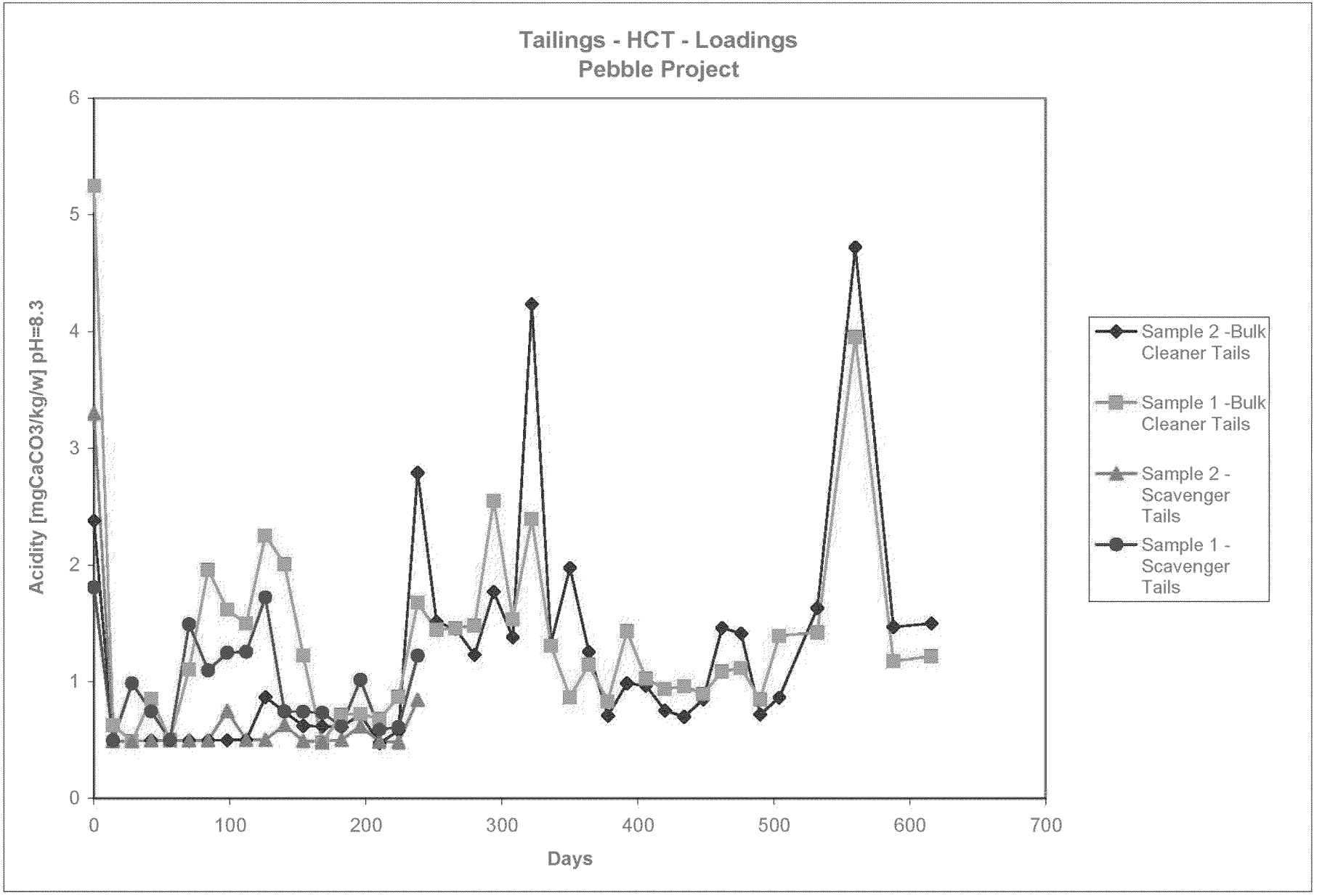


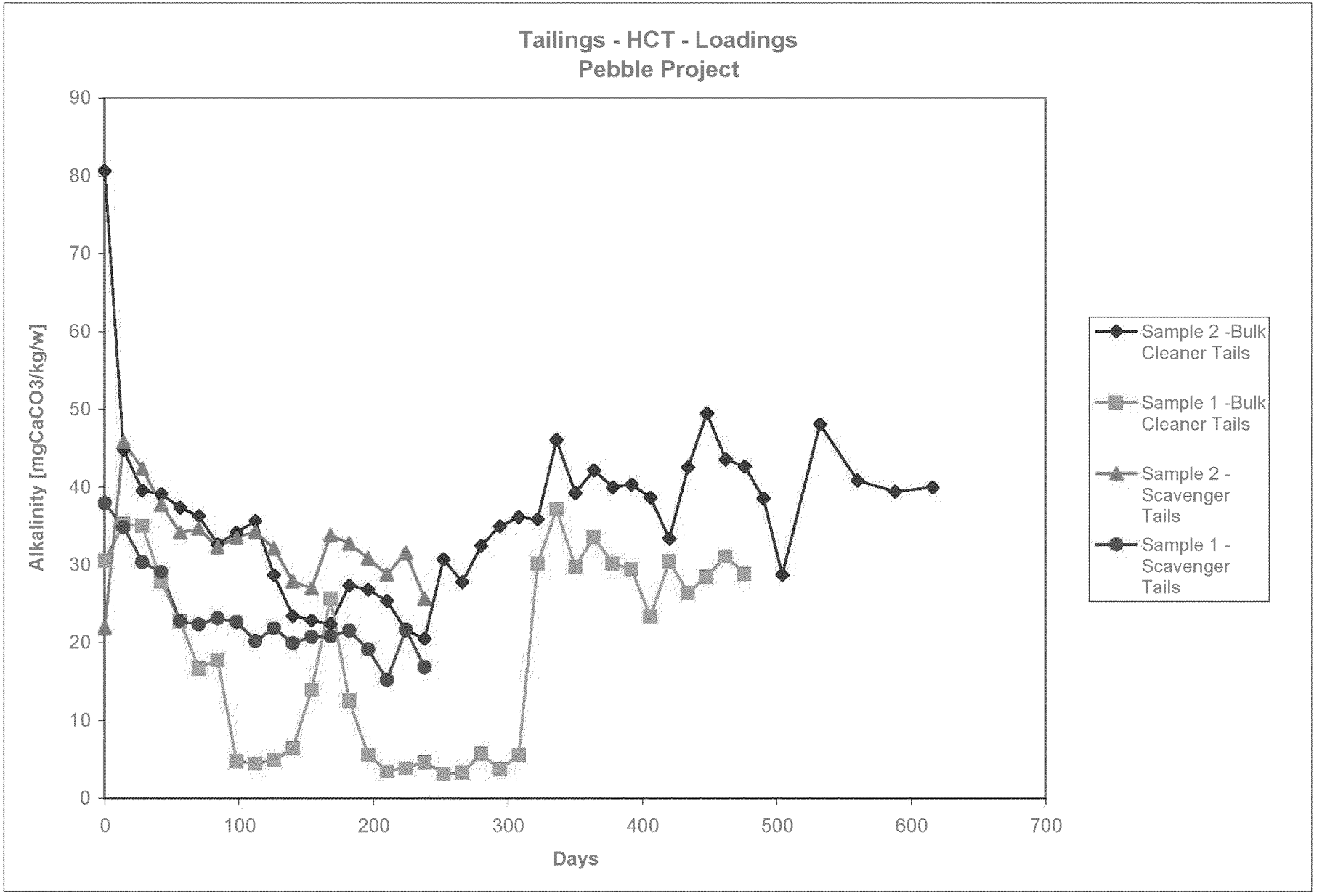
EPA-7609-0005804-0161

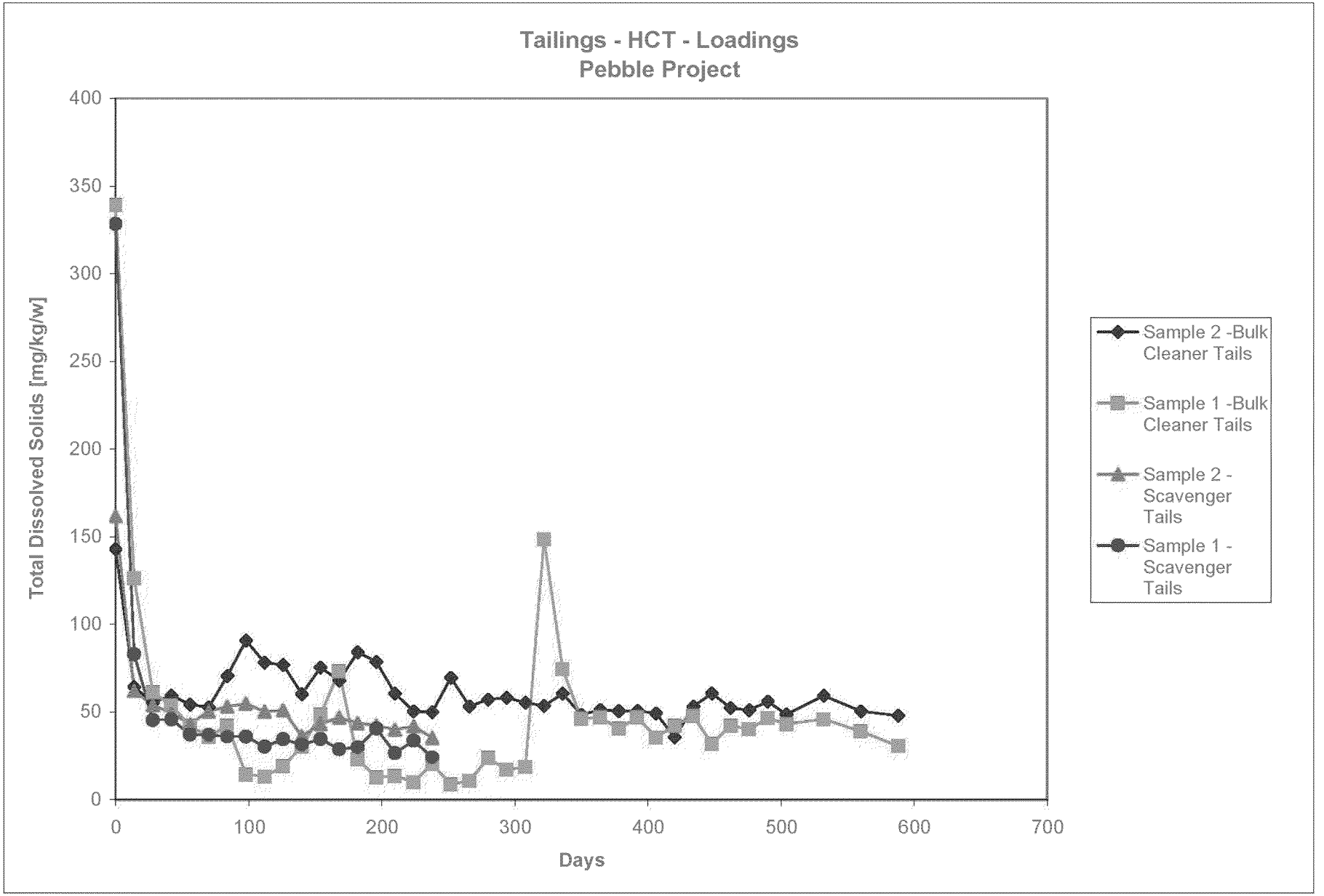
Attachment E
Graphs for Tailings Humidity Cells

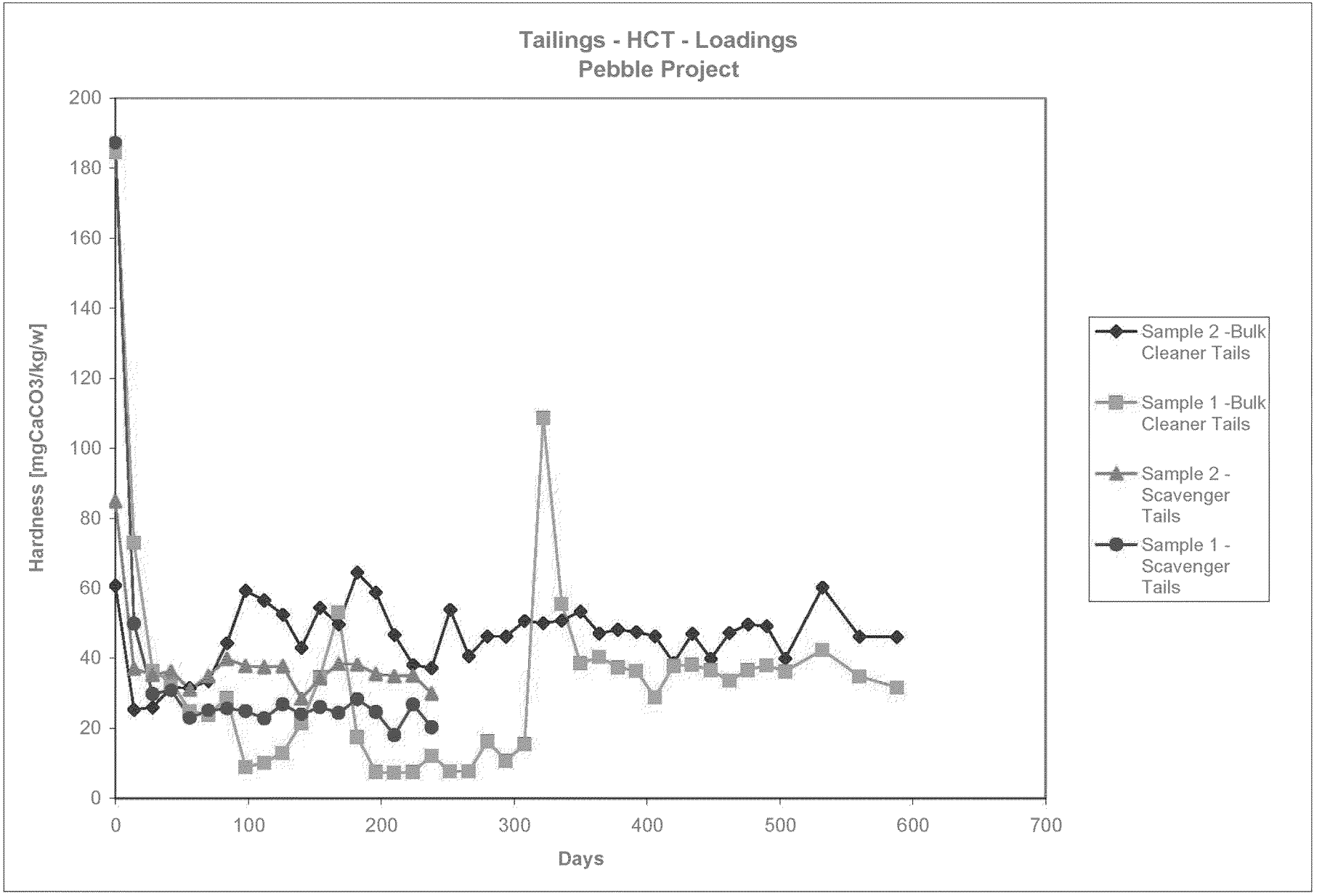

Tailings - HCT - Concentrations
Pebble Project
pH
8.5
8
7.5
7
6.5
6
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

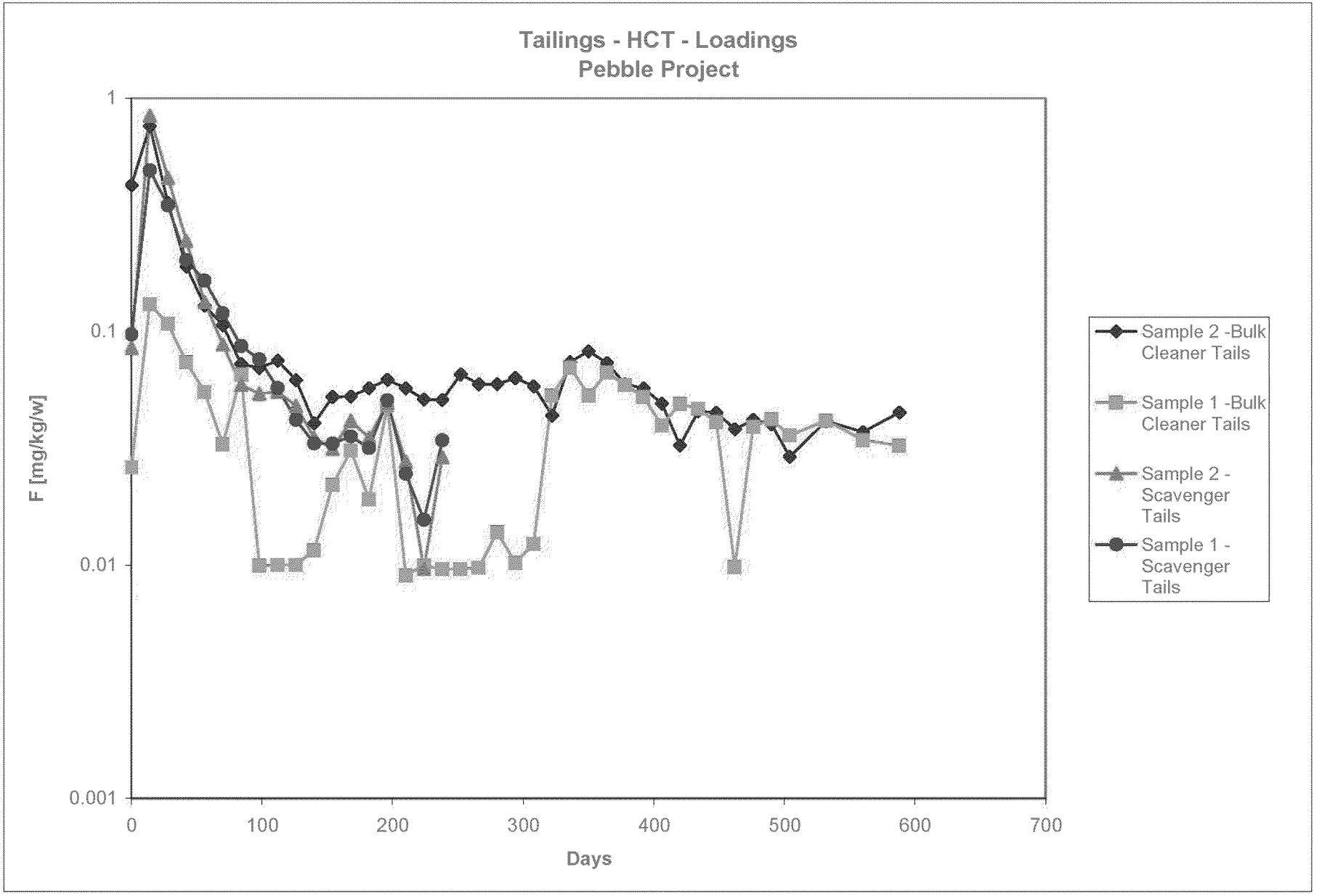

Tailings - HCT - Loadings
Pebble Project
Acidity [mgCaCO3/kg/w] pH=4.5
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

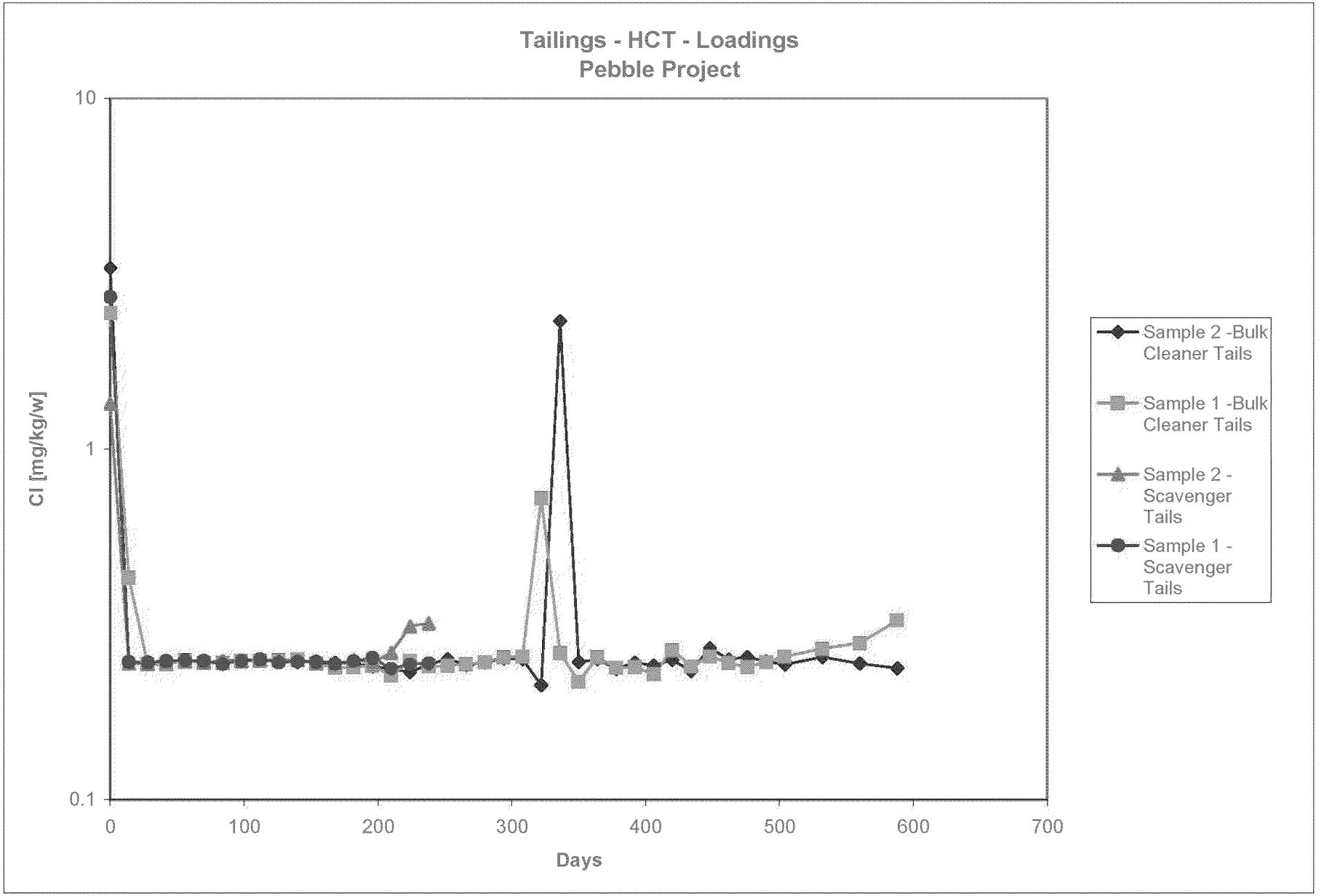

Tailings - HCT - Loadings
Pebble Project
Acidity [mgCaCO3/kg/w] pH=8.3
Days
0
1
2
3
4
5
6
0
100
200
300
400
500
600
700
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

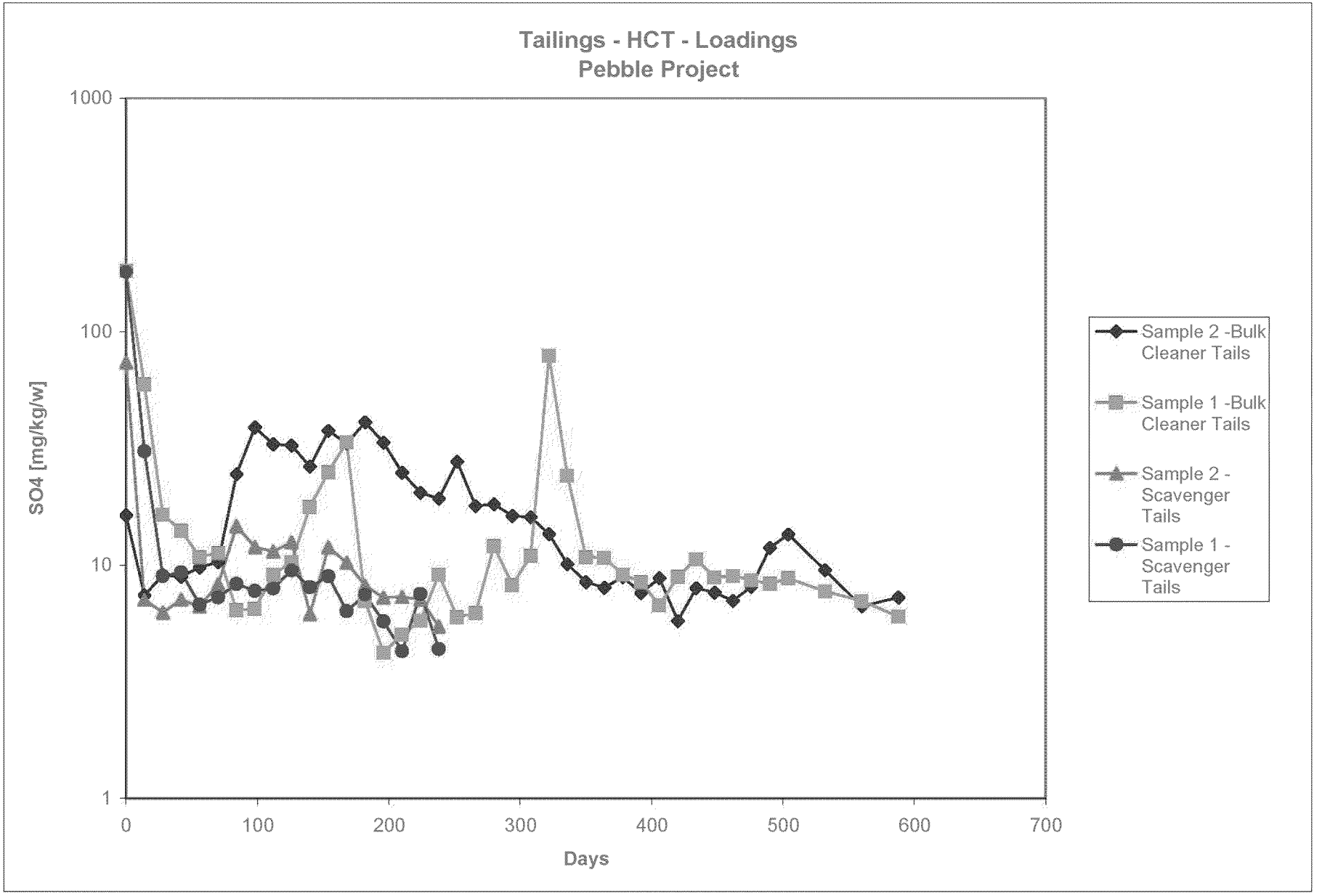

Tailings - HCT - Loadings
Pebble Project
Alkalinity [mgCaCO3/kg/w]
Days
0
10
20
30
40
50
60
70
80
90
0
100
200
300
400
500
600
700
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

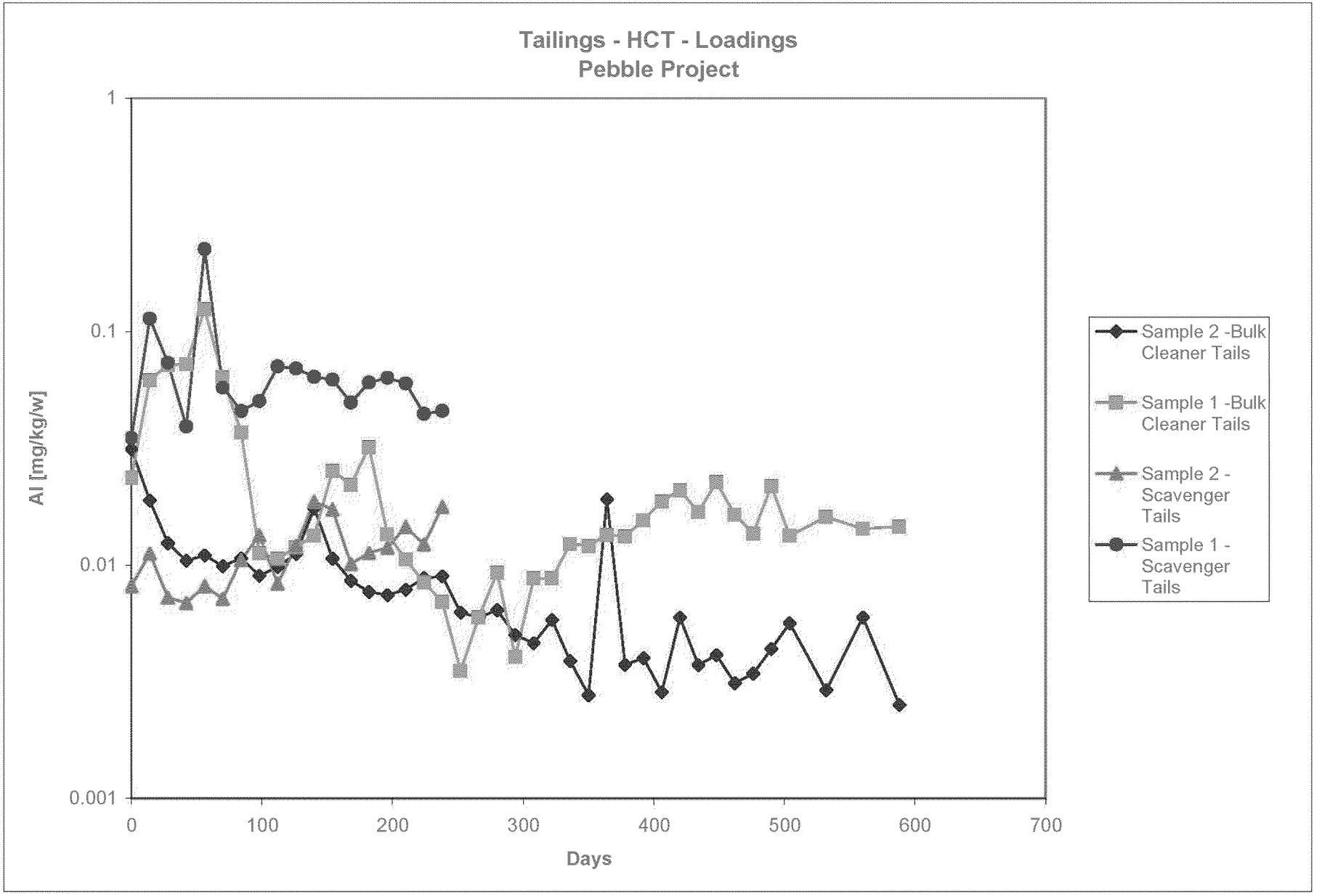

Tailings - HCT - Loadings
Pebble Project
Total Dissolved Solids [mg/kg/w]
400
350
300
250
200
150
100
50
0
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

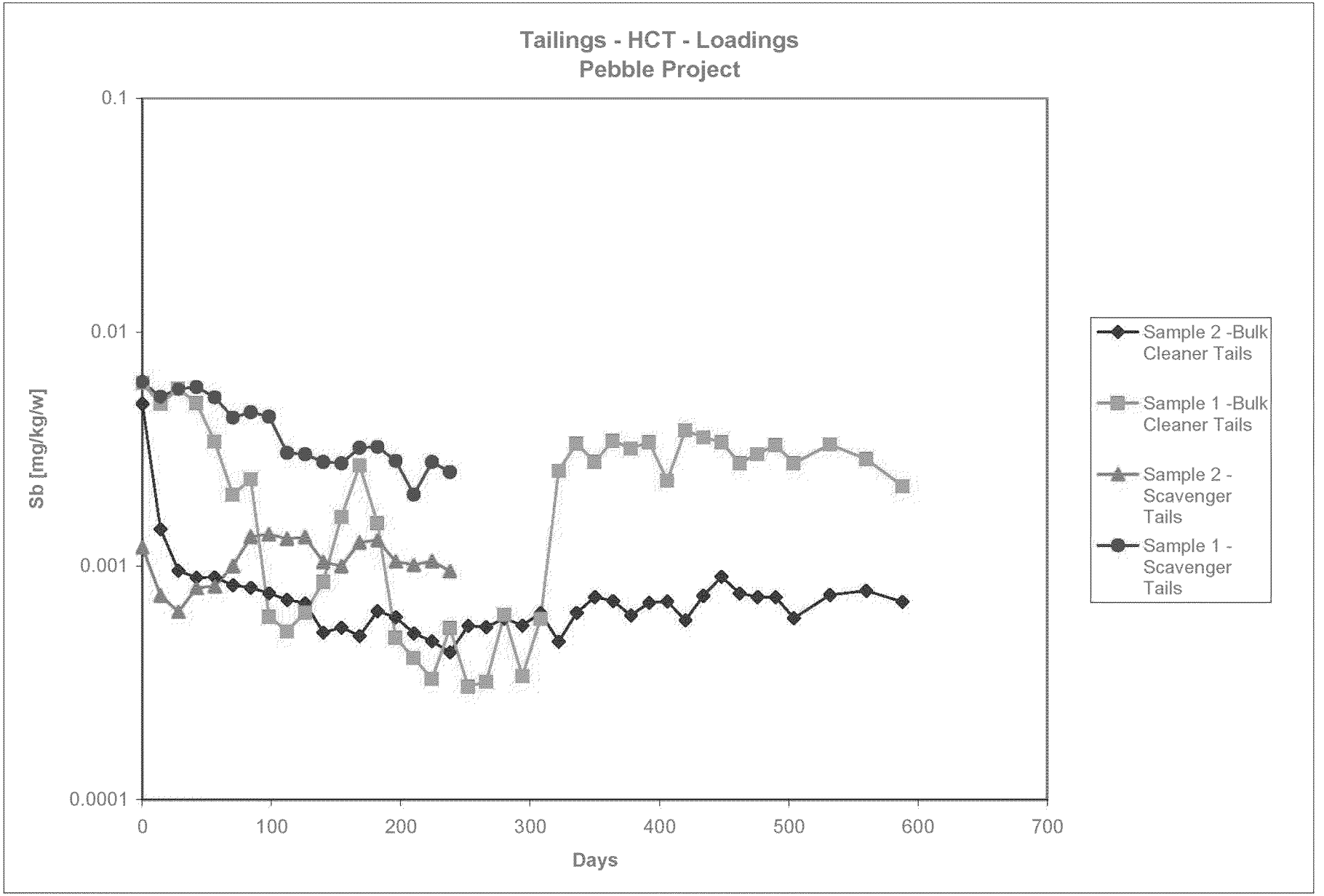

Tailings - HCT - Loadings
Pebble Project
Hardness [mgCaCO3/kg/w]
200
180
160
140
120
100
80
60
40
20
0
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

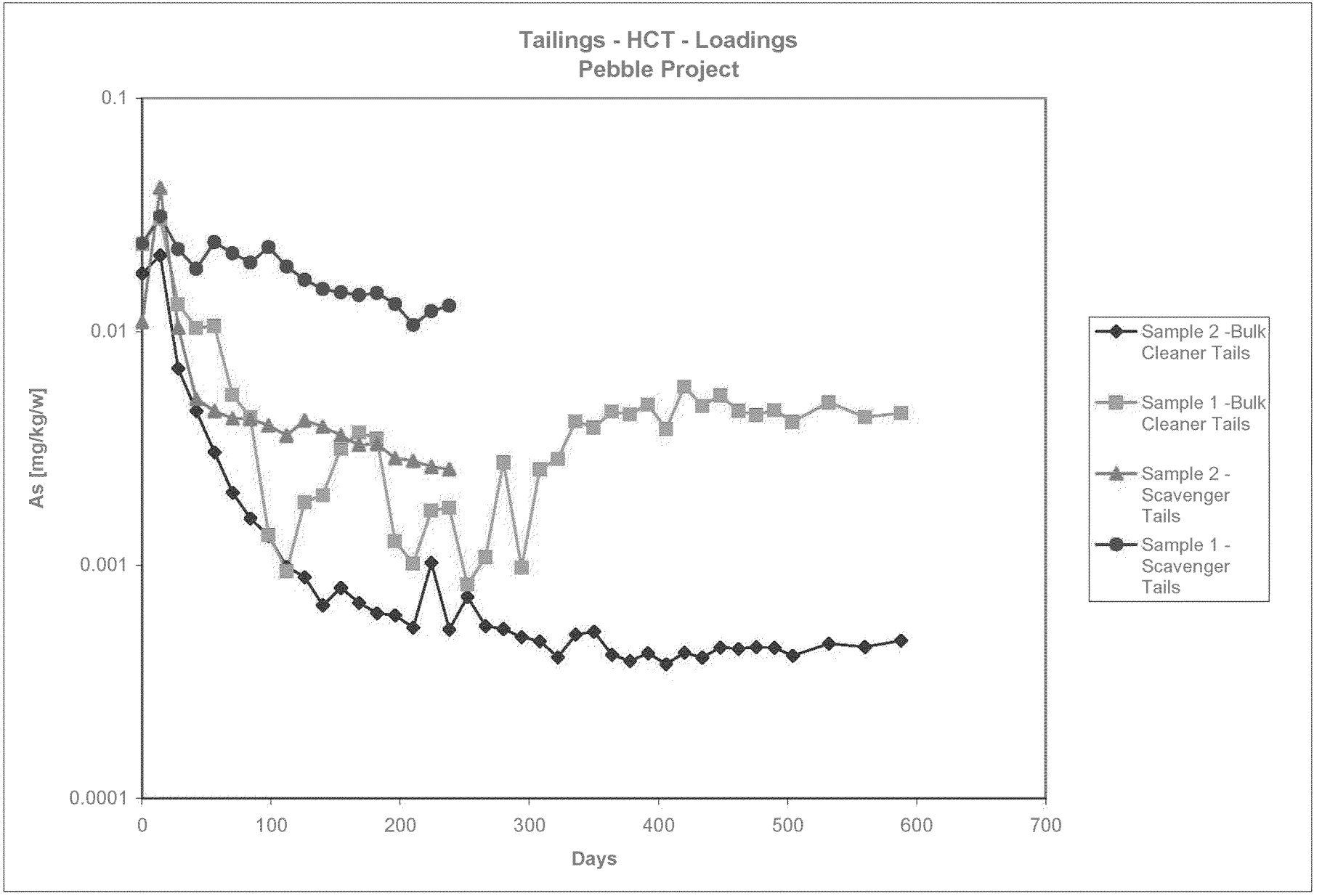

Tailings - HCT - Loadings
Pebble Project
F [mg/kg/w]
1
0.1
0.01
0.001
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

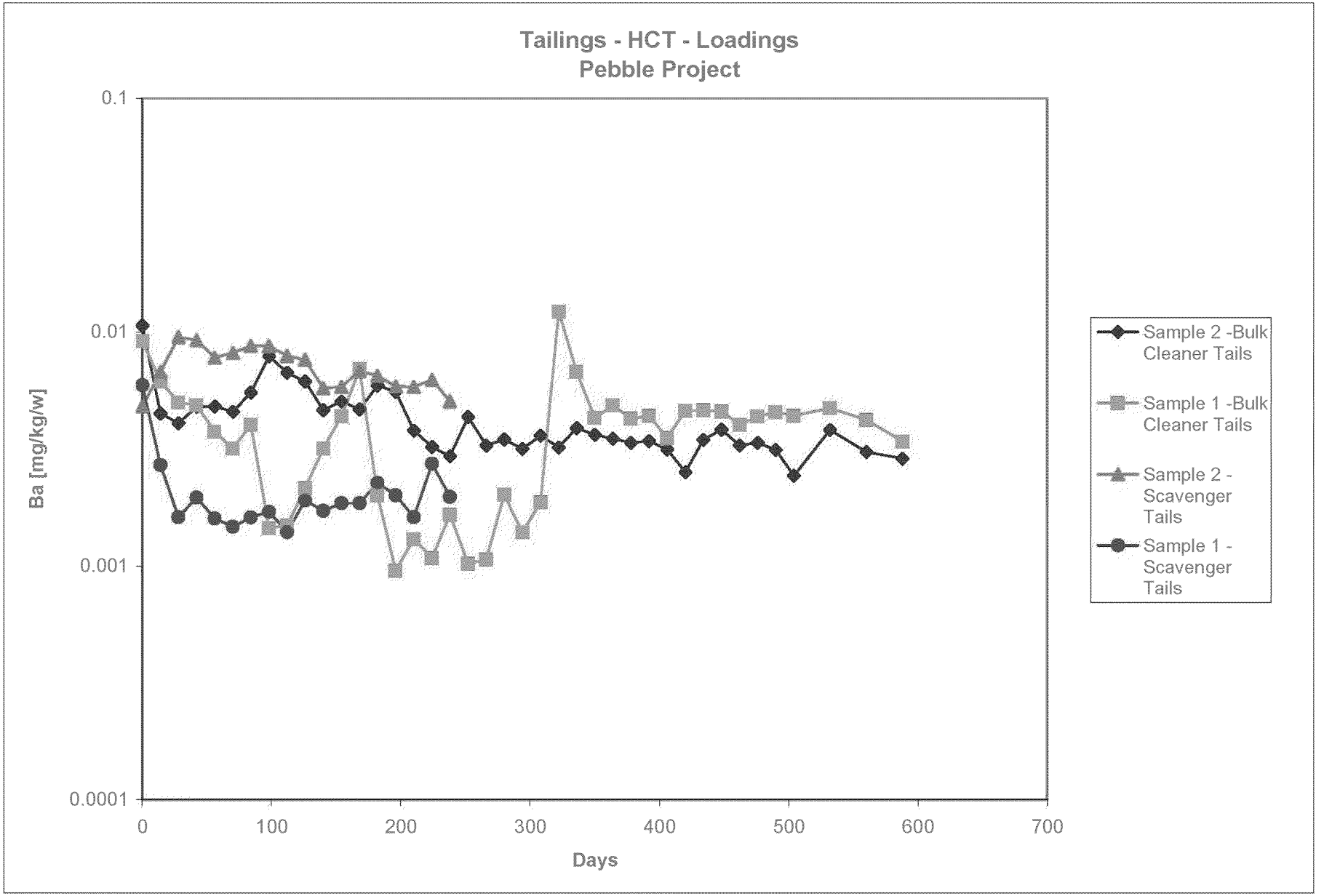

Tailings - HCT - Loadings
Pebble Project
Cl [mg/kg/w]
10
1
0.1
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

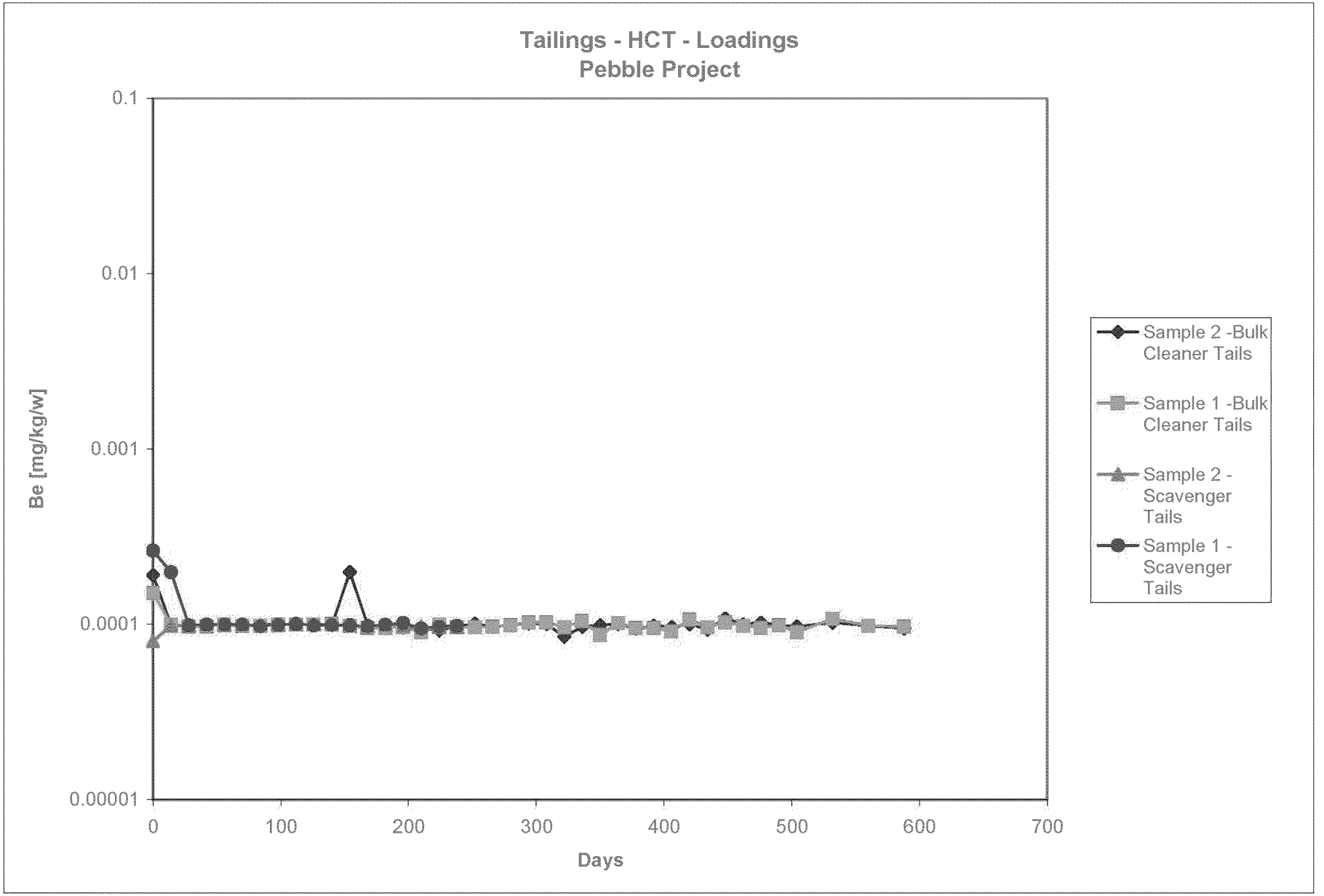

Tailings - HCT - Loadings
Pebble Project
SO4 [mg/kg/w]
1000
100
10
1
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

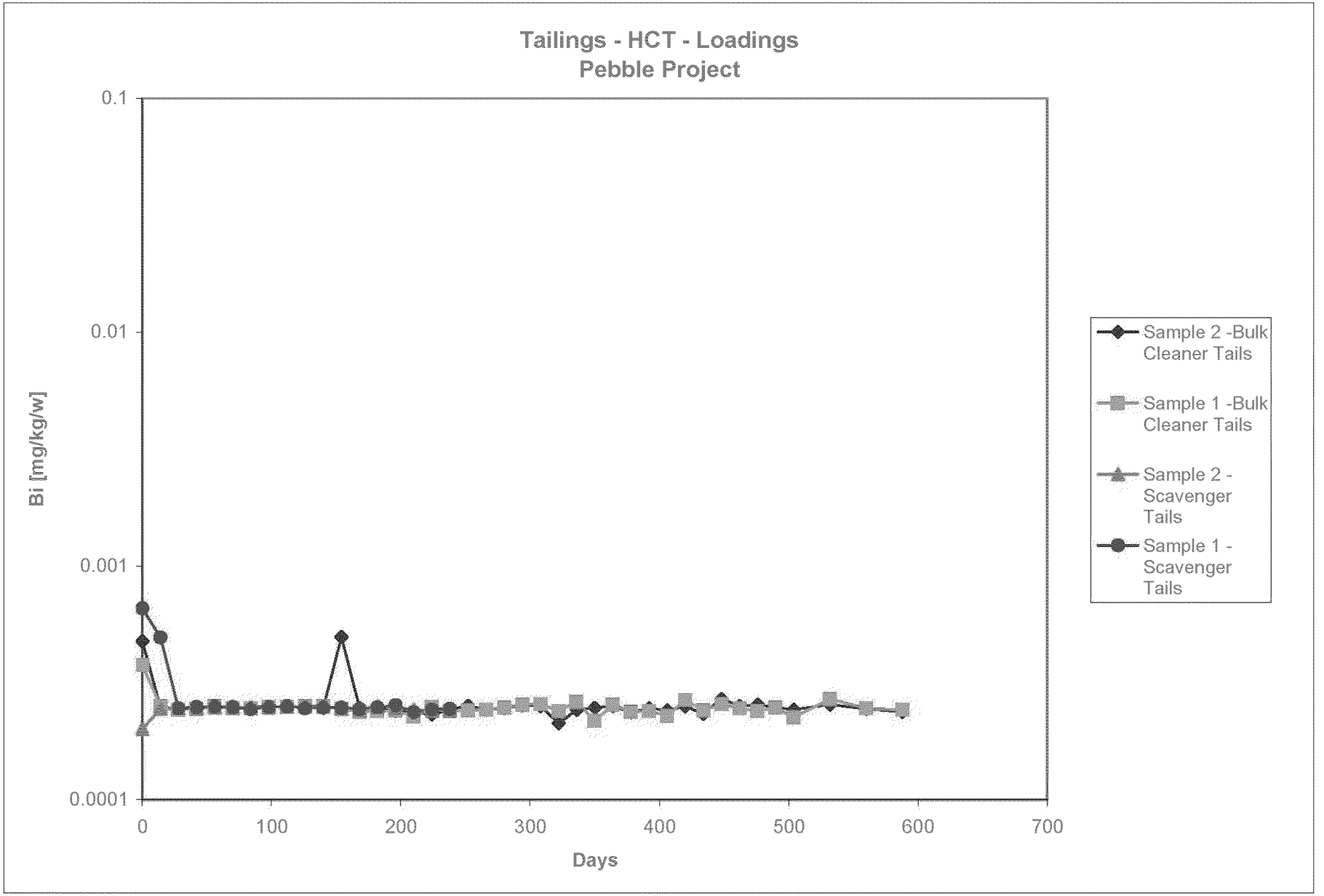

Tailings - HCT - Loadings
Pebble Project
Al [mg/kg/w]
1
0.1
0.01
0.001
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

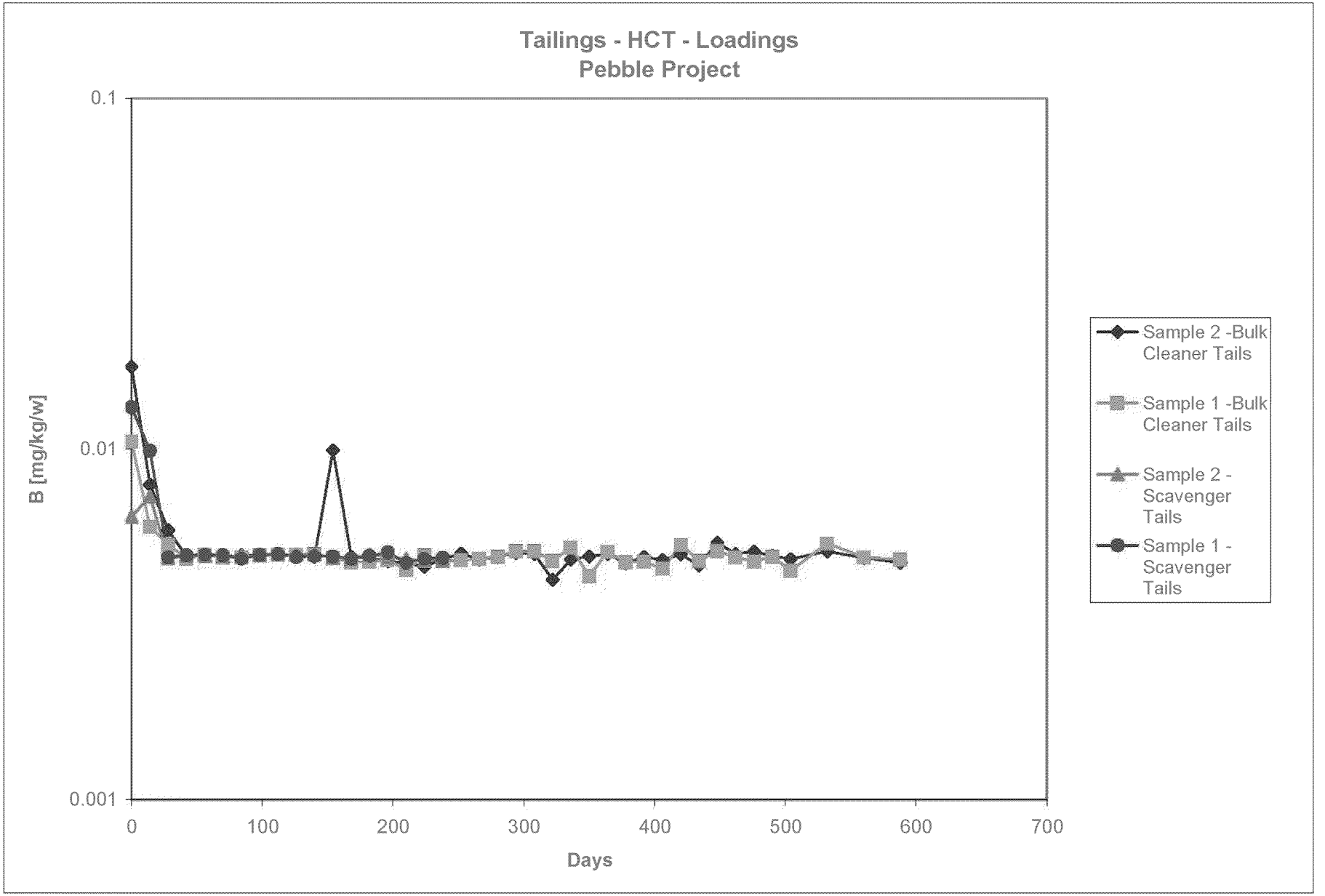

Tailings - HCT - Loadings
Pebble Project
Sb [mg/kg/w]
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

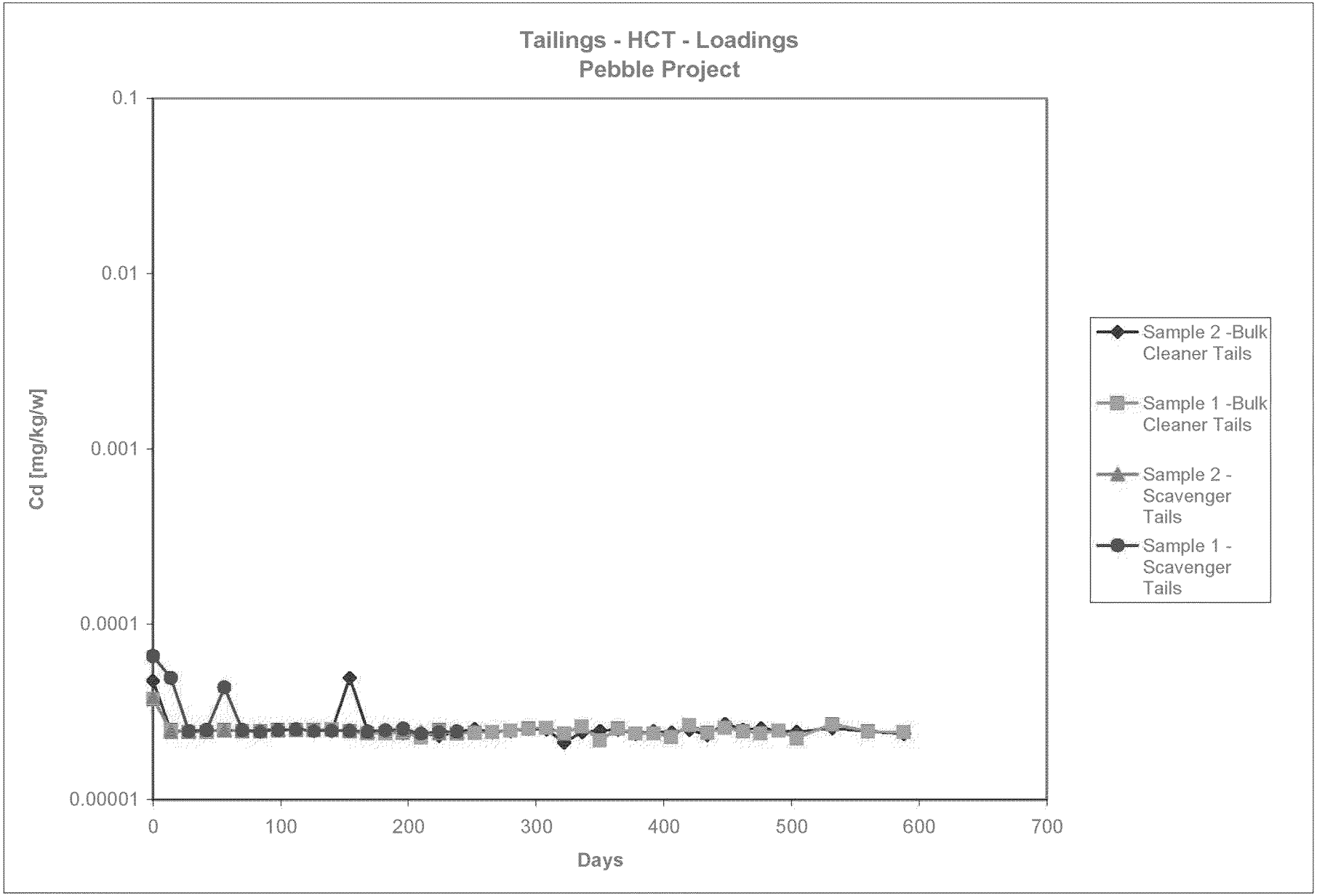

Tailings - HCT - Loadings
Pebble Project
0.1
0.01
0.001
0.0001
As [mg/kg/w]
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

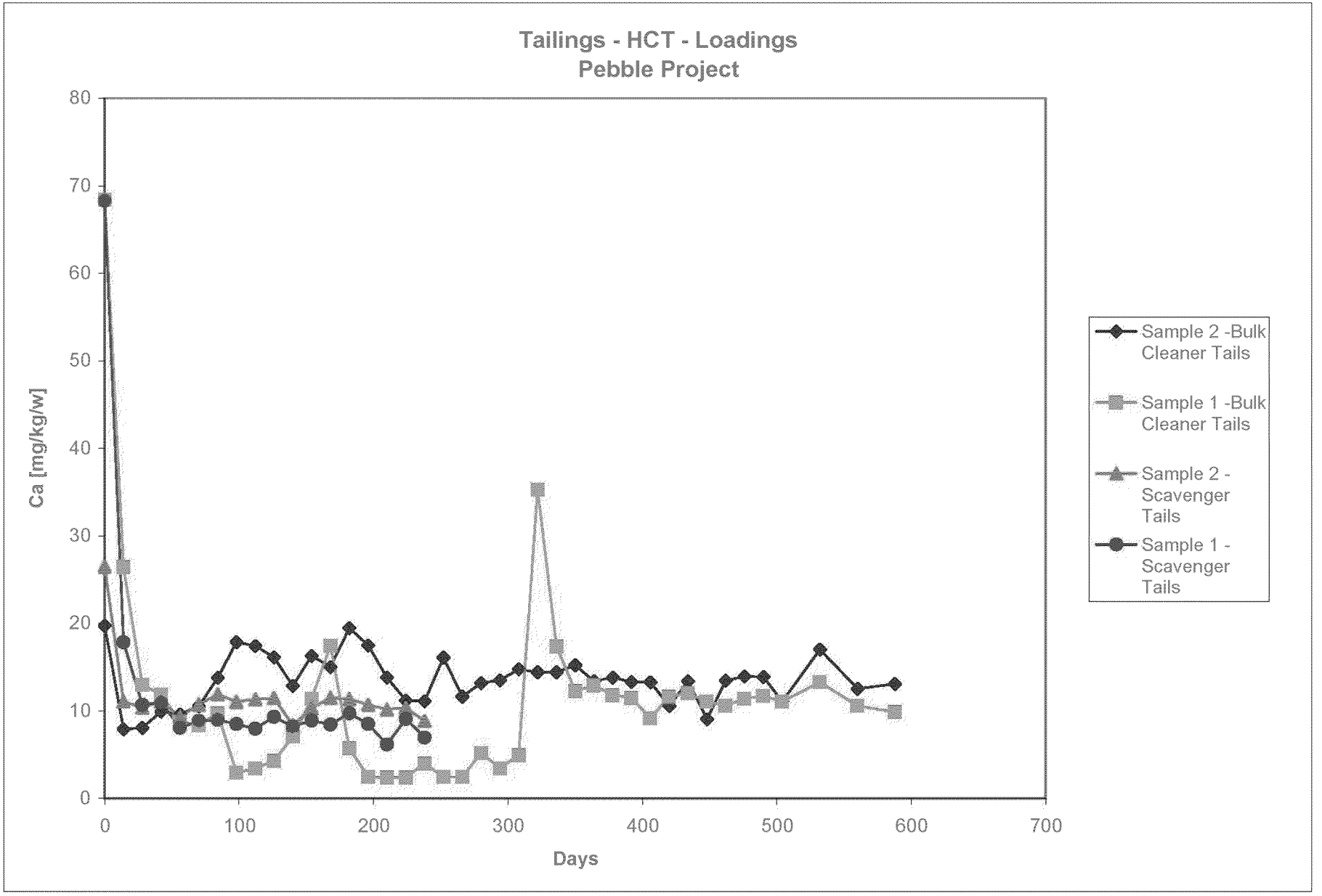

Tailings - HCT - Loadings
Pebble Project
0.1
0.01
0.001
0.0001
Ba [mg/kg/w]
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

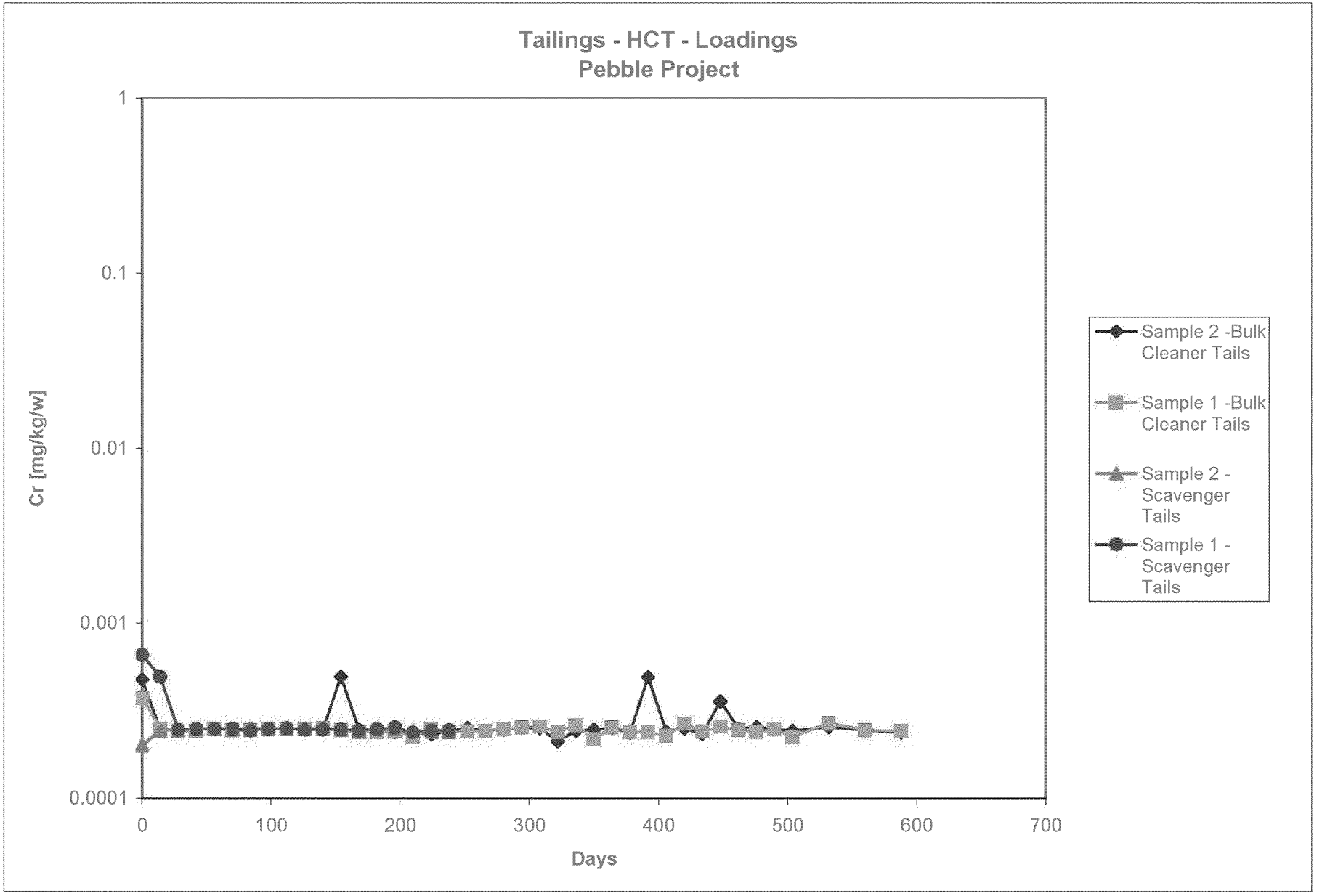

Tailings - HCT - Loadings
Pebble Project
Be [mg/kg/w]
0.1
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

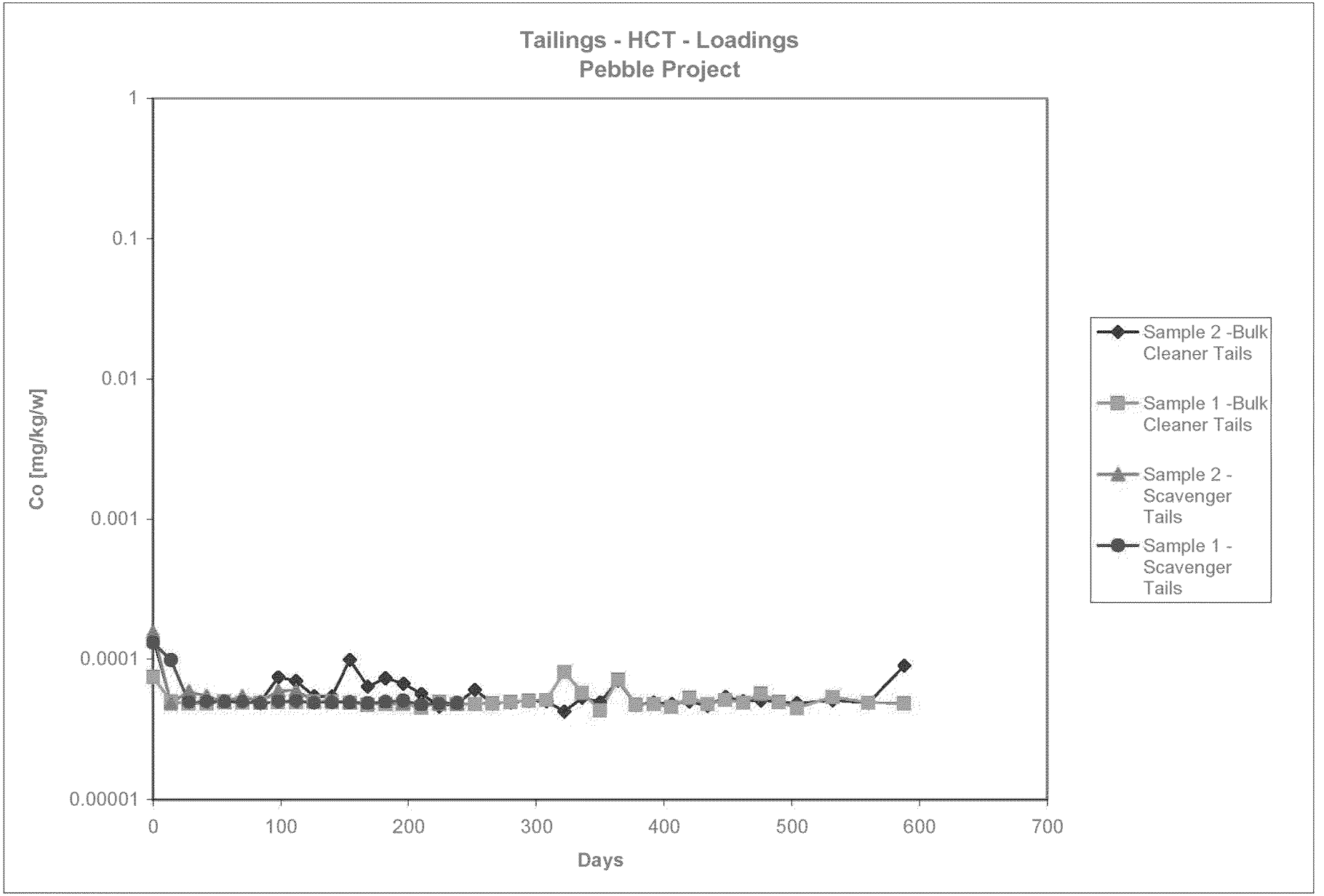

Tailings - HCT - Loadings
Pebble Project
Bi [mg/kg/w]
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

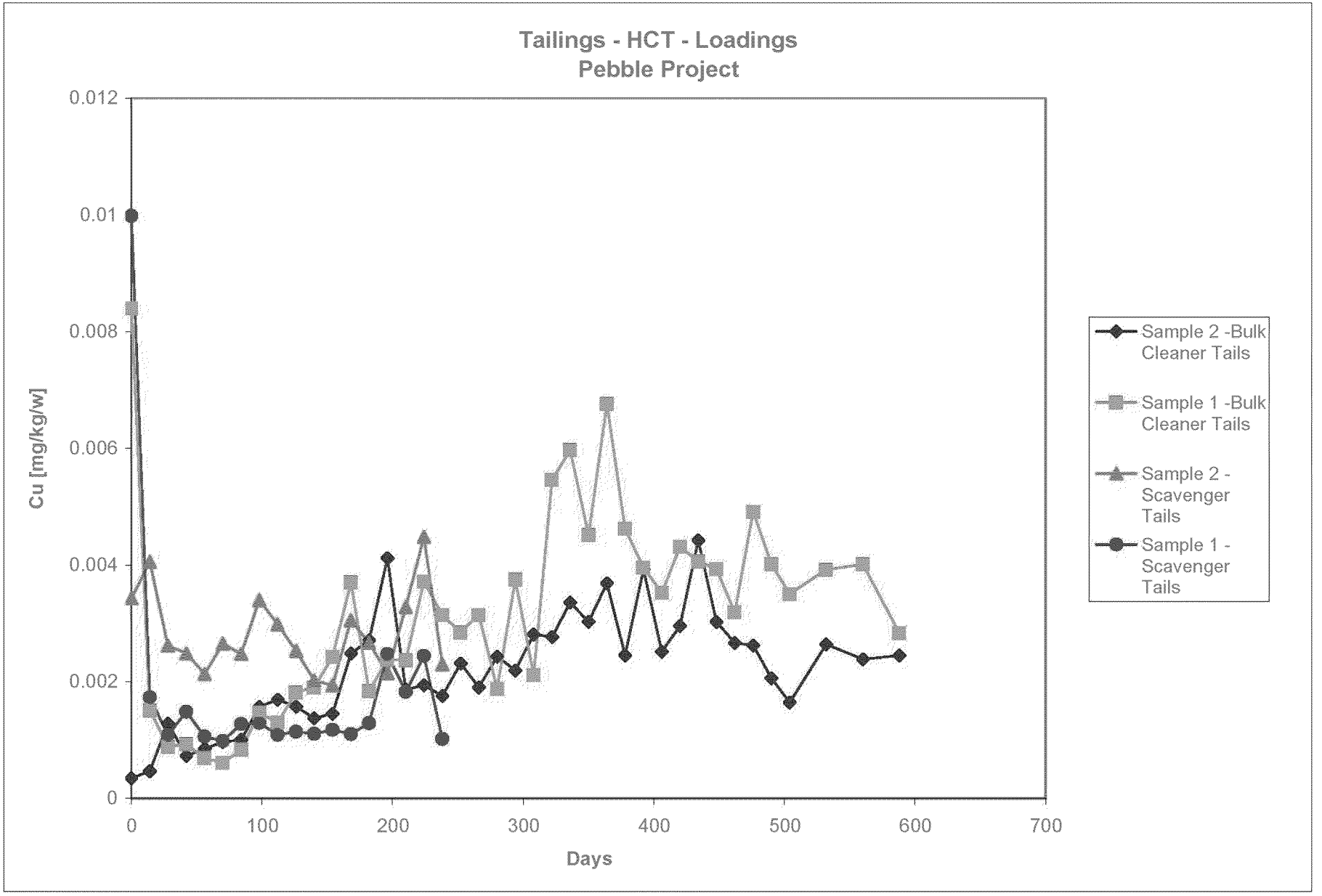

Tailings - HCT - Loadings
Pebble Project
0.1
0.01
0.001
B [mg/kg/w]
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

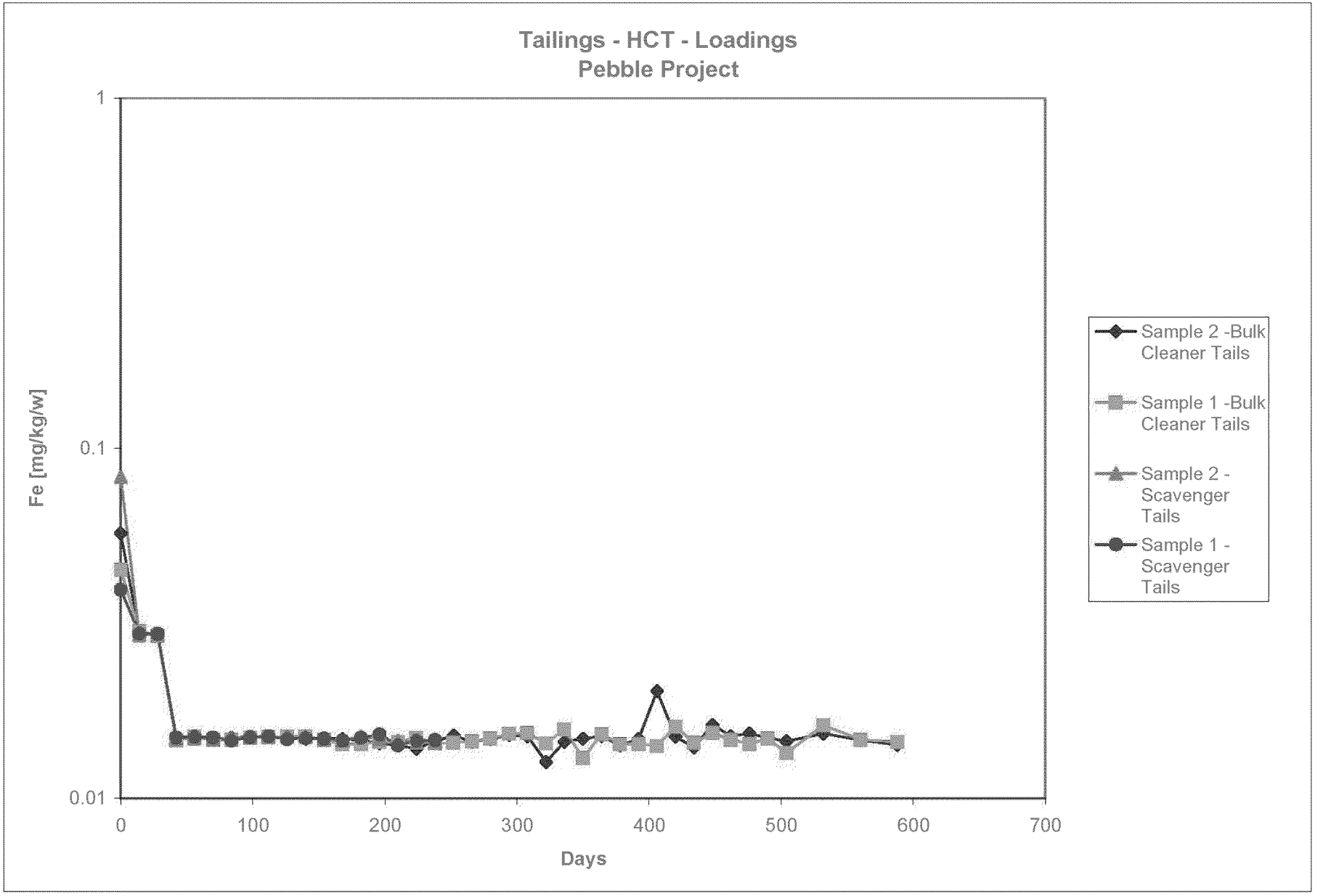

Tailings - HCT - Loadings
Pebble Project
Cd [mg/kg/w]
0.1
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

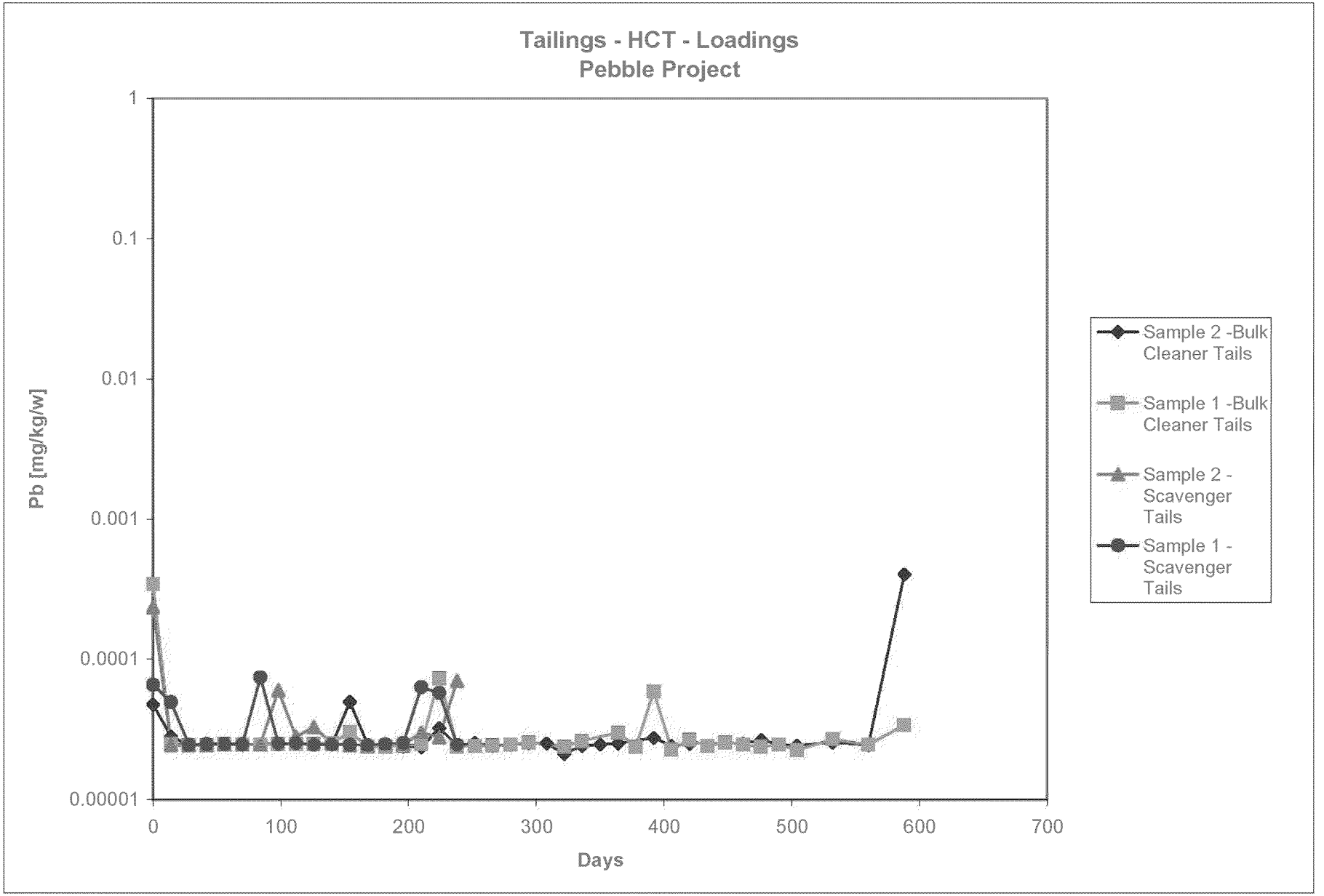

Tailings - HCT - Loadings
Pebble Project
Ca [mg/kg/w]
Days
0
10
20
30
40
50
60
70
80
0
100
200
300
400
500
600
700
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

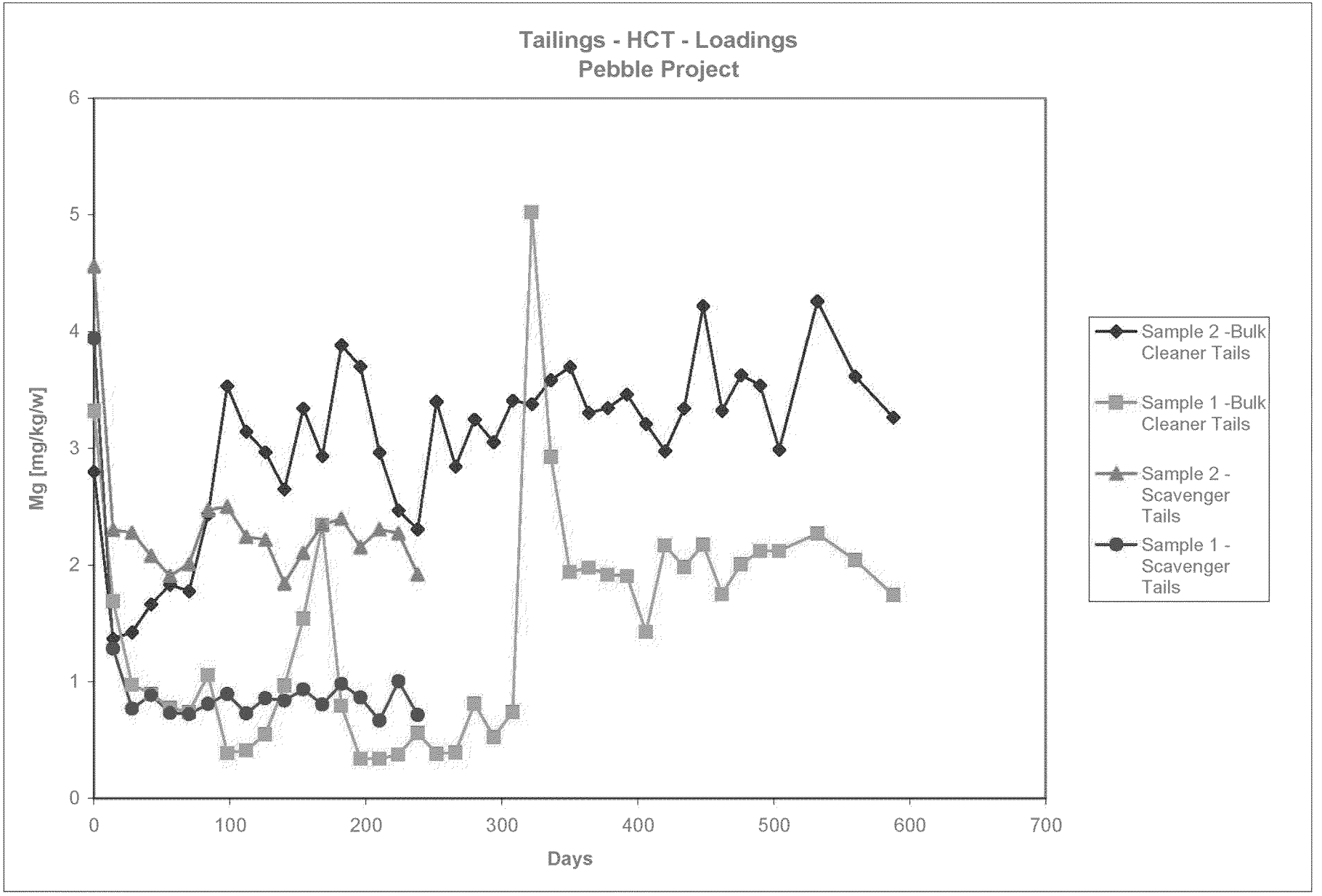

Tailings - HCT - Loadings
Pebble Project
Cr [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

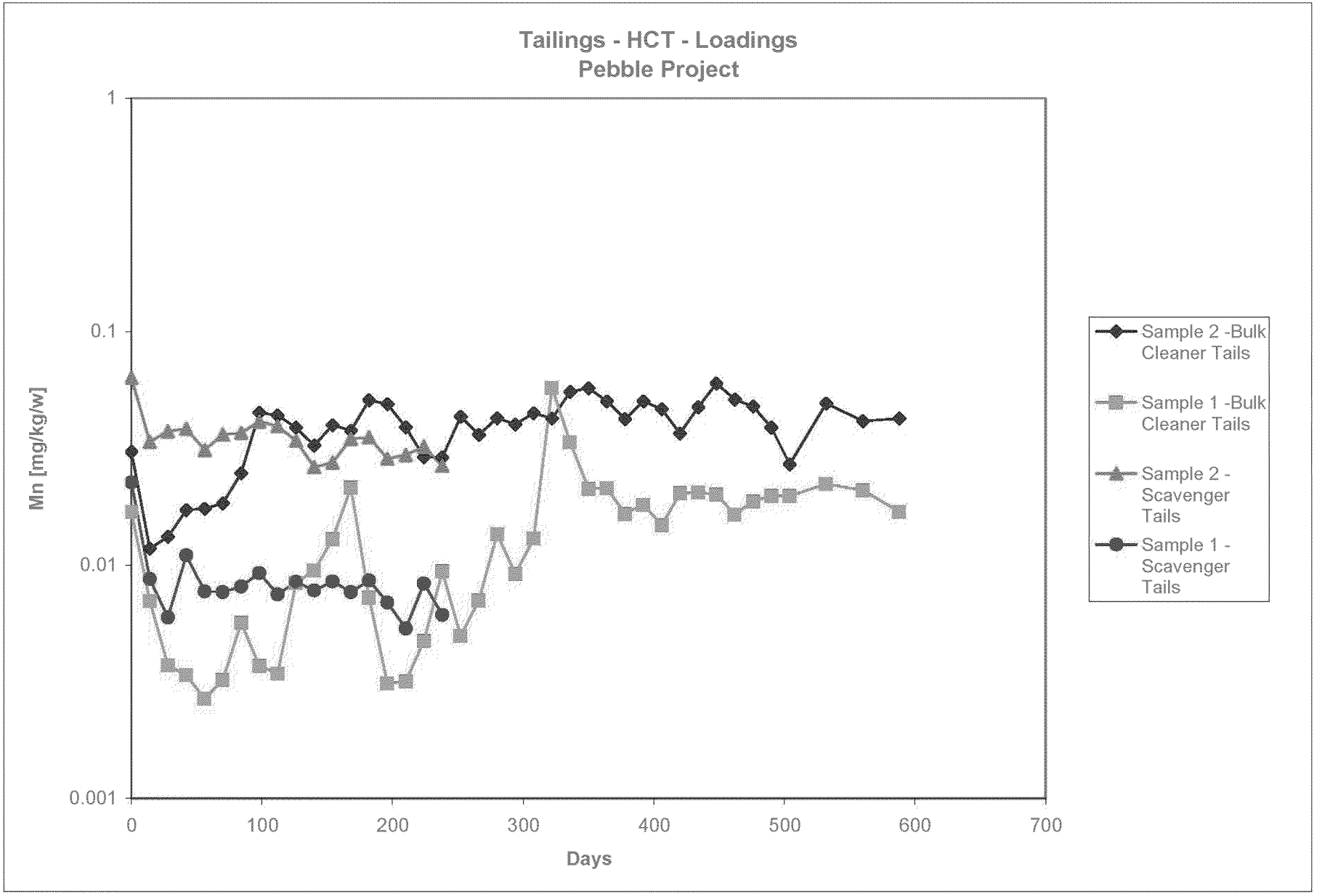

Tailings - HCT - Loadings
Pebble Project
Co [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

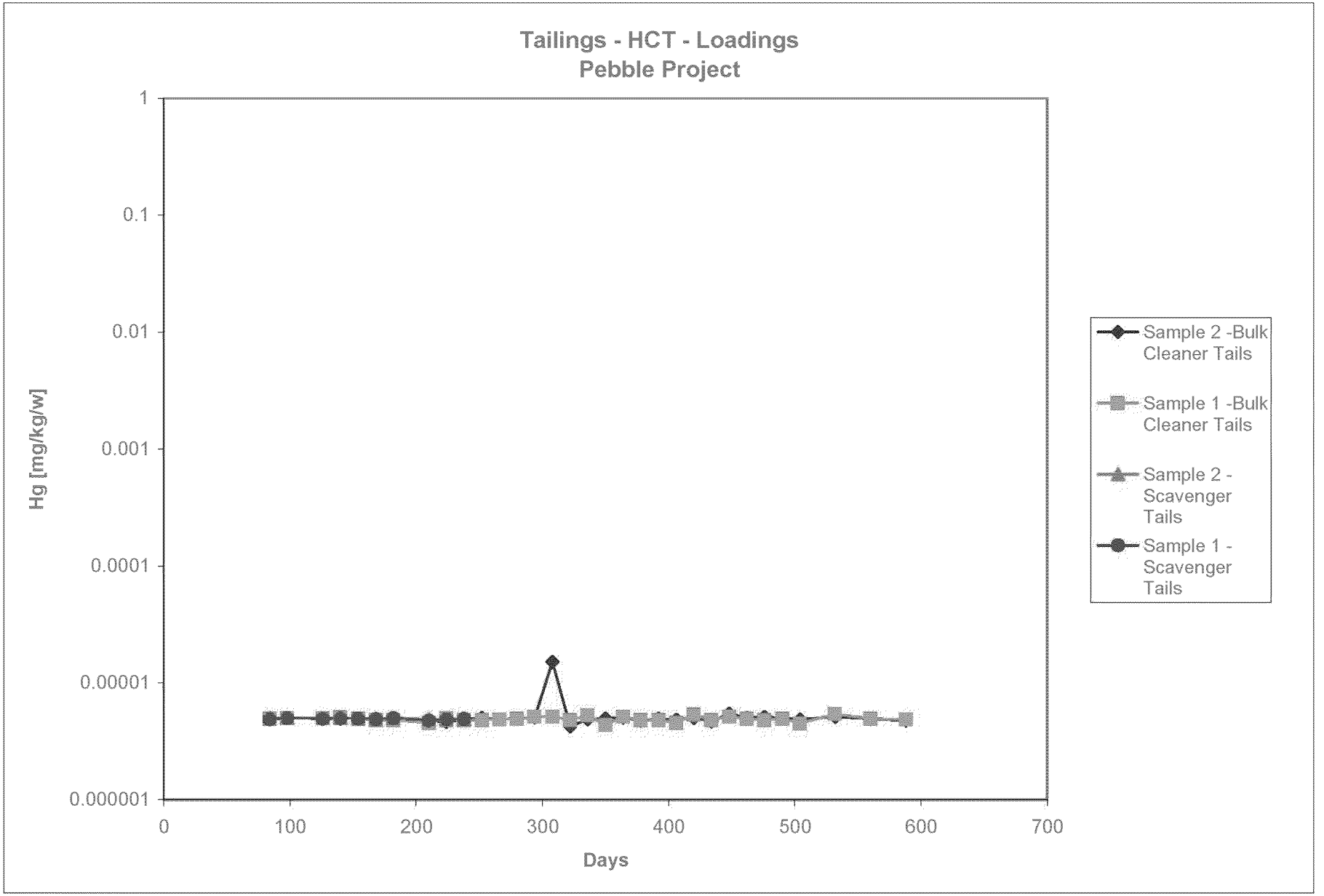

Tailings - HCT - Loadings
Pebble Project
Cu [mg/kg/w]
0.012
0.01
0.008
0.006
0.004
0.002
0
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

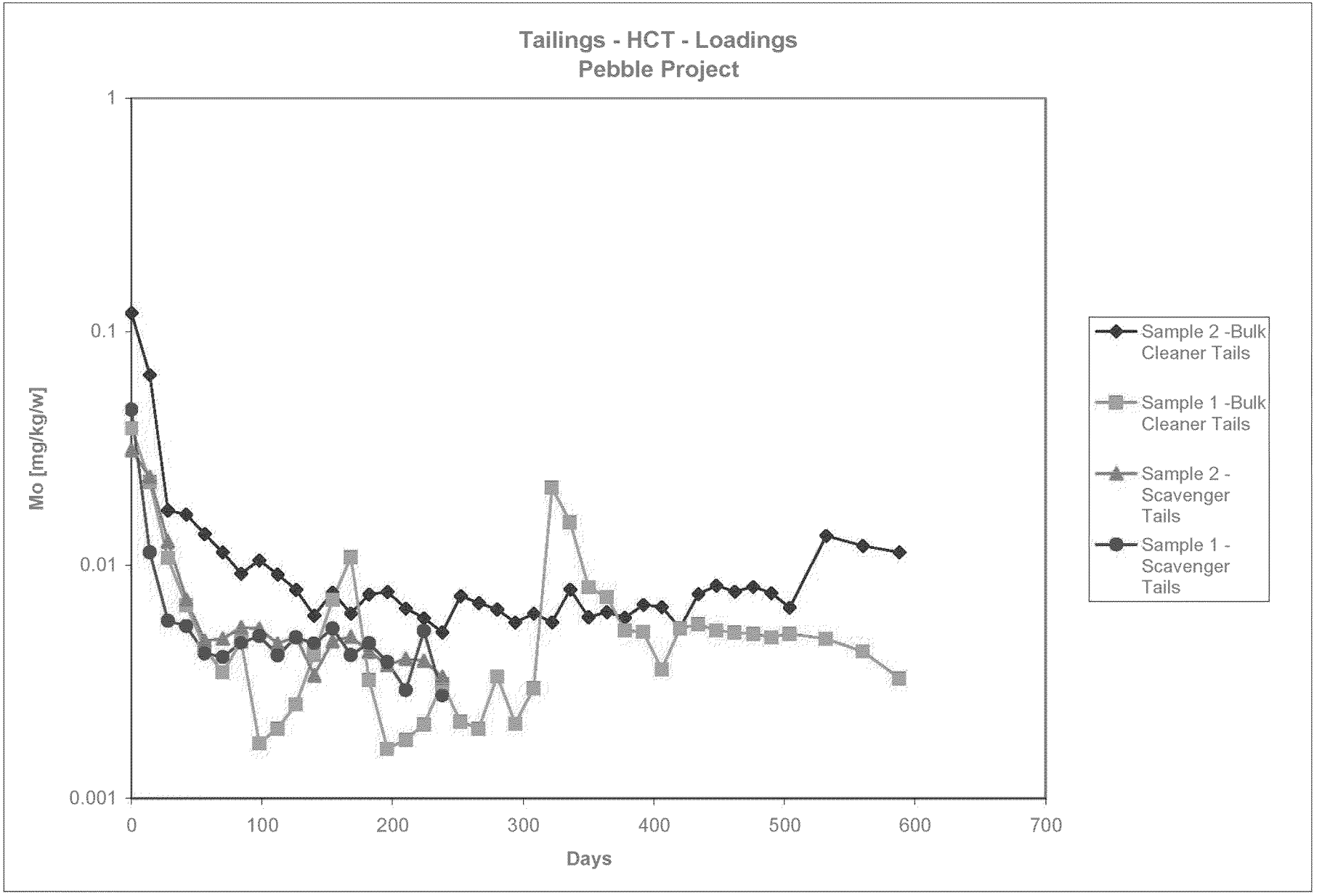

Tailings - HCT - Loadings
Pebble Project
Fe [mg/kg/w]
1
0.1
0.01
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

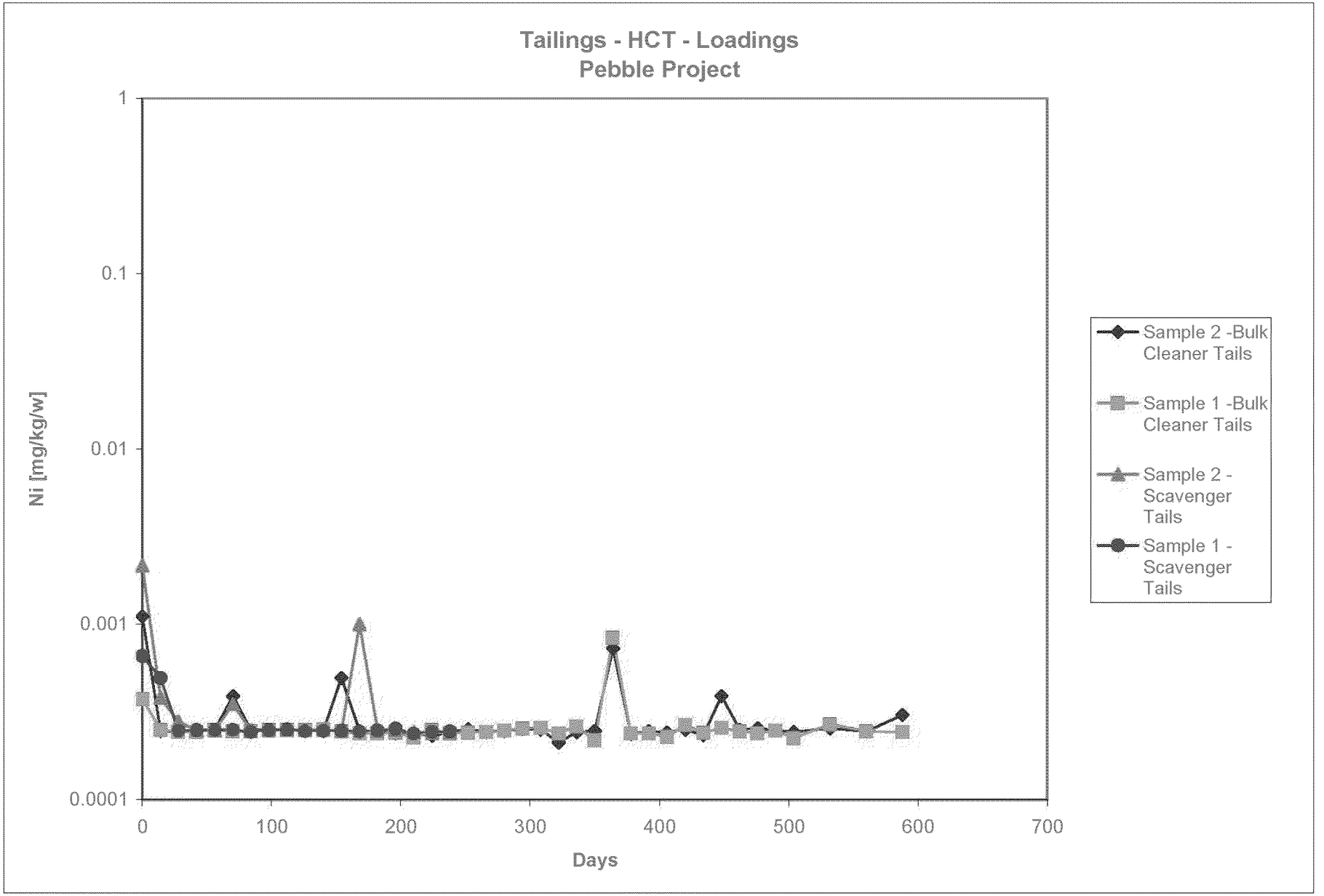

Tailings - HCT - Loadings
Pebble Project
Pb [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

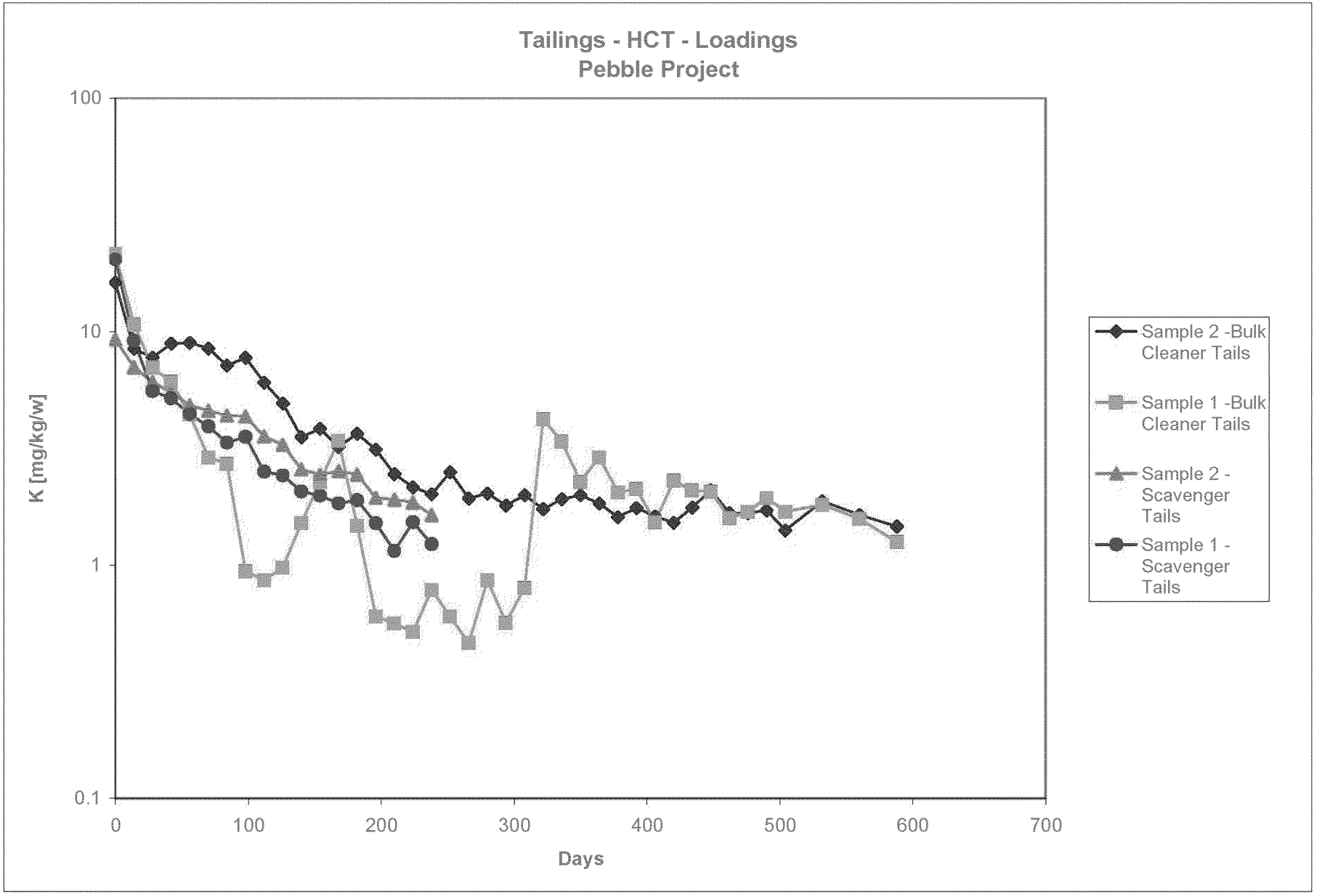

Tailings - HCT - Loadings
Pebble Project
Mg [mg/kg/w]
Days
0
1
2
3
4
5
6
0
100
200
300
400
500
600
700
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

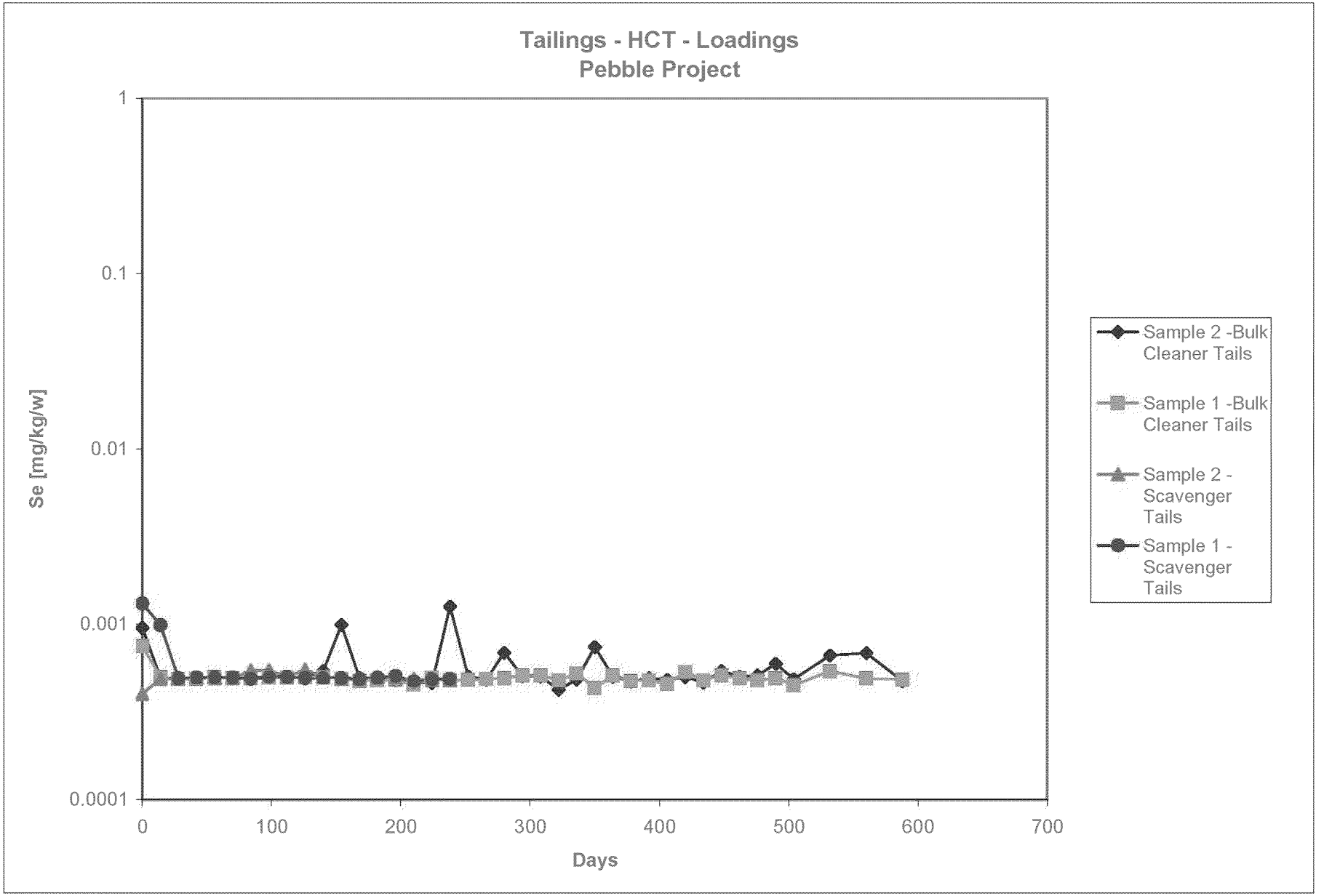

Tailings - HCT - Loadings
Pebble Project
Mn [mg/kg/w]
1
0.1
0.01
0.001
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

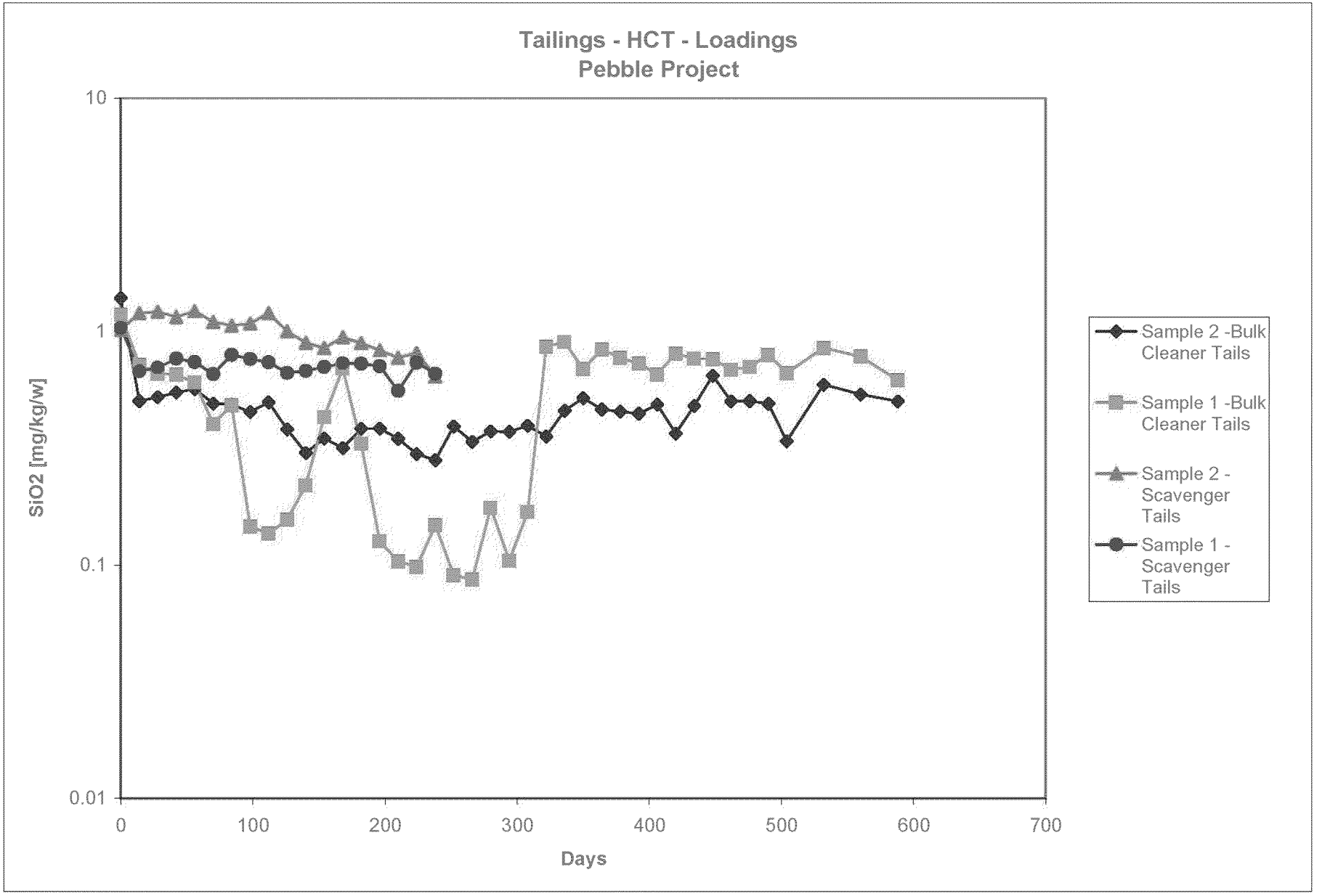

Tailings - HCT - Loadings
Pebble Project
Hg [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0.00001
0.000001
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

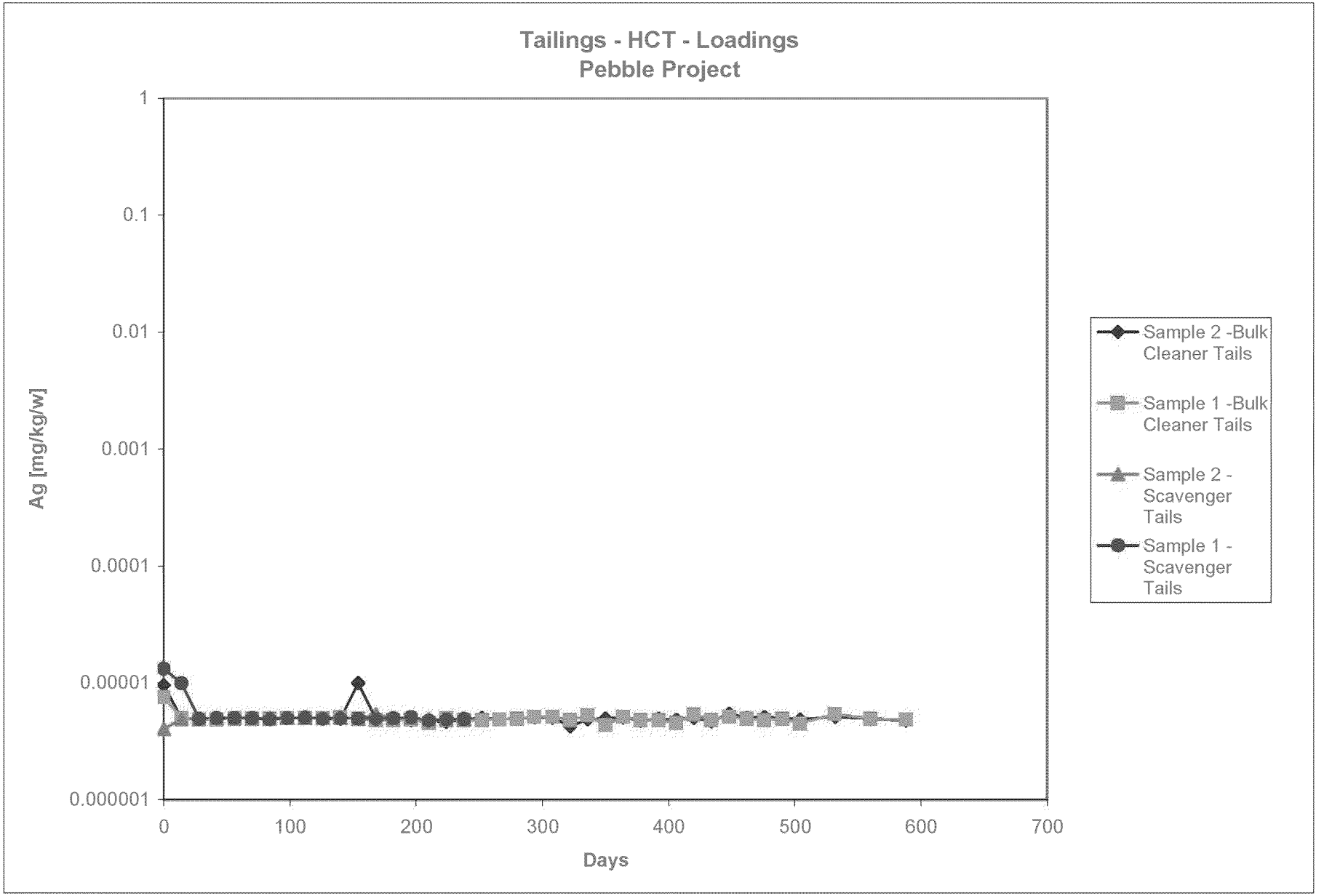

Tailings - HCT - Loadings
Pebble Project
Mo [mg/kg/w]
1
0.1
0.01
0.001
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

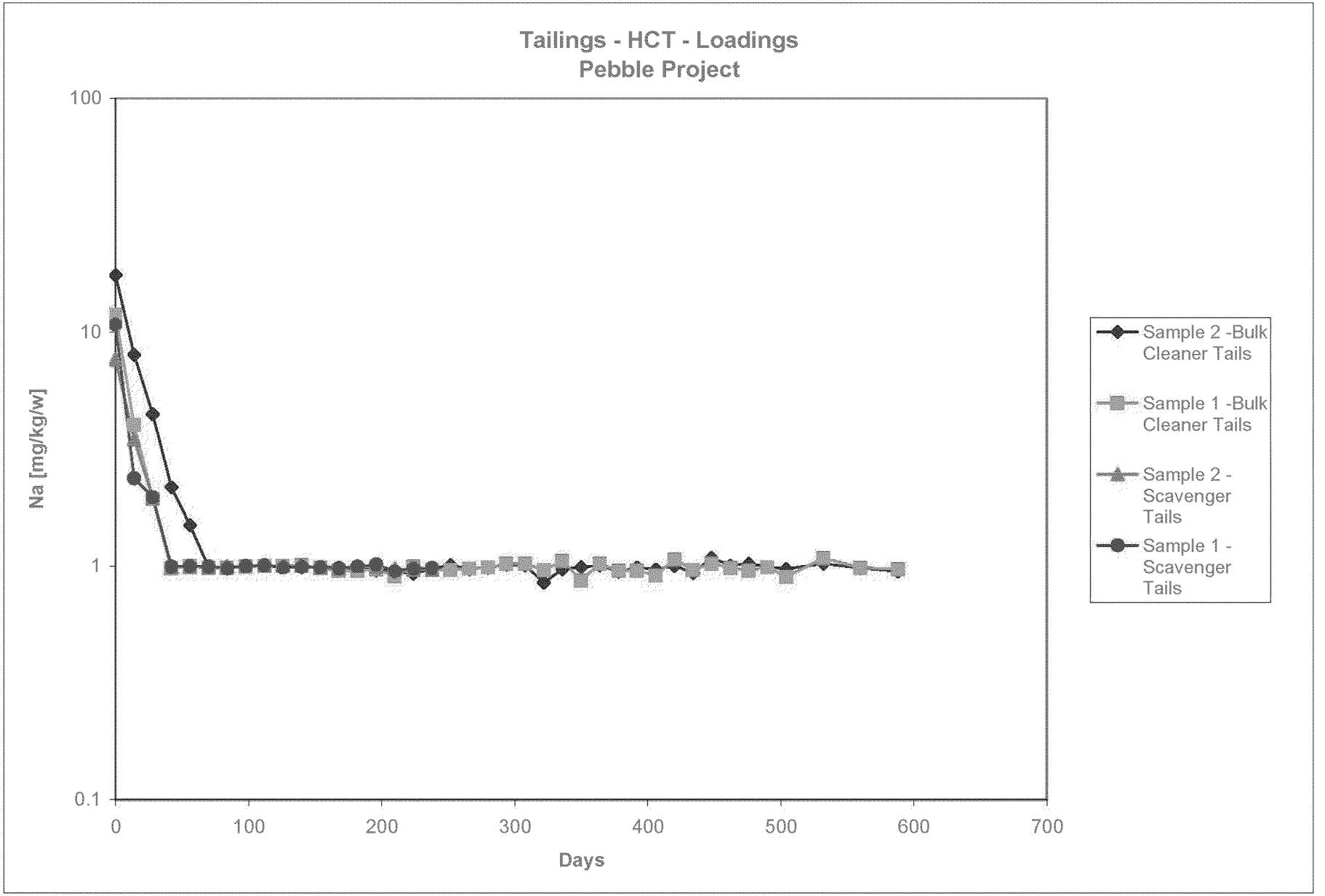

Tailings - HCT - Loadings
Pebble Project
Ni [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

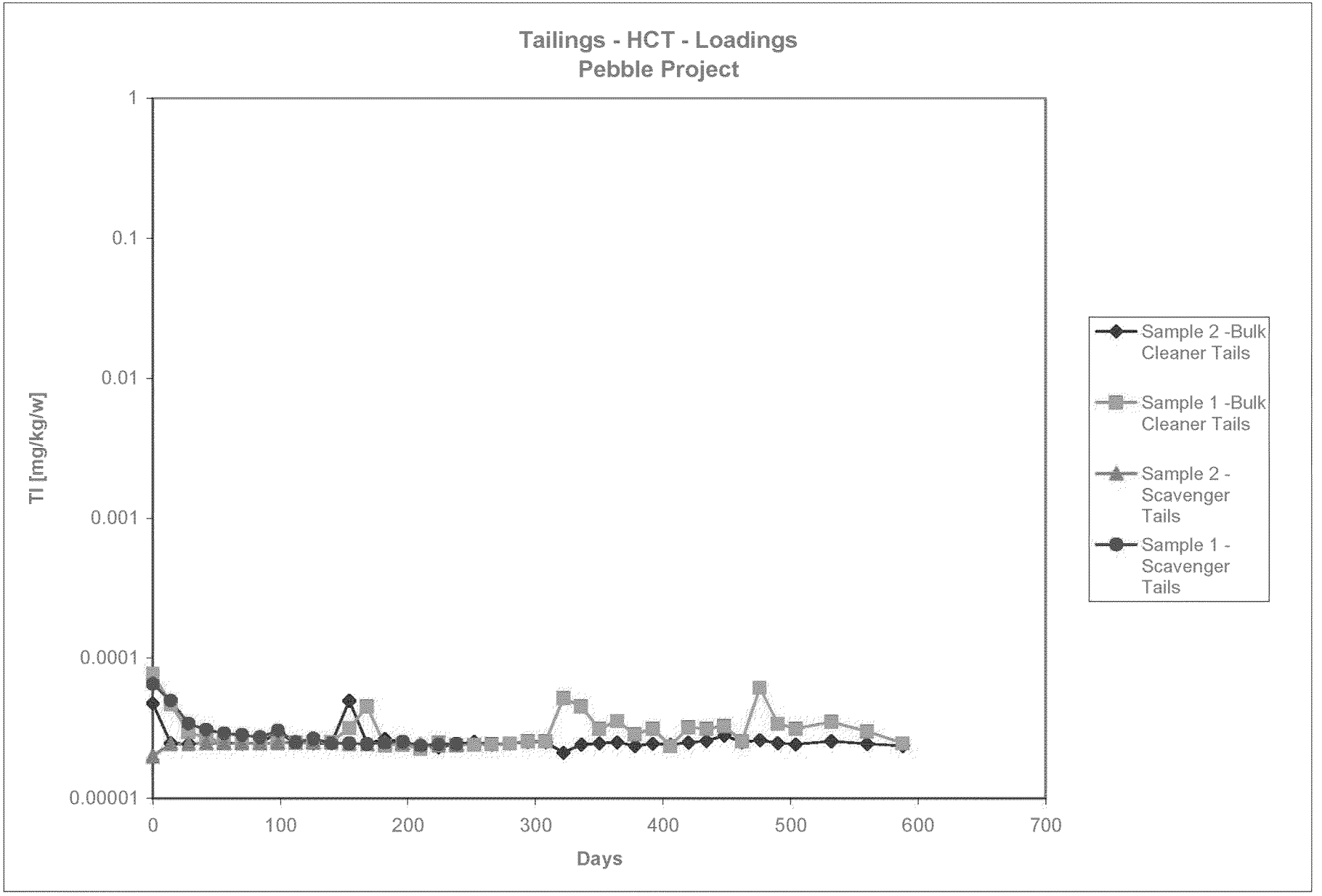

Tailings - HCT - Loadings
Pebble Project
K [mg/kg/w]
100
10
1
0.1
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

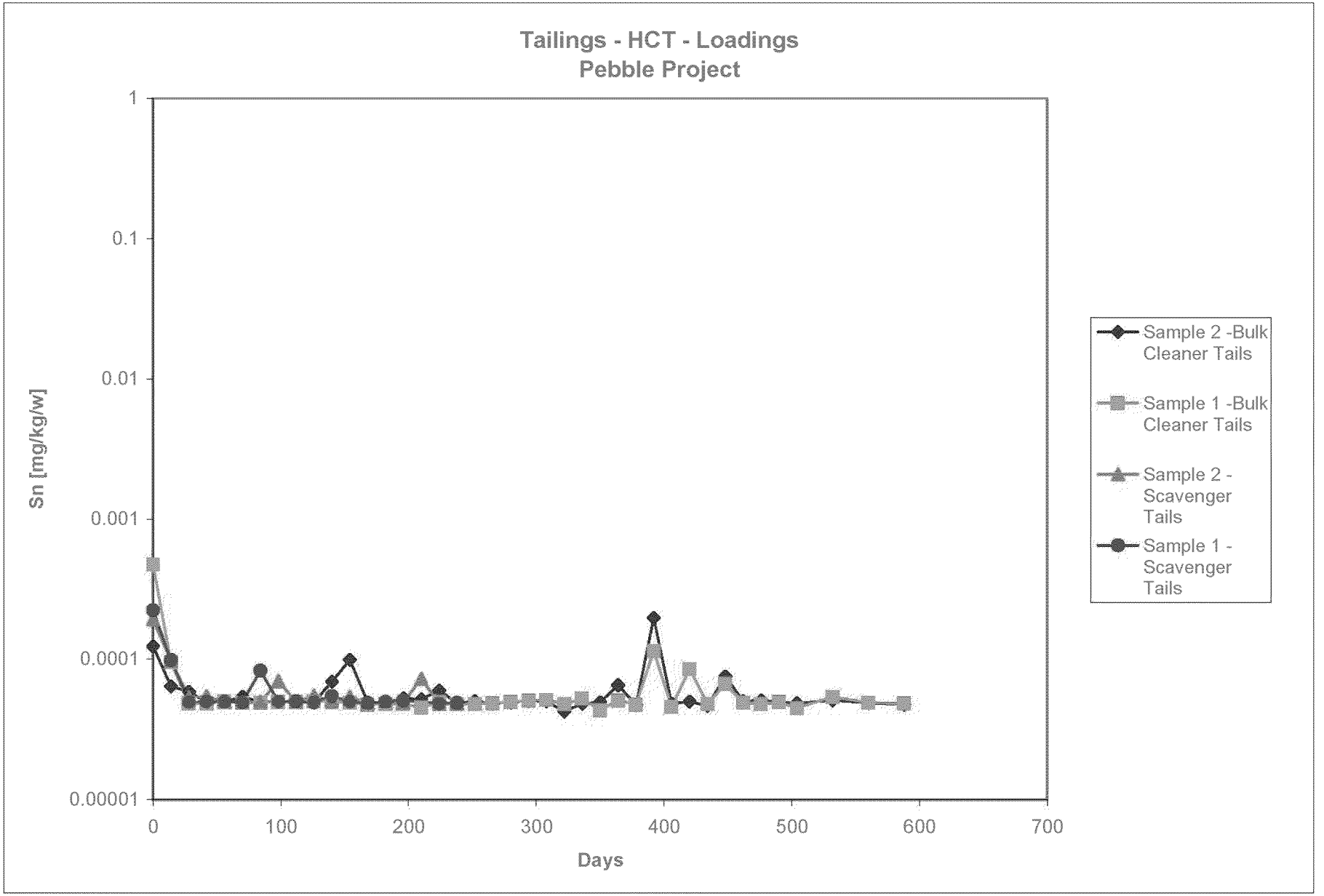

Tailings - HCT - Loadings
Pebble Project
Se [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

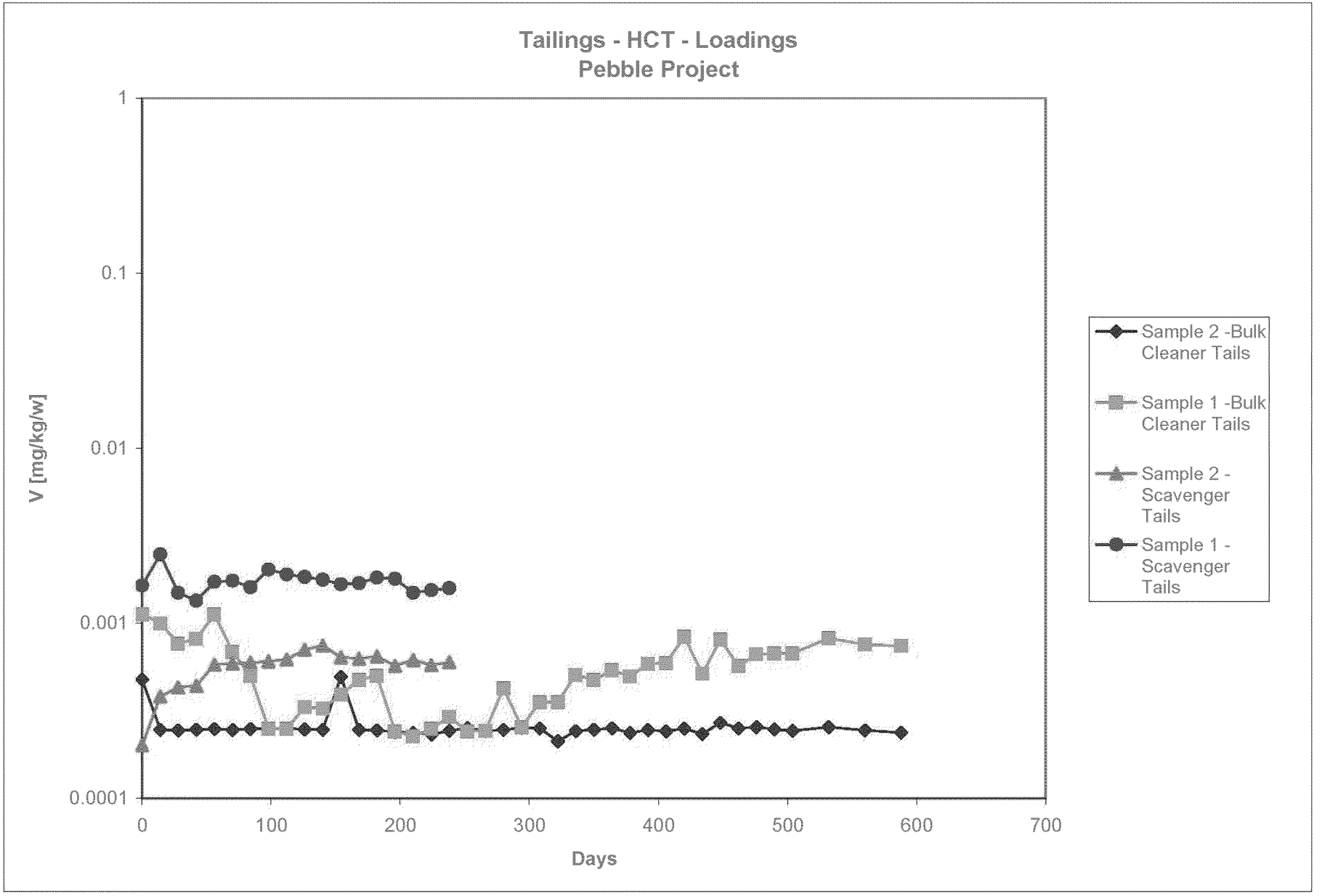

Tailings - HCT - Loadings
Pebble Project
SiO2 [mg/kg/w]
10
1
0.1
0.01
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails

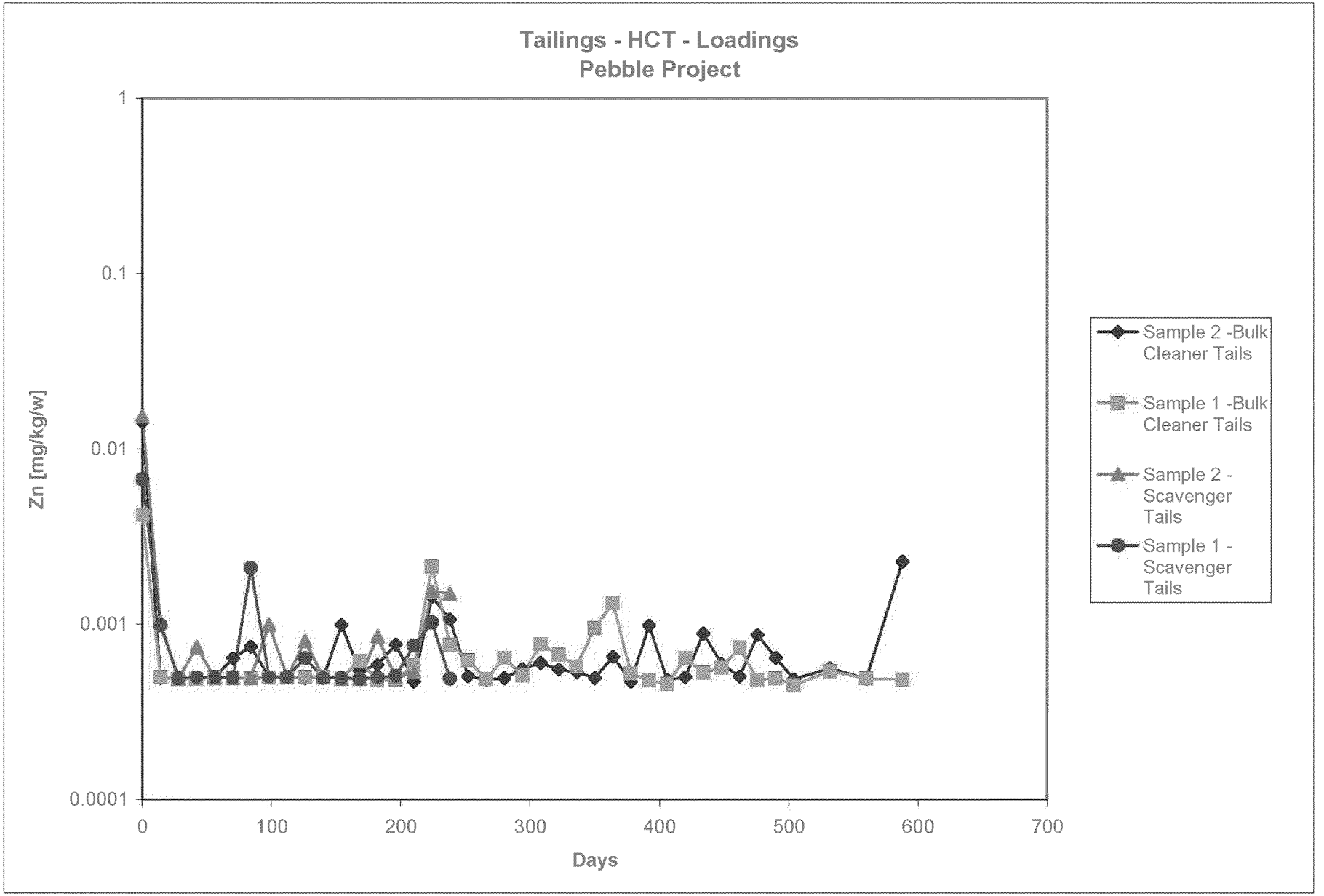

Tailings - HCT - Loadings
Pebble Project
Ag [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0.00001
0.000001
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails


Tailings - HCT - Loadings
Pebble Project
100
10
1
0.1
Na [mg/kg/w]
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails


Tailings - HCT - Loadings
Pebble Project
Tl [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails


Tailings - HCT - Loadings
Pebble Project
Sn [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0.00001
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails


Tailings - HCT - Loadings
Pebble Project
V [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails


Tailings - HCT - Loadings
Pebble Project
Zn [mg/kg/w]
1
0.1
0.01
0.001
0.0001
0
100
200
300
400
500
600
700
Days
Sample 2 -Bulk Cleaner Tails
Sample 1 -Bulk Cleaner Tails
Sample 2 - Scavenger Tails
Sample 1 - Scavenger Tails