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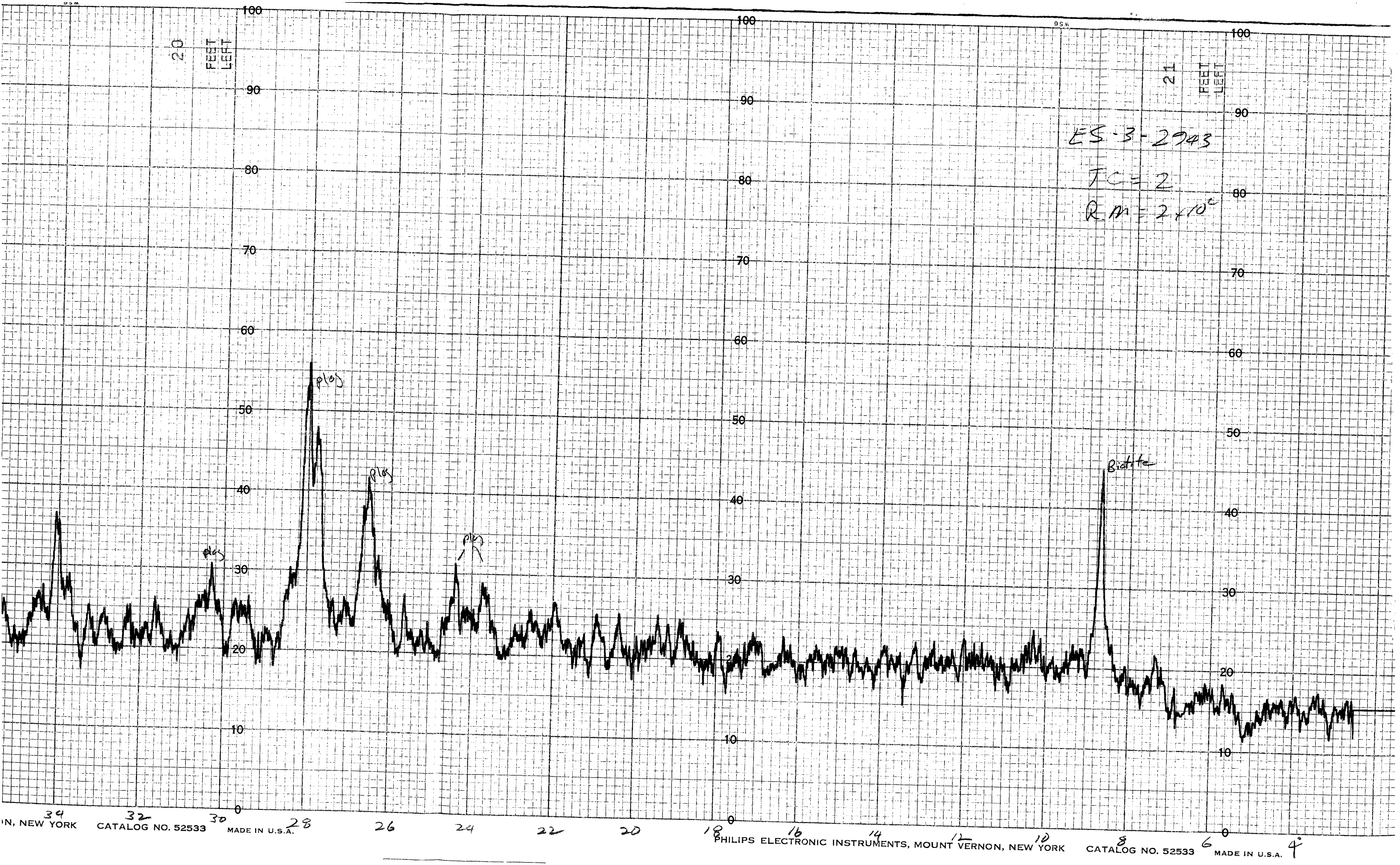
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pla
pla
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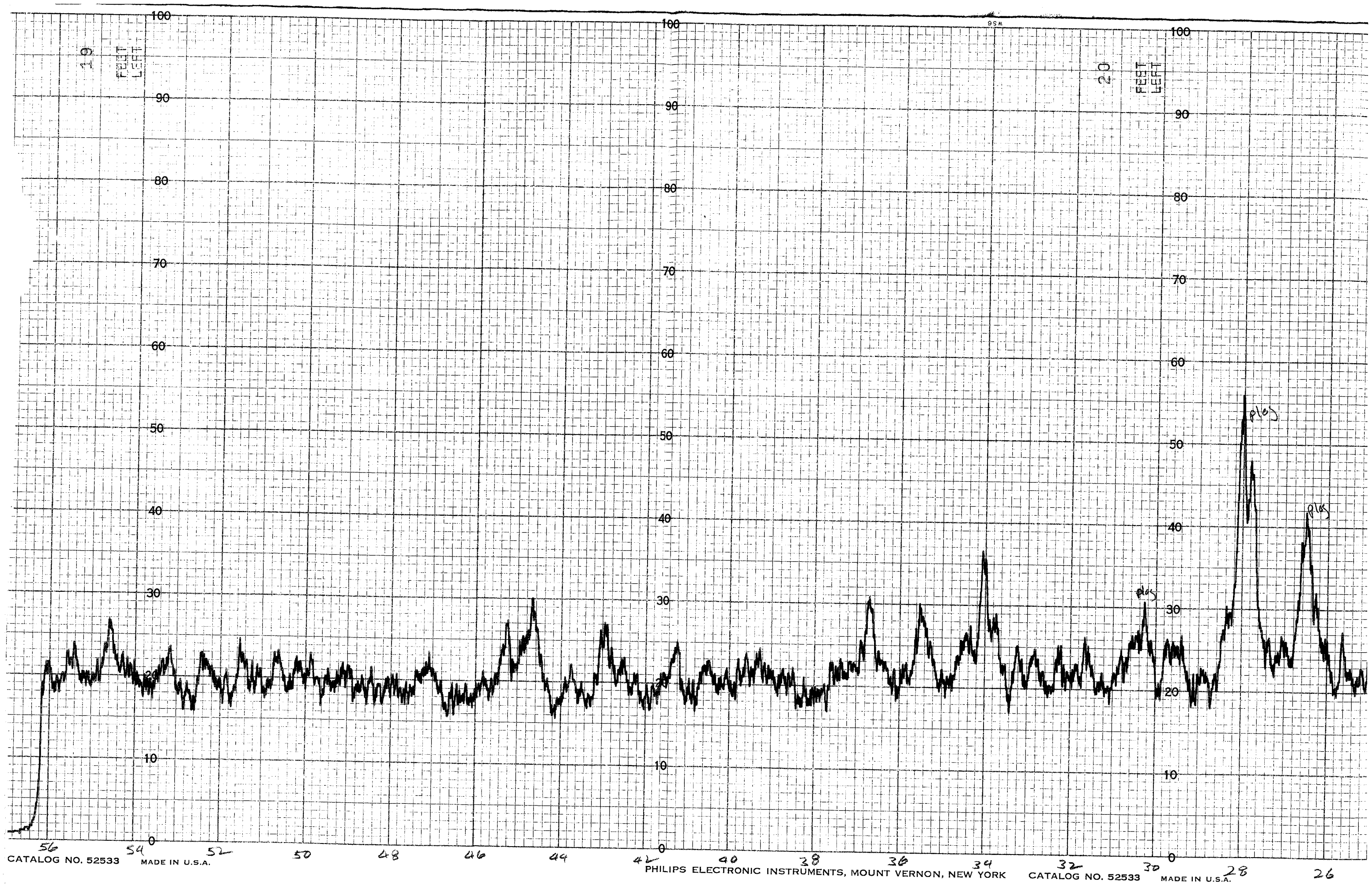
IN, NEW YORK
CATALOG NO. 52533
MADE IN U.S.A.
PHILIPS ELECTRONIC INSTRUMENTS, MOUNT VERNON, NEW YORK
CATALOG NO. 52533
MADE IN U.S.A.



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PHILIPS ELECTRONIC INSTRUMENTS, MOUNT VERNON, NEW YORK

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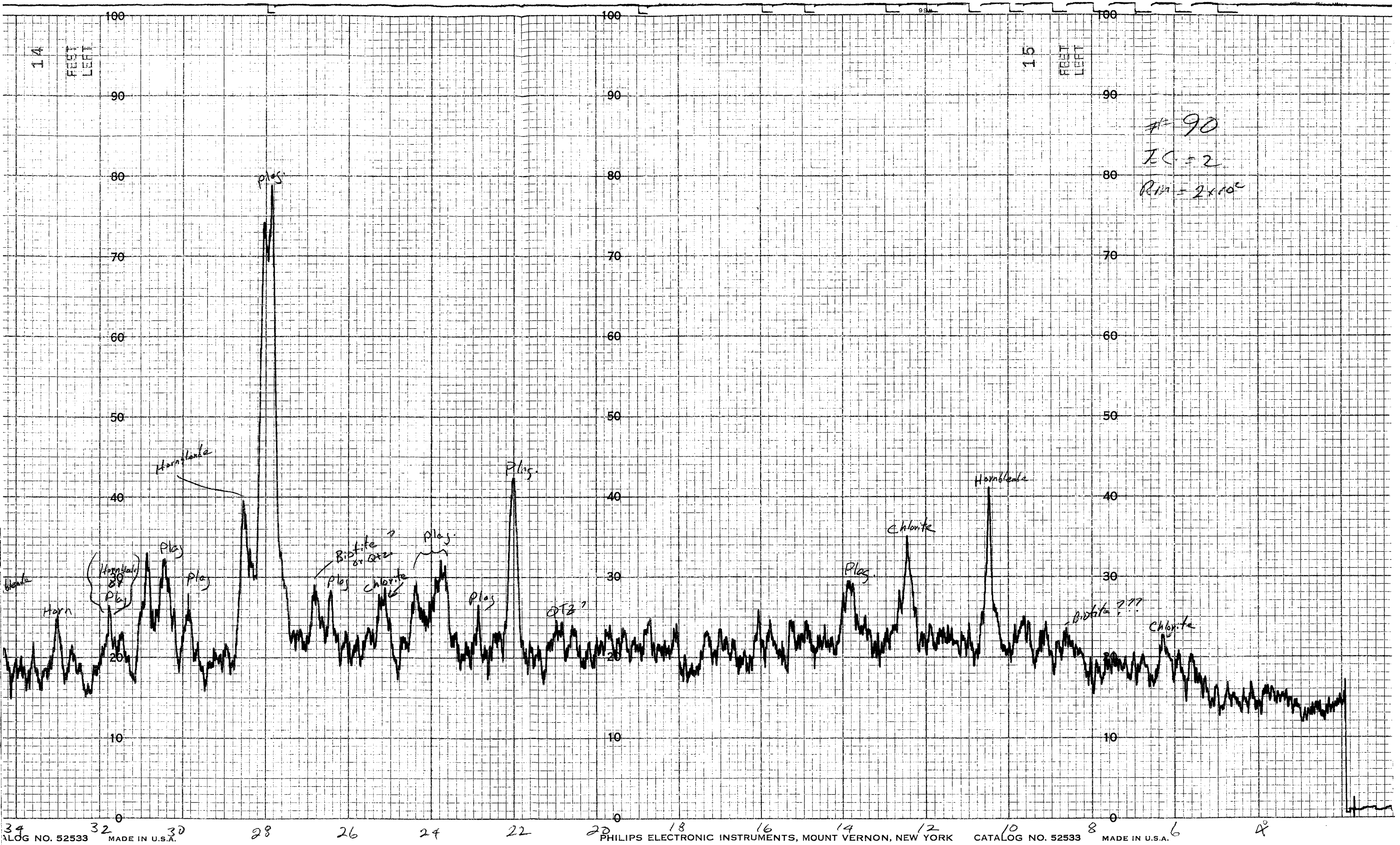
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22
20
18
16
14
12
10
8
6
4
Hornblende
Horn
Plag
Hornblende or Plag
Plag
Hornblende
Biotite or Qtz ?
Plag
Chlorite
Plag.
Plag
Plag.
QTZ ?
Plag.
Chlorite
Hornblende
Biotite ???
Chlorite
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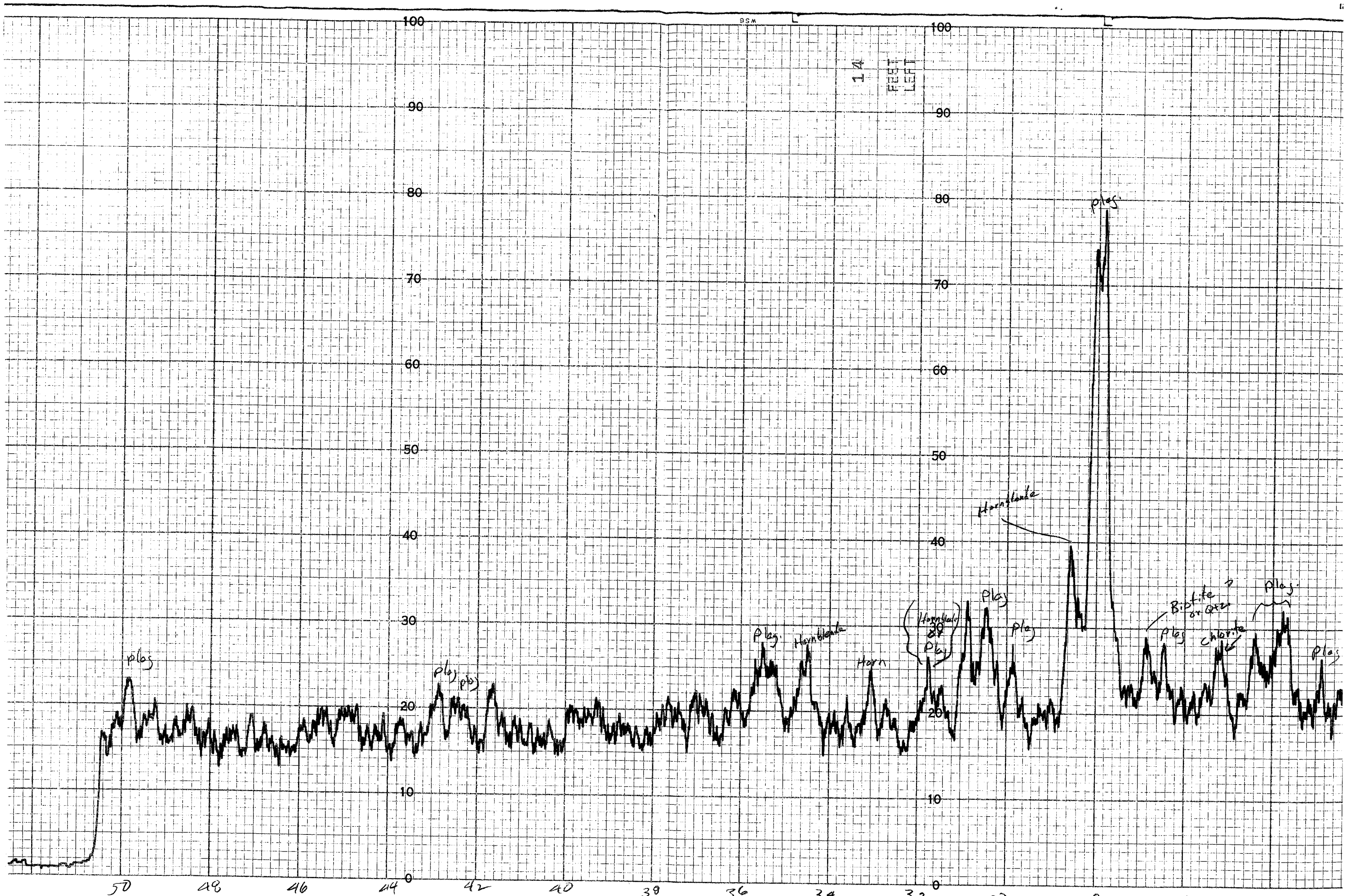
Rin = 2x10^2



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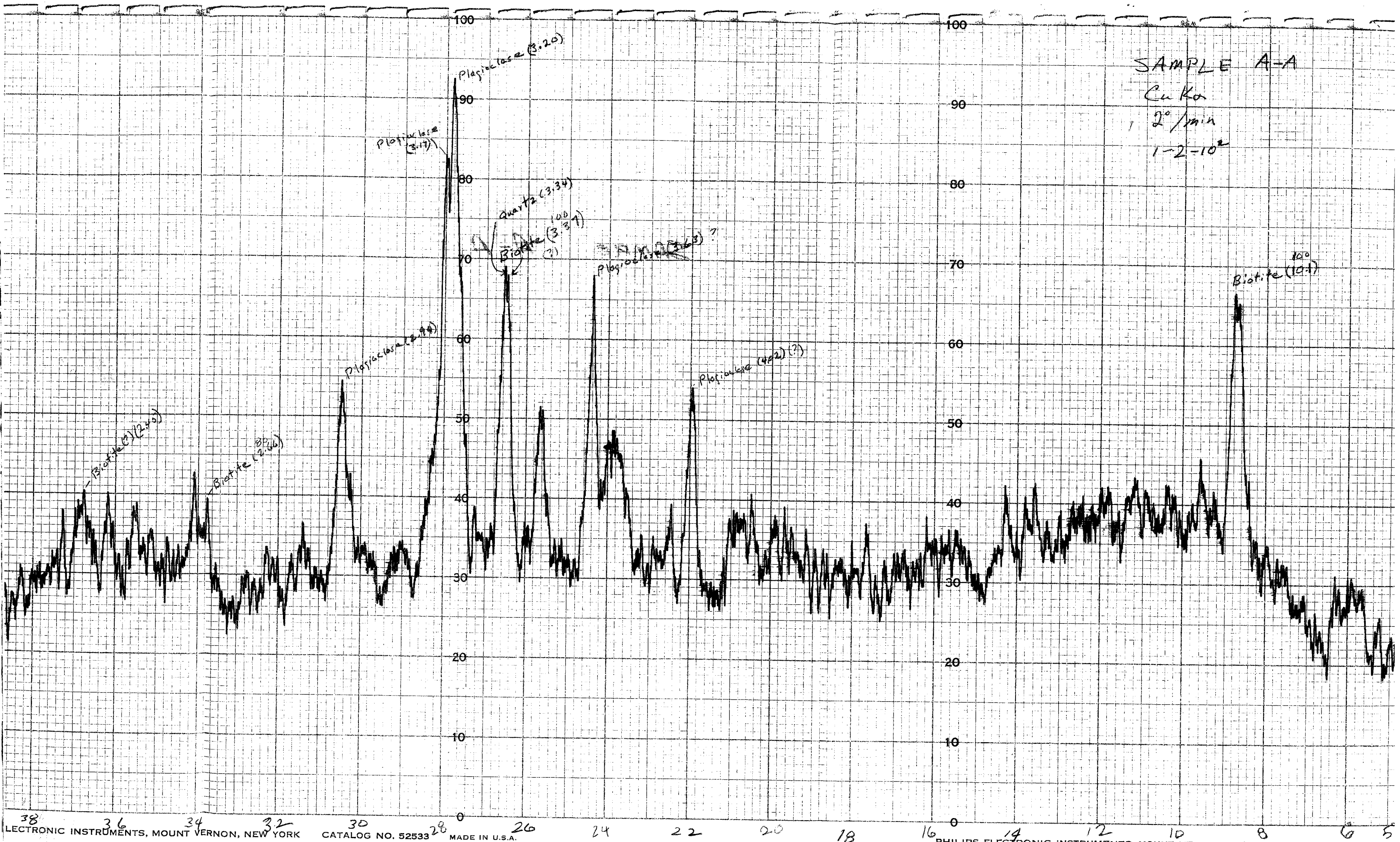
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Cu Kα
2°/min
1-2-10²
Plagioclase (3.20)
Plagioclase (3.17)
Quartz (3.34)
Biotite (3.34) (?)
Plagioclase (3.18)
Plagioclase (3.94)
Plagioclase (4.22) (?)
Biotite (2.46)
Biotite (2.66)
Biotite (10.1)
100
90
80
70
60
50
40
30
20
10
0
38
36
34
32
30
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26
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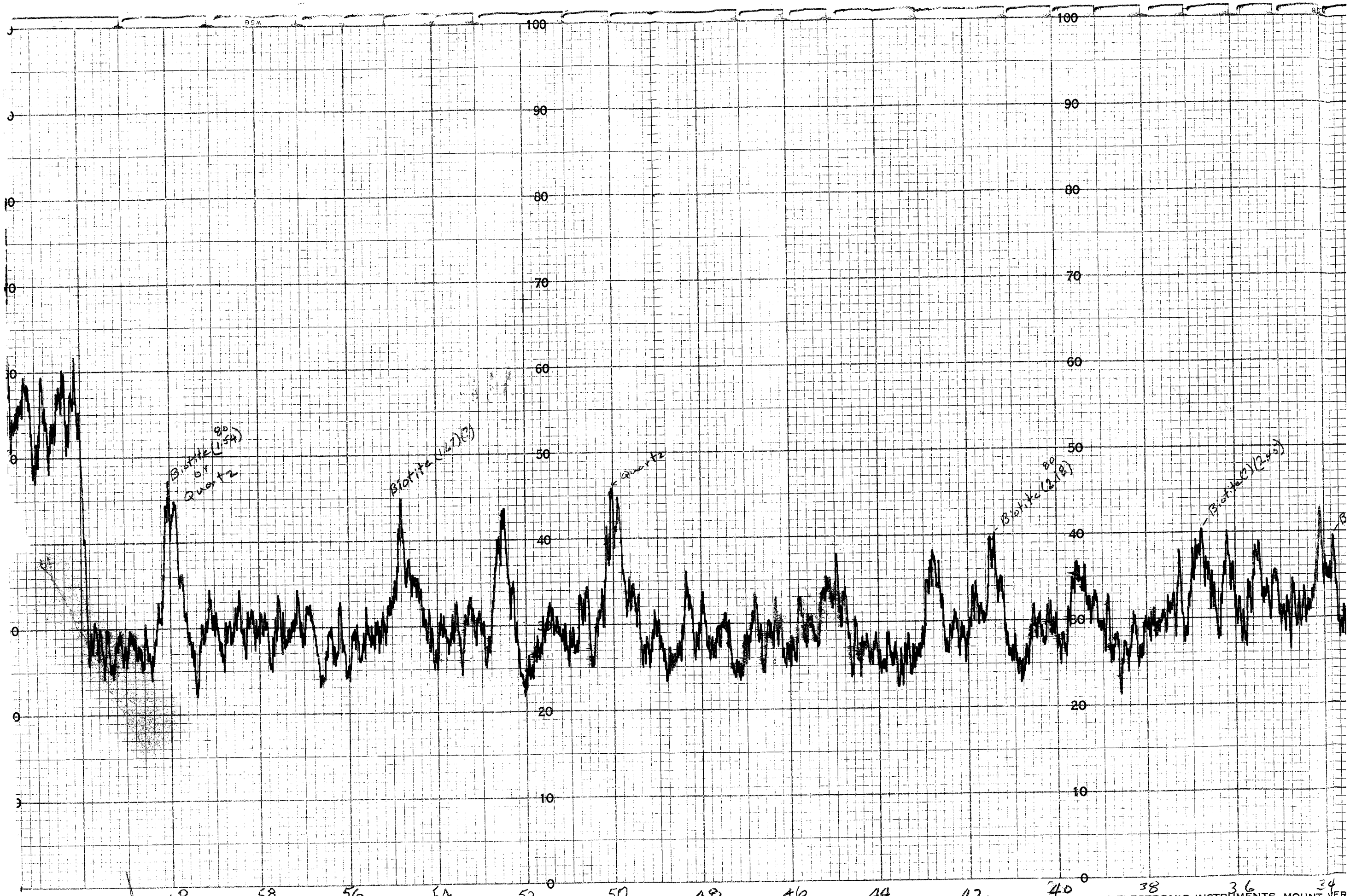
CATALOG NO. 52533
MADE IN U.S.A.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Quartz
Biotite (1.6)(2)
Quartz
Biotite (2.8) 80
Biotite (2.5)
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90
80
70
60
50
40
30
20
10
0
60
58
56
54
52
50
48
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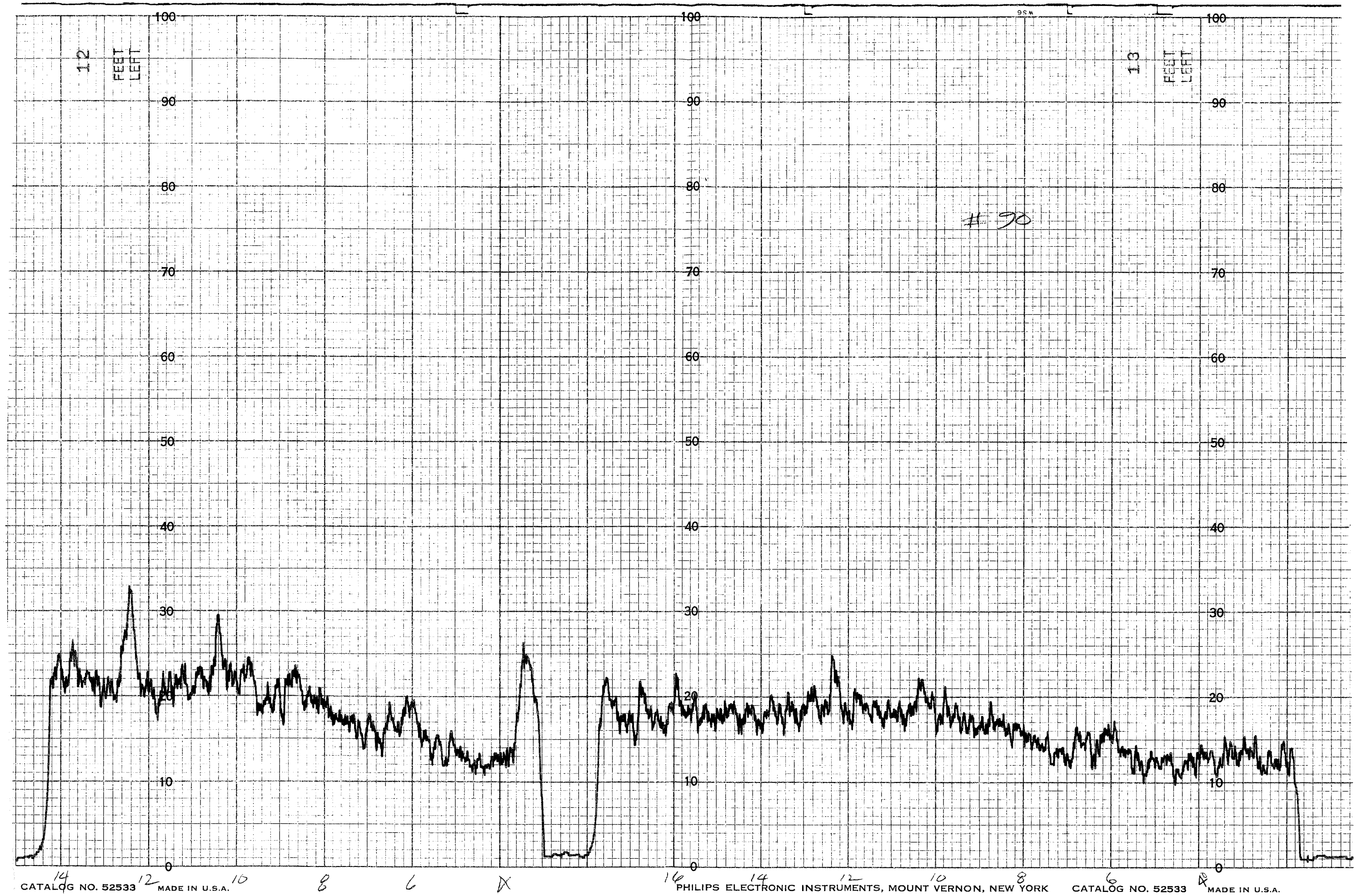
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#90
CATALOG NO. 52533
MADE IN U.S.A.
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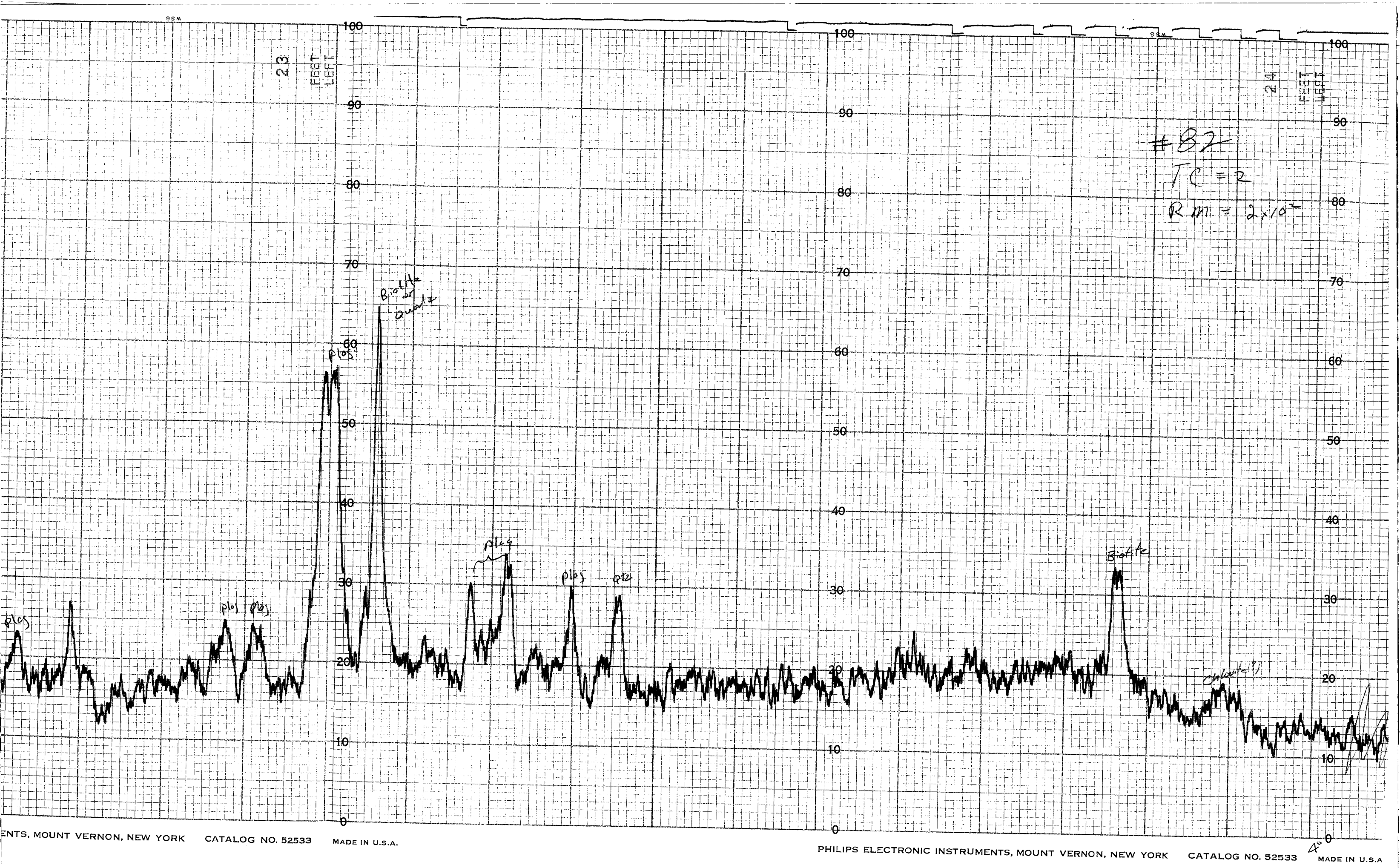
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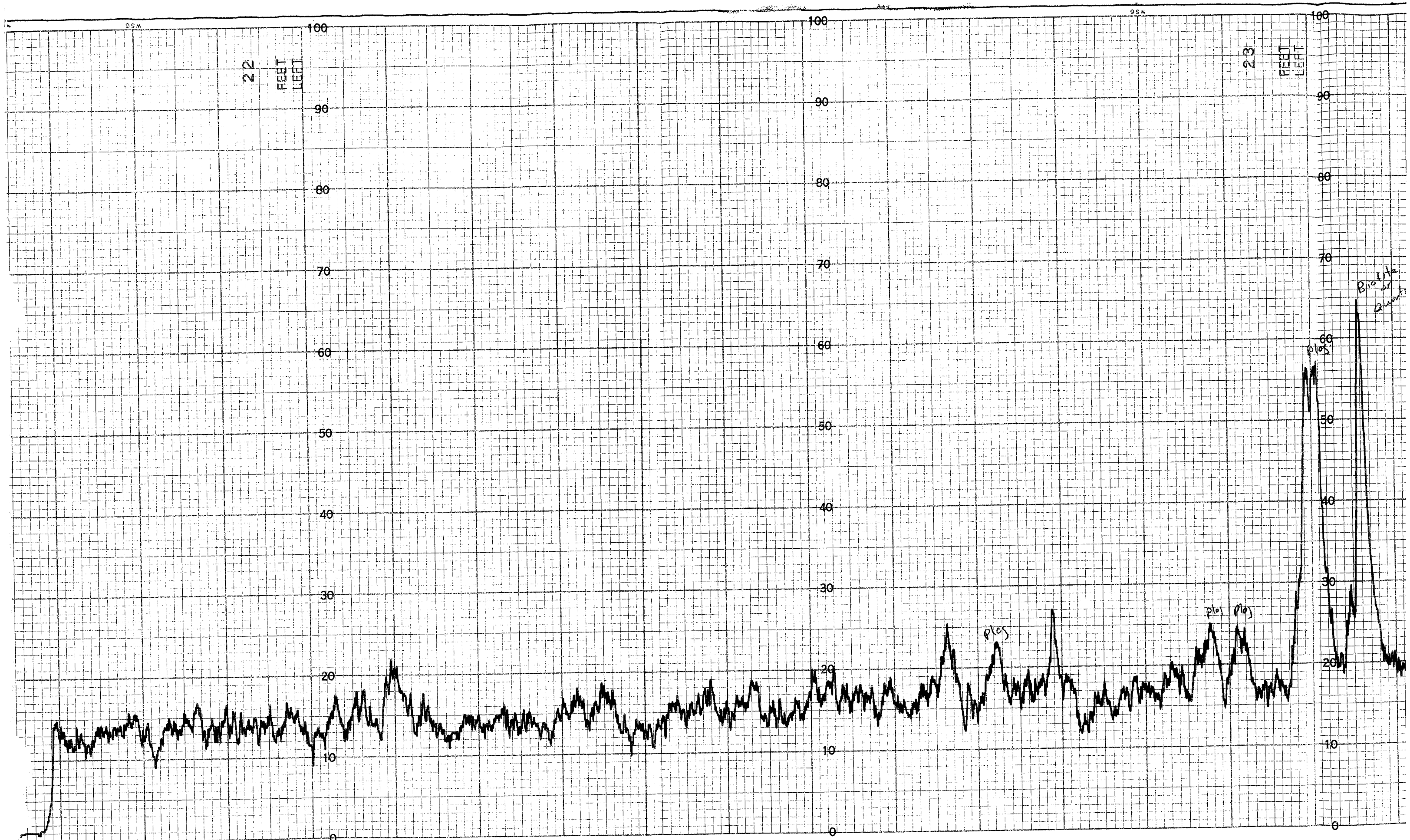
0
#82
TC = 2
Rm = 2x10⁻
Biotite or quartz
plag
plag
plag
plag
plag
plag
qtz
Biotite
chlorite (?)
ENTS, MOUNT VERNON, NEW YORK
CATALOG NO. 52533
MADE IN U.S.A.
PHILIPS ELECTRONIC INSTRUMENTS, MOUNT VERNON, NEW YORK
CATALOG NO. 52533
MADE IN U.S.A



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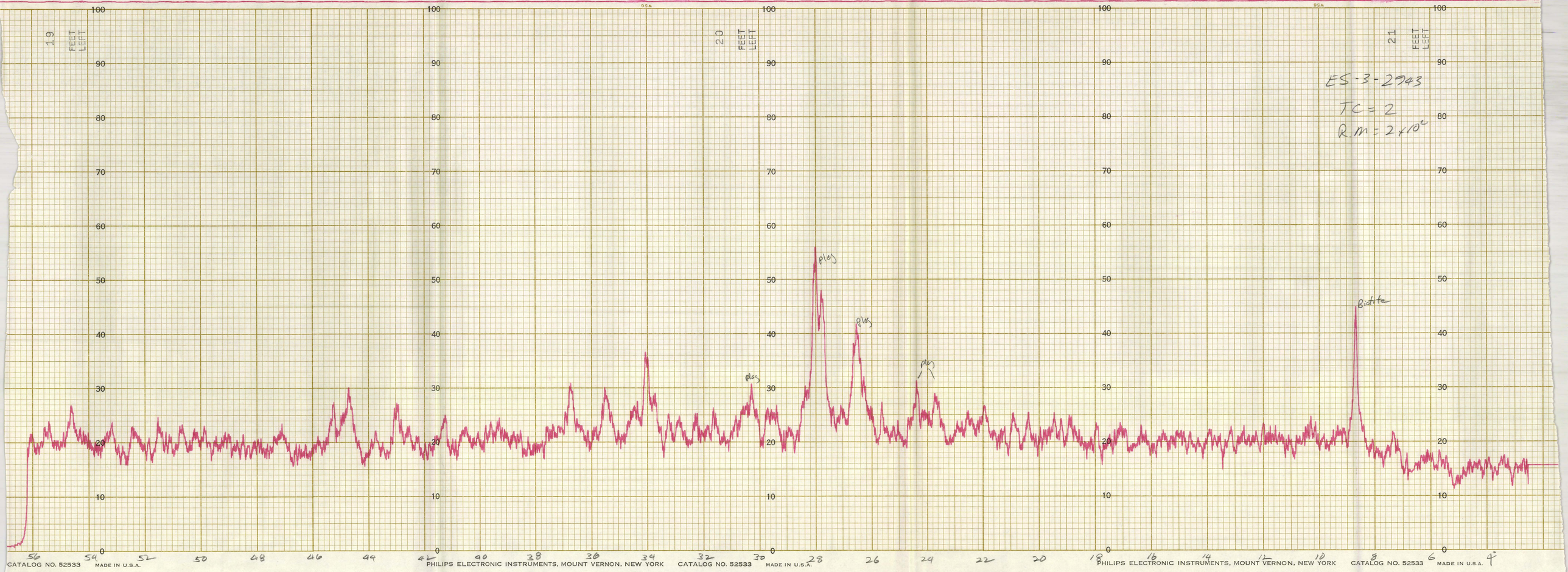
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ES-3-2943
TC = 2
R.m = 2 x 10^2
plag
plag
plag
plag
Biotite
CATALOG NO. 52533 MADE IN U.S.A.
PHILIPS ELECTRONIC INSTRUMENTS, MOUNT VERNON, NEW YORK
CATALOG NO. 52533 MADE IN U.S.A.
PHILIPS ELECTRONIC INSTRUMENTS, MOUNT VERNON, NEW YORK
CATALOG NO. 52533 MADE IN U.S.A.

14 FEET LEFT
15 FEET LEFT
# 90
IC = 2
Rm = 2x10²
Plag
Plag
Plag
Plag
Hornblende
Horn
Hornblende or Plag
Plag
Plag
Hornblende
Plag.
Biotite ? or Qtz ?
Plag
Chlorite
Plag.
Plag
Plag.
QTZ ?
Plag.
Chlorite
Hornblende
Biotite ???
Chlorite
50
48
46
44
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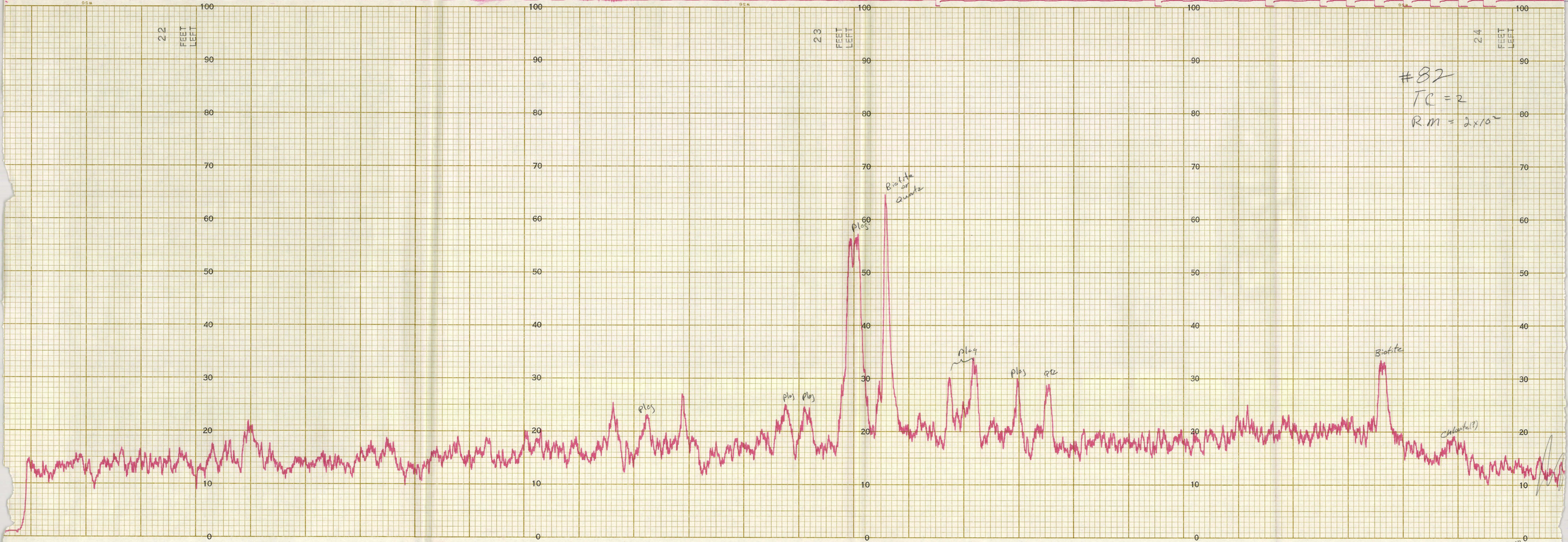
PHILIPS ELECTRONIC INSTRUMENTS, MOUNT VERNON, NEW YORK CATALOG NO. 52533 MADE IN U.S.A.



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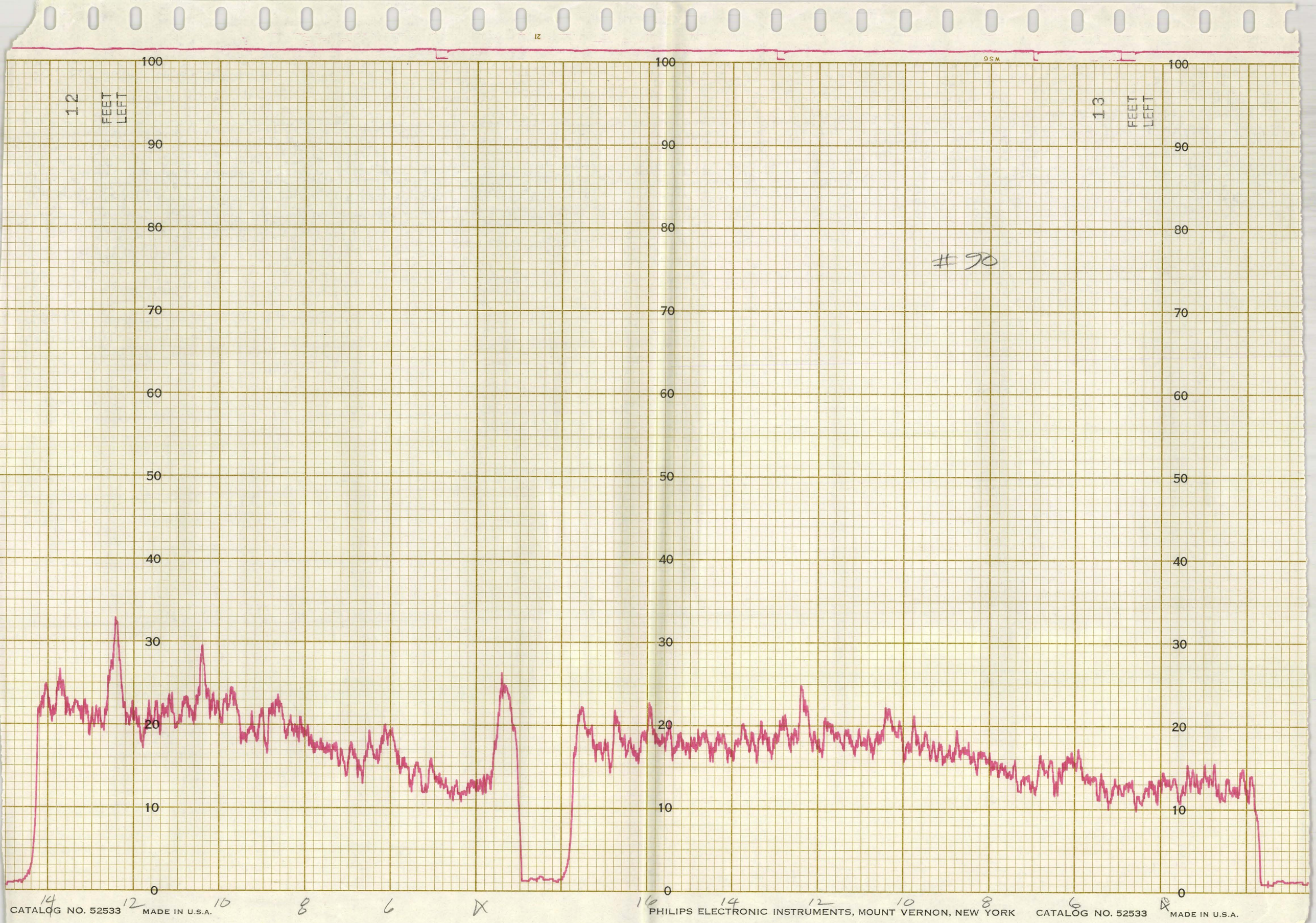
PHILIPS ELECTRONIC INSTRUMENTS, MOUNT VERNON, NEW YORK CATALOG NO. 52533 MADE IN U.S.A.
PHILIPS ELECTRONIC INSTRUMENTS, MOUNT VERNON, NEW YORK CATALOG NO. 52533 MADE IN U.S.A.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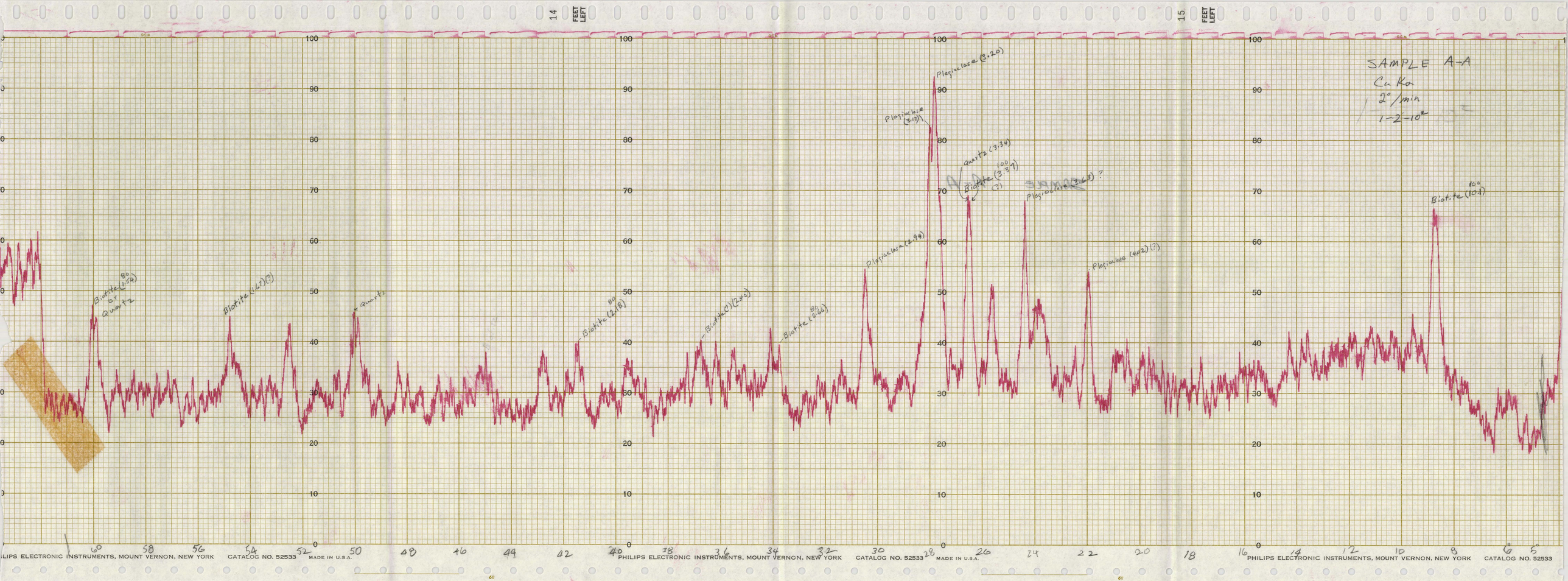
CATALOG NO. 52533
MADE IN U.S.A.
PHILIPS ELECTRONIC INSTRUMENTS, MOUNT VERNON, NEW YORK
CATALOG NO. 52533
MADE IN U.S.A.


14 FEET LEFT
15 FEET LEFT
SAMPLE A-A
Cu Kα
2°/min
1-2-10²
Biotite (1.54) 80 or Quartz
Biotite (1.62)(?)
Quartz
Biotite (2.18) 80
Biotite (2.45)
Biotite (2.46) 80
Plagioclase (2.94)
Plagioclase (3.17)
Plagioclase (3.20)
Quartz (3.34)
Biotite (3.37) 100
(?)
Plagioclase (3.68)?
Plagioclase (4.02)(?)
Biotite (10.1) 100
PHILIPS ELECTRONIC INSTRUMENTS, MOUNT VERNON, NEW YORK CATALOG NO. 52533 MADE IN U.S.A.

PETROGRAPHIC ANALYSIS

Date 10-28-71

Analyst JAF

Sample No. 3900' (Core from Kennecott)

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Dark gray dense fine-grained rock w/ sulfides & some quartz veinlets.

Thin-section texture: fine- to medium-grained, slightly porphyritic

THIN SECTION MINERALOGY

Mineral	Chemical Composition
plagioclase	
quartz	
biotite	
chlorite	
K-feldspar	
Anhydrite (?)	
Sericite	
opaques	

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Plagioclase occurs as phenocrysts (not too abundant) and as smaller anhedral grains. The smaller grains are oligoclase. Quartz and K-feldspar are irregular grains mostly about 1mm or less. Several small veinlets cut the rock. These are composed mostly of quartz, K-feldspar and anhydrite (?). It is difficult to determine the relative proportions of quartz & K-feldspar because of their similar appearance. Fine-grained biotite is abundant away from the veins. Some is associated with chlorite and appears to be replacing it. Some of the larger plagioclase grains are flecked w/ sericite and coarser sericite is locally present. A mineral tentatively identified as anhydrite is fairly abundant mostly in veinlets w/ quartz. Minor chlorite is present and appears to be altering to biotite.

CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)

PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

The rock was probably a quartz monzonite or quartz latite(?) It is difficult to determine how much quartz is original & how much is secondary. Veinlets are common. Biotite is fine-grained & in some areas appears to be replacing chlorite. It is fairly evenly distributed throughout the rock.

PETROGRAPHIC ANALYSIS

Date 11-22-71

Analyst JAF

Sample No. Sample from P-D drill hole

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Light gray fine-grained "sugary" rock. Chalcopyrite is disseminated & in small veinlets.

Thin section Texture: fine-grained, mostly equigranular.

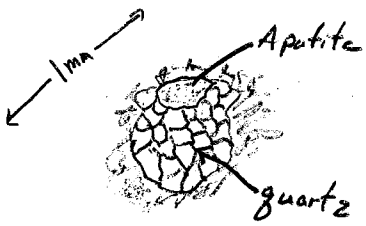
THIN SECTION MINERALOGY

Mineral	Chemical Composition
biotite	
quartz	
plagioclase	
K-feldspar	
Chlorite	
Apatite	magnetite
Sulfides	magnetite

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Plagioclase is not too abundant, occuring as irregular, cloudy grains. Quartz is very abundant as clusters of small grains commonly in "pockets" (see sketch). Some quartz is in small veinlets w/ K-feldspar. K-feldspar is abundant in veinlets, in some areas making up all of the vein. Other minerals in veins are quartz and sulfides. Some K-feldspar occurs outside veins but not much. Fine-grained biotite is abundant, making up about 30% of the rock. Chlorite is generally coarser-grained than biotite and much less abundant. Fairly coarse apatite is present, sulfides occur mostly in veinlets. Some magnetite is present in the rock.

CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)



PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

It is difficult to determine the original rock type. most of the quartz and K-feldspar are secondary.

PETROGRAPHIC ANALYSIS

Date 1-21-72

Analyst JAF

Sample No. K-3125' Dec 71

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Dark gray medium-grained rock. Veins contain Chalcopyrite. Little or no disseminated chalcopyrite.

Thin section Texture. Fine-to medium grained. Hypautomorphic Granular.

THIN SECTION MINERALOGY

Mineral	Chemical Composition
Plagioclase	chlorite
orthoclase	Anhydrite
Quartz	Sericite
Biotite	Chalcopyrite
black opaque (magnetite?)	Sphene
	Apatite

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Original rock was a quartz monzonite (?) or granodiorite composed of Plagioclase, biotite, orthoclase and quartz. The texture is almost Porphyritic with fairly large plagioclase xtals and smaller grains of the other three minerals. Away from the veins most of the minerals are fresh. Plagioclase contains a few specks of sericite and some of the biotite is partially converted to chlorite.

The center of the vein is made up mostly of anhydrite and chalcopyrite. Secondary orthoclase is on either side of the anhydrite and all the plagioclase is destroyed near the vein. Some fairly coarse needles of sericite are in this zone but are not very abundant.

Chlorite is fairly abundant in the zone of secondary orthoclase. Biotite is more converted to chlorite in this zone. Quartz in the zone of alteration is similar to that in the "unaltered" rock. A minor amount of secondary biotite is present both near the vein and in the rock away from the vein, however most of the biotite is primary.

CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)

PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

Original mineralogy	Secondary minerals
Plagioclase	Chlorite
Orthoclase	Orthoclase
Quartz	Anhydrite
Biotite	Sericite
Magnetite	Sphene
Apatite	Chalcopyrite
	Biotite

Sample # 44

Hand Sample: Gray, medium- grained with iron staining.

Thin section texture: Fine- to medium- grained, porphyritic.

Mineralogy

plagioclase
epidote
hornblende
chlorite
orthoclase
magnetite
hematite
apatite

Plagioclase- Fairly fresh, a slight amount of epidote alteration.
Hornblende- Minor mineral, very "ragged".
Epidote- Fairly abundant, usually in fairly large patches. commonly associated with chlorite, replacing hornblende in some cases.
Orthoclase- Fine-grained, seems to be more abundant around masses of chlorite and epidote.
Magnetite- Very abundant, some fairly coarse- grained. Commonly surrounded by a red translucent material (hematite ?). Rock is stained around most grains.

This rock appears to be very similar to the porphyritic andesite from the core. Plagioclase is present in similar amounts. Some hornblende remains whereas in the core it has been completely replaced. Iron oxides are more abundant than in most of the core samples that I've looked at. Plagioclase is less altered than in the shallow samples from ES-1.

Sample #45

Hand Sample: Light tan, porphyritic.

Thinsection texture: Porphyritic, Very fine-grained groundmass.

Mineralogy

plagioclase
quartz
sericite
biotite(?)
epidote
calcite
orthoclase
magnetite(?)
apatite
sphene

Plagioclase- Subhedral to euhedral phenocrysts up to 2mm in length. Most grains are altered to calcite and sericite.
Quartz- Rounded and partially resorbed phenocrysts up to 1mm in diameter.
Mica- Phenocrysts 1mm or less in length are intergrowths of sericite and a pale green mica with slightly lower birefringence (hydrobiotite ?) Also included in these masses are fine-grained sphene or some related mineral. The shapes of these masses suggest that they are replacements of biotite.
Orthoclase- Some very fine-grained orthoclass occurs in the groundmass.
Epidote- only a few scattered grains are present.

Sample # 46

Hand Sample: Light gray, porphyritic.

Thinsection texture: Porphyritic, very fine-grained groundmass.

Mineralogy

plagioclase
mica
quartz
magnetite
leucoxene
calcite
orthoclase
apatite

Plagioclase- Phenocrysts, altered to sericite and biotite (or hydrobiotite) with minor calcite.

Quartz- Rounded and partially resorbed phenocrysts.

Mica- Small phenocrysts of intergrown sericite and greenish brown biotite (hydrobiotite ?). Probably forming after biotite.
Groundmass- Too fine-grained to identify all minerals. Staining indicates that orthoclase is fairly abundant.

This rock appears very similar to #45. I can not estimate mineral percentages because of the fine-grained groundmass. Plagioclase is the most abundant phenocryst in both rocks with the intergrown micas being slightly more abundant than quartz.

Sample # 47

Hand Sample: Light tan, porphyritic.

Thin section texture: Fine- to medium-grained porphyritic.

Mineralogy	Approx. %
plagioclase	50
quartz	25
orthoclase	15
biotite, hornblende, magnetite	10
chlorite	
sericite	

Plagioclase- Subhedral phenocrysts up to 3mm in length: zoned. Almost no alteration; a few grains are slightly altered to sericite.

Hornblende- Subhedral phenocrysts up to 5mm in length. Poikilitic inclusions of other minerals common.

Biotite- Phenocrysts avering about 1mm. Partially replaced by chlorite and magnetite in some parts of the section.

Groundmass- Fine-grained, appears to be made up of about equal amounts of quartz and orthoclase. A few quartz phenocrysts are also present.

PETROGRAPHIC ANALYSIS

Date 10-28-71

Analyst JAF

Sample No. 3820 (Core from Kennecott)

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Dark gray, dense, fine to medium-grained rock w/ sulfides & quartz veinlets

Thin section texture: fine-grained, slightly porphyritic

THIN SECTION MINERALOGY

Mineral	Chemical Composition
Plagioclase	
quartz	
biotite	
~~[illegible]~~	
Anhydrite ?	
K-feldspar	
Chlorite (minor)	
opaques (magnetite & sulfides)	

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

This rock is very similar to the sample from 3900'. It seems to be slightly finer-grained but ~~[illegible]~~ mineralogically identical. See the description of 3900'.

CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)

PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

PETROGRAPHIC ANALYSIS

Date 10-29-71

Analyst JAF

Sample No. P

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Dense, dark gray, fine-to medium-grained rock w/ sulfides & some quartz veinlets.

Thin section texture: fine- to medium-grained, porphyritic.

THIN SECTION MINERALOGY

Mineral	Chemical Composition
Plagioclase ~ An_{44}	
quartz	
biotite	
chlorite	
K-feldspar ?	
magnetite	
sulfide	
Anhydrite ?	calcite

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Plagioclase occurs as phenocrysts up to about 1mm in length. Finer-grained plagioclase is also present. Quartz with probably some K-feldspar are finer-grained. Fine-grained biotite is scattered throughout the rock, some appears to be replacing chlorite. Anhydrite(?) and quartz occur in small veinlets.

This rock is similar to those from 3820' and 3900'. It is finer-grained in some areas.

CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)

PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

Sample # 42

Hand Sample: Fine- to medium- grained, porphyritic. Greenish-gray.

Thin section texture: Fine- to medium- grained, hypautiomorphic, seriate to porphyritic.

Mineralogy	Approx. %
plagioclase	50
orthoclase	20
quartz	20
hornblende	5
epidote	
magnetite	
chlorite	
apatite	
sericite (?)	

Plagioclase occurs as fairly large subhedral to euhedral crystals averaging about 2mm in length. Some are zoned. With uncrossed nicols the plagioclase appears slightly cloudy but with crossed nicols most grains appear to be unaltered. A few grains contain flecks of epidote and very small amounts of what appears to be sericite. Orthoclase occurs as anhedral grains avering about 1mm in diameter. It is unaltered. Quartz is present as anhedral grains about 0.5mm in diameter.

Fairly large subhedral crystals of hornblende are present. They contain numerous inclusions of the other minerals. Some epidote is associated with hornblende but most of the hornblende is fresh. Epidote occurs as a minor alteration product of plagioclase and as clumps of crystalw up to about 1mm in diameter. In some cases it is intergrown with chlorite. Chlorite also occurs as irregular flacks. The relationship of hornblende, epidote and chlorite is not clear. Most of the hornblende appears fresh. Most of the epidote is present as fairly larfe masses of pure epidote or with chlorite. Some chlorite is independent of other minerals.

Sample # 43

Hand sample: Fine- to medium- grained porphyritic. Light gray.

Thin section texture: Porphyritic, fine-grained groundmass with medium- to coarse-grained phenocrysts.

Mineralogy	Approx. %
plagioclase	45
orthoclase	25
quartz	20
chlorite, epidote, magnetite, sericite, sphene, calcite	10

Plagioclase- Phenocrysts ranging in size from about 2mm to 6mm. Most grains show some alteration, usually to epidote. Some of the larger grains are altered to fairly coarse-grained sericite with some calcite. Chlorite occurs within a few plagioclase sites.

Orthoclase- Very fine-grained; occurs only in groundmass.

Quartz- Fine-grained in groundmass.

Epidote- Alteration product of plagioclase or intergrown with irregular masses of chlorite and occassionally calcite.

Chlorite- Irregular masses usually associated with epidote.

Magnetite- Almost always associated with chlorite.

The chlorite and epidote masses probably represent completely altered mafic minerals.

(2071') - Plagioclase phenocrysts altered to sericite. Appears to be a finer-grained sericite than in previous samples. 70 - 90% of plagioclase replaced. Appears to be some secondary quartz in the plagioclase sites. Carbonates and epidote very rare if present. Chlorite occurs in the groundmass and as relatively large masses. Talc(?) is present along fractures. Sericite appears to be slightly more abundant in groundmass than in other samples.

(2136') - Plagioclase phenocrysts appear less altered. ~30-50% replacement. Sericite alteration less pronounced. Epidote alteration of plagioclase more abundant than sericite or the two are about equal. Some small quartz veinlets. Chlorite common as masses and in groundmass. Opaques (magnetite & hematite) very abundant in areas rich in chlorite. Minor calcite in a veinlet.

(1103') "Bleached" Sample highly fractured & iron stained. Plagioclase phenocrysts 50-70% replaced by sericite & epidote. Sericite more abundant than epidote. Biotite is fairly abundant and texturally appears similar to the chlorite in the other samples. Some biotite is specially associated with plagioclase. Hematite surrounded by iron-staining is fairly common.

(2037')- Altered & iron-stained plagioclase phenocrysts in distinct. ~~tw~~ Dark brown masses appear to be iron stained masses of sericite, Possibly some biotite. Chlorite is fairly common, mostly in small masses. Sericite also occurs in groundmass. Fe-oxide minerals surrounded by brown staining are common.

PETROGRAPHIC ANALYSIS

Date 4-17-72

Analyst JAF

Sample No. 48 granodiorite porphyry

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Light gray, medium-grained porphyritic rock. Light & Dark colored phenocrysts.

Thinsection Texture: Porphyritic, fine-grained groundmass, medium-grained phenocrysts.

THIN SECTION MINERALOGY

Mineral	Approx %	Chemical Composition
Plagioclase	30-35	
Quartz	20-25	
Chlorite	10-15	
Clinozoisite	≅ 5	
orthoclase	15-20	
Calcite	< 1	
sericite, magnetite	traces	

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Plagioclase - subhedral phenocrysts, up to 3 mm in length. Slightly altered to sericite, epidote (Clinozoisite) & calcite. Zoned.

Quartz - Rounded, partially resorbed grains up to 1.5 mm in diameter. mostly much finer-grained in groundmass.

Orthoclase - fine-grained, restricted to groundmass.

Chlorite - Penninite, mostly fine-grained aggregates up to 3 mm in length. Commonly intergrown with epidote-group minerals.

Epidote (clinozoisite) - Aggregates up to 3mm in length. Commonly intergrown with chlorite & calcite.

original mafic mineral is now altered to chlorite & epidote. texture suggests that hornblende was the original mineral. Possibly some was biotite.

CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)

PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

Probably quartz latite or dacite porphyry.

Too many phenocrysts -- granodiorite porphyry.

PETROGRAPHIC ANALYSIS

Date 4-15-72

Analyst JAF

Sample No. 49 quartz monzonite

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

gray medium-grained granular rock.

Thin section Texture: Fine- to medium-grained porphyritic.

THIN SECTION MINERALOGY

Mineral	Approx %	Chemical Composition
Plagioclase	45-50	
Biotite	~10	
Orthoclase	15-20	
Quartz	15-20	
Bi + 2V≈60 } — Clinozoisite(?)	~1	
Magnetite		

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Plagioclase - Phenocrysts, up to 5 mm long. Mostly very fresh. zoned. Andesine. Subhedral to euhedral.

Biotite - Irregular flakes up to 1mm in diameter. Dark brown, many grains are bleached. Some have numerous inclusions of other primary minerals. A few are intergrown with clinozoisite.

Orthoclase - fine-grained, irregular grains. Restricted to groundmass.

Quartz - Fine- to medium-grained. Mostly in groundmass w/ orthoclase. A few larger spherical grains are present.

Clinozoisite - small grains, fractured. Some intergrown with masses of biotite.

magnetite - usually associated with biotite or intergrown biotite & clinozoisite.

CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)

PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

Qtz Latite or Qtz dacite porphyry

Too many phenocrysts - granodiorite por.

PETROGRAPHIC ANALYSIS

Date 4-17-72

Analyst JAF

Sample No. 50

andesite (latite?)

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

gray fine-grained. Appears to contain abundant epidote

Thin section texture: mostly fine-grained, microporphyritic, Subparallel alignment of phenocrysts.

THIN SECTION MINERALOGY

Mineral	Chemical Composition
Plagioclase	Fine grain size makes % estimate impossible. Much of groundmass is orthoclase, Plagioclase phenocrysts are very abundant.
Epidote	
Calcite	
Chlorite	
orthoclase	
magnetite	
sericite	

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Plagioclase - Phenocrysts, euhedral, maximum size: 1 mm. Moderate alteration to sericite & epidote. Epidote alteration much more intense in parts of the sample.

Epidote - Abundant, makes up approx. 30% of rock. Most seem to be forming from plagioclase. Some grains up to 1 mm in diameter. Irregular distribution in sample.

Chlorite - (Penninite) fine-grained, some aggregates are larger. Texture suggests that much is a replacement of biotite.

Orthoclase - very fine-grained - groundmass. Seems to be fairly abundant in groundmass.

magnetite - fine-grained, scattered throughout rock. Some red-brown stain around some grains.

CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)

PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

original minerals probably Plagioclase, orthoclase & biotite. Maybe a basalt or possibly an basite. Propylitic alteration.

PETROGRAPHIC ANALYSIS

Date 4-15-72

Analyst JAF

Sample No. 51

rhyodacite (dacite?)

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Dark gray fine-grained homogeneous rock.

Thin section texture: Mostly fine-grained; poorly developed micro-porphyritic texture.

THIN SECTION MINERALOGY

Mineral	Approx %	Chemical Composition
Plagioclase	45-55	
Quartz	10-15	
Orthoclase	10-15	
Biotite	~5	
Zoisite(?)	~5	
Apatite		
Sericite, magnetite		

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Plagioclase - subhedral laths, mostly less than 1mm in length. Very slight sericitic alteration

Quartz - Irregular grains. Larger than plagioclase. Late mineral to crystallize as it partially surrounds and encloses plagioclase and biotite

Orthoclase - Similar occurrence to quartz. Irregular grains partially enclosing plagioclase.

Biotite - Variable grain size, larger grains include smaller grains of plagioclase. Most grains are fresh, a few are slightly bleached.

*Zoisite - Subhedral grains less than 1mm. Fairly abundant, unusual texture in that they appear to be a primary mineral.

Magnetite - mostly spherical clusters of small grains.

~~CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)~~

* I'm not completely satisfied with this identification. The optics point to this mineral but the occurrence seems a little strange. It might possibly be a pyroxene but this seems a little unusual also.

PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

Probably a dacite -

PETROGRAPHIC ANALYSIS

Date 4-15-72

Analyst JAF

Sample No. 56

dacite porphyry

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Light greenish gray, fine- to medium-grained porphyritic.

Thin section Texture: fine-grained groundmass; medium grained phenocrysts.

THIN SECTION MINERALOGY

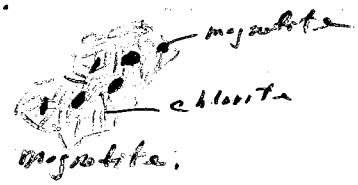
Mineral	Chemical Composition
Plagioclase	
Quartz	
Chlorite	
magnetite	
sericite	
Clay minerals.	

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Plagioclase - Phenocrysts up to 3 mm in length & appear to be very abundant in groundmass. Almost all grains show some argillication. This is most intense near the margins of the larger phenocrysts

Some of the larger grains show minor sericite alteration. The small grains in the groundmass are fairly strongly argillized.

Chlorite - masses of fine-grained chlorite up to 2 mm in diameter. Penninite variety.



Commonly contain magnetite.

Textural relations suggest replacement of biotite or possibly hornblende.

Quartz - fine-grained in groundmass. Probably makes up ~15% of groundmass much more abundant in one small zone. May be a veinlet.

CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)

PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

Probably a dacite porphyry or similar rock, mostly plagioclase & quartz with approx 5% matrix (now chlorite)

PETROGRAPHIC ANALYSIS

Date 4 - 14 - 72

Analyst JAF

Sample No. 57

quartz latite porphyry

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Light gray, fine-grained, some large "fragments" of what appears to be epidote.

Thin section Texture: Fine-to-medium-grained porphyritic. Phenocrysts very abundant

THIN SECTION MINERALOGY

Mineral	Approx %	Chemical Composition
Plagioclase	40-45	
Quartz	10-15	
Biotite		
Orthoclase	30-35	
Chlorite } Epidote }	~5	
Sericite	Apatite	

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Plagioclase - subhedral, complexly twinned phenocrysts up to 8 mm. moderate alteration to sericite & epidote.

Quartz - anhedral grains up to 1mm. Some of the larger grains are very angular and appear to have been broken.

Orthoclase - All fine grained in groundmass. Little or no alteration

Biotite - fairly large flakes to fine. Almost completely altered to chlorite + epidote.

CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)

PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

Probably a quartz latite porphyry. Alteration minerals characteristic of propylitic zone.

PETROGRAPHIC ANALYSIS

Date 5-18-72

Analyst JAF

Sample No. 59

andesite

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Fine to medium-grained, Dark gray.

Thin section Texture - fine- to medium-grained porphyritic, flow structures in groundmass

THIN SECTION MINERALOGY

Mineral	Chemical Composition
Plagioclase	
Biotite	
Hornblende	
Quartz	Epidote
Chlorite	Sericite
Calcite	magnetite
Orthoclase	hematite

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Plagioclase - A few phenocrysts, slightly sericitized. Mostly in groundmass as microlites with subparallel alignment.

Quartz - mostly in groundmass.

Hornblende - fairly large grains ~ 5-10% of rock. A few grains are partially converted to biotite

Biotite - 5-10% of rock. Some grains up to 2 mm in length. Margins altered to chlorite.

Chlorite - alteration of biotite. Some fine-grained in groundmass; may be completely altered biotite.

Epidote - not too abundant, mostly in fairly large clusters.

Orthoclase - not too abundant, Groundmass.

CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)

PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

Probably an andesite.

PETROGRAPHIC ANALYSIS

Date 5-18-72

Analyst JAF

Sample No. 61 (or 19?)

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Dark Gray, mostly fine-grained rock.

Thin section Texture: mostly fine-grained, some suggestion of flow structure

THIN SECTION MINERALOGY

Mineral	Chemical Composition
Plagioclase	
Quartz	
Epidote	
Sericite	
Calcite	
Apatite	orthoclase
Chlorite	magnetite
	hematite

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Plagioclase - A few fairly large phenocrysts. Almost completely replaced by sericite with some Calcite and epidote. ~~Some~~ Abundant microlites in groundmass appear to be plagioclase. These are not as altered as the phenocrysts.

Quartz - mostly very fine-grained, a few larger grains

Epidote & Chlorite - Fairly abundant in groundmass.

Orthoclase - groundmass, not very abundant

magnetite - slightly altered to hematite

CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)

PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

This is a bad rock to work with. Very fine grain size and alteration make ?? estimate impossible and identification difficult. Texture looks like volcanic rock. Could it be metamorphosed? Some roughly spherical masses of sericite, epidote & calcite may be amygdules ??

PETROGRAPHIC ANALYSIS

Date 5-18-72

Analyst JAF

Sample No. 65-B

quartz biotite porphyry

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Light gray, fine- to medium-grained porphyritic rock

Thin section Texture: fine-grained groundmass, medium- to coarse-grained phenocrysts.

THIN SECTION MINERALOGY

Mineral	Approx %	Chemical Composition
Plagioclase	40	
Quartz	25	
Orthoclase	20	
Chlorite	10	
Epidote	5	
Magnetite		
Sericite		

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Plagioclase - Phenocrysts, up to 5 mm in length. Some grains are fairly strongly sericitized, minor epidote alteration.

Quartz - Groundmass, fine-grained, A few grains up to 1mm in diameter

Orthoclase - All in groundmass. Fine-grained

Chlorite - In fairly large (2½ mm) patches. Textural relations suggest biotite replacement. Intergrown with epidote

Epidote - Some fairly coarse-grained. Intergrown with chlorite as replacement of biotite or alteration product of plagioclase.

Sericite - Alteration product of plagioclase.

CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)

PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

Quartz Latite Porphyry

PETROGRAPHIC ANALYSIS

Date 7-16-72

Analyst JAF

latite or quartz latite

Sample No. 73

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Light brown, mostly fine-grained slightly porphyritic. A few fairly large spherical qtz. grains

Thin section texture: mostly fine-grained, porphyritic.

THIN SECTION MINERALOGY

Mineral	Chemical Composition
Plagioclase	
Orthoclase	
Chlorite	
Quartz	
Epidote	
Hydrolimonite (?), magnetite, sphene	

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Plagioclase - euhedral phenocrysts up to 4 mm across. Some alteration to very fine-grained sericite. Also some in fine-grained groundmass

Orthoclase - some very fine-grained, in groundmass. Difficult to determine how much is present. Seems to be less abundant than plagioclase.

Chlorite - Fairly abundant. Mostly as fibrous masses up to ~0.5 mm. Some finer-grained.

Quartz - Mostly fine-grained. A few larger spherical grains. Probably makes up less than 10% of rock.

Epidote - A few spherical aggregates up to 1mm across. Not too abundant

Hydrobiotite(?) - Fine-grained yellow-green mica. Birefringence too high for chlorite. Abundant in groundmass.

Magnetite - Commonly associated w/ chlorite. Some skeletal grains

CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)

PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

PETROGRAPHIC ANALYSIS

Date 7-17-72

Analyst JAF

dacite (or andesite)

Sample No. 75

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Dark gray, mostly fine-grained porphyritic

Thin section Texture: mostly fine grained, porphyritic.

THIN SECTION MINERALOGY

Mineral	Chemical Composition
Plagioclase	
Chlorite	
Quartz	
Hydrobiotite (?)	
Hematite	
Epidote	

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Plagioclase – phenocrysts up to ~2mm, mostly smaller. Also abundant in groundmass. Minor alteration to epidote and very small amounts of sericite. Not much altered

Chlorite – in patches up to ~1.5cm in size.

Quartz – fine-grained, in groundmass. A few rounded & resorbed phenocrysts.

Hydrobiotite(?) – fine-grained material scattered throughout groundmass. Greenish brown color. Birefringence too high for chlorite.

Hematite - fine-grained, red under reflected light. Scattered throughout rock. Not too abundant.

Epidote - minor mineral. Alteration product of plagioclase

Grain size of groundmass too fine to give any meaningful estimate of %. Mostly plagioclase, chlorite, hydrobiotite & quartz.

CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)

PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

PETROGRAPHIC ANALYSIS

Date 7-16-72

Analyst JAF

Sample No. 78

granodiorite

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Light colored, porphyritic. Abundant iron oxide staining on fractures.

Thinsection Texture: fine- to medium-grained porphyritic

THIN SECTION MINERALOGY

Mineral	Approx %	Chemical Composition
Plagioclase	40-50	
Quartz	20	
Chlorite	5	
Orthoclase	15-20	
Hematite	<5	
Sericite	~1	

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Plagioclase - Anhedral crystals up to 2mm. Phenocrysts. Fairly strong sericite alteration. Andesine

Quartz - Fine-grained, in groundmass. Appears to be late crystallizing as it is very irregular in shape and surrounds all other minerals.

Chlorite - Fairly large masses up to 1mm. Commonly contain abundant fine-grained hematite

Orthoclase - Fine-grained, in groundmass. Little or no alteration

Hematite - Fairly abundant. Commonly associated w/ chlorite

appears black in transmitted light but red in reflected light.
None of the opaque minerals are black in reflected light.

CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)

PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

PETROGRAPHIC ANALYSIS

Date 7-16-72

Analyst JAF

dacite

Sample No. 79

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Medium-gray, mostly fine-grained, porphyritic.

Thin section Texture: Fine- to medium-grained porphyritic

THIN SECTION MINERALOGY

Mineral	Approx %	Chemical Composition
Plagioclase	50-60	
Hornblende	15-20	
Quartz	5	
Epidote	5-10	
Orthoclase	≤5	
magnetite	<5	

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Plagioclase - phenocrysts. Strong compositional zoning. Average size ~1 mm. Euhedral. Very fresh.

Hornblende - Pale greenish brown. Euhedral phenocrysts. Mostly less than 1 mm in diameter

Quartz - fine-grained in groundmass

Epidote - A few irregular clusters of crystals.

Orthoclase - groundmass - not very abundant.

Magnetite - fairly abundant in groundmass. Slight reddish iron oxide stain around some grains.

CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)

PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

PETROGRAPHIC ANALYSIS

Date 4-15-72

Analyst JAF

Sample No. 13

andesite

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Dark gray, fine-grained, some large masses of epidote.

Thin section Texture: mostly fine-grained, microporphyritic

THIN SECTION MINERALOGY

Mineral	Approx %	Chemical Composition
Plagioclase	50-60	
Hornblende	25-30	
Magnetite	~5	
Epidote	~5	
Quartz		
Orthoclase		

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Plagioclase - Near An_{50} in Composition, microphenocrysts. Most are cloudy but little distinct alteration. Maximum length ~1½ mm. Random orientation.

Hornblende - Dark green, irregular masses up to about 1mm in diameter. "Ragged" looking. Often aggregates of fine-grained crystals.

Magnetite - Very abundant. Mostly about 0.1 mm in diameter. More or less evenly scattered throughout slide

Epidote - Large irregular masses, up to 1cm in diameter.

Quartz & orthoclase - very minor minerals <1% of rock.

CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)

PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

Probably an andesite or basalt. Plag. composition falls very near An_{50}.

PETROGRAPHIC ANALYSIS

Date 4-12-72

Analyst JAF

Sample No. 37

dacite ?

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Dark gray, fine- to medium-grained porphyritic

Thinsection Texture: Porphyritic, fine-grained groundmass w/ fine- to medium-grained phenocrysts. Suggestion of alignment of crystals.

THIN SECTION MINERALOGY

Mineral	Approx %	Chemical Composition
Plagioclase	30-35 (phenocrysts)	
Hornblende	5-10	
Magnetite		
Quartz	too fine-grained to estimate %	
Orthoclase		
Epidote		
Apatite		
Chlorite		

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Plagioclase - Euhedral phenocrysts 1 to 1½ mm in diameter. Mostly fresh; some argillization. Most crystals are complexly zoned.

Hornblende - subhedral phenocrysts up to 3 mm in length. Most are fresh; a few are partially replaced by epidote.

Quartz - fine-grained, in groundmass

Orthoclase - fine-grained, in groundmass

Epidote - A few spherical masses ~~an~~ of epidote are present. Minor replacement product of hornblende.

chlorite - a few small flakes. After biotite?

CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)

PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

Probably a dacite, can't really tell how much orthoclase or quartz is present. Little or no alteration.

PETROGRAPHIC ANALYSIS

Date 4-15-72

Analyst JAF

Sample No. 40

andesite

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Dark gray, fine-grained granular to microporphyritic.

Thin section Texture: Mostly fine-grained, microporphyritic

THIN SECTION MINERALOGY

Mineral	Approx %	Chemical Composition
Plagioclase	60-70	
Hornblende	25-30	
Magnetite		
Chlorite		
sericite		
Quartz		
Orthoclase		
Calcite		
epidote		

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Plagioclase - subhedral, a few microphenocrysts. Cloudy appearing minor sericite & epidote replacement.

Hornblende - fine- to medium-grained crystals, "ragged" some alteration to chlorite.

Quartz, Orthoclase, Calcite - Restricted to small veinlets cutting the rock. much of the chlorite is associated w/ these veinlets. Quartz makes up most of the veinlet minerals.

CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)

PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

Andesite or basalt. I wasn't able to get plagioclase composition.

No.	Hand Specimen	Thin Section
1	biotite granodiorite porphyry (float)	
2	no specimen	
3	fine-grained granodiorite ?	
4	porphyritic andesite	
5	no sample	
6	porphyritic andesite	
7	porph. andesite ?	
8	andesite ? sericitized	
9	no sample	
10	f.g. diorite	
11	propylitized porph. andesite	
12	chloritic alt. f.g. andesite	~~much carb.~~
13	" " " "	much magnetite
14	bleached, sericitized porph andesite	
15	dirty por. granodiorite ?	
16	epidotized por. hbld. qtz diorite	
17	" " " " (with enprite stain ?) *	
18	pale green por. andesite? (same as # 11)	
19	wk. epidote por hbld qtz diorite? (no apparent quartz) = #16	
20	fragmental andesite; trace c-bp matrix similar to # 12, 13 prop. alteration	
21	epidotized por. hbld qtz dior. (but no apparent quartz)	
22	por. granodiorite (no apparent qtz)	
23	propylitized hbld granodiorite porphyry	
23	aphanitic andesite	
23	epidotized aphanitic andesite	
23	light green propylitized por. andesite	
24	no sample	

No	Hand Specimen	Thin Section
25	quartz diorite porphyry	
26	chloritized, silicified andesite ? tr pyrite	
27	porphyritic latite	
28	chloritized silicified? por. andesite tr. pyrite	
29	fragmental, pieces quartz lat. in andesitic? matrix ≈ #26	
30	qtz latite intruding andesite	
31	qtz latite (qtz monz?) white plag in light gray aphanitic groundmass	
32	no sample	
33	hbld qtz monz similar to #31, more pink groundmass	
34	no sample	
35	no sample	
36	chloritized, weakly porph. f.g. quartz monzonite (latite?) andesite	
37	chloritized qtz mon. porphyry	dacite?
38	porph qtz mon.; aphanitic groundmass (chloritized)	
38	chloritized biotite qtz. diorite porph.	
38	" qtz diorite porph. (2 pieces)	
39	f.g. qtz dior porph.; chloritized, much magnetite	
40	f.g. dior.(?) porph; chloritized, " "	andesite
41	f.g. dior or qtz dior porph. chloritized	
42	qtz diorite (field name granodiorite)	granodiorite
43	porph. hbld quartz latite or qtz monzonite f.g. groundmass K-spars sericitized; rest chloritized	qtz mzt porphyry
44	weakly porph andesite,? groundmass aphanitic = #23, ≈ #36	andesite porph.
45	pink porph quartz latite, white plag. in aphanitic groundmass	qtz lat. por.
46	" " " more apparent qtz, more tan in color	qtz lat. por.
47	hbld qtz monz porphyry	granodiorite por.
48	hbld qtz dior (granodiorite?) porph	granodiorite por.

No	Hand Specimen	Thin Section
49	granodiorite (qtz monz?) porphyry	granodiorite por.
50	f.g. qtz dior porphyry	andesite porph.
51	aphanitic andesite ?	dacite
52	weakly chloritized andesite porphyry	
53	weakly chlorited qtz diorite porphyry	
54	propylitized porph andesite	
55	intensely silicified quartz diorite?	
56	chloritized, weakly sericitized, porph andesite?	dacite
57	fine grained qtz monzonite? equigranular ±	qtz lat. porph.
58	quartz diorite	
59	f.g. porphyritic qtz drt, propylitized	andesite
60	qtz dior porph. propylitic alt.	
61	dacite? porphyry, good chlorite, wk sericite?	?
62	qtz drt, f.g.; plag phenos in vfg groundmass – well sericitized	
63	hbld grndt porph; K-spars sericitized, plag fresh; phen ≥ grdmass probably a little bleached	
64	qtz drt porph; strong epidote, weak-mod chl	
A-65	hbld grndt porph, K-spar sericitized, plag → ± epidote hbld → epidote + chl + hematite	quartz latite porphyry
B-65	hbld qtz drt por? differs from A in that plag phenocrysts are bigger, less hbld; nearly all phenocrysts have pink interior w/ white margin, very little sericite; good epidote & alb, hbld → goethite → geikite? chl	
66	intensely altered qtz drt?; strong sericite + calcite from plag.; hbld → chlorite + lim; good hematite occasionally in large clumps after biotite?	

No

67 porph. dacite ?; dark green dirty looking, small white plag phenocrysts in aphanitic groundmass, entire rock well sericitized; probably same as 61

68 dacite ? porphyry wk chlor-serici epid; lim Fe-mafics?

69 contaminated qtz dit

70 Kan fine grained andesite - mod chlorite, strong magnetite

71 Kan andesite porphyry - mod chlorite, strong magnetite

72 f.g. andesite agglom., yellow-green color, weak sericite, weak chlorite, strong limonite 60J40G w/ orange tinge limonite after mafics?

73 porphyritic latite? qtz-plag-hbld phenocrysts in aphanitic matrix, weak sericite-chlorite latite or qtz lat. <10% qtz

74 light gray qtz diorite dike — plag-hbld phenocrysts in aphanitic matrix; mod. epidote

75 andesite? porphyry str. chlor. wk epid-seri dacite (or andesite)

76 f.g. qtz ~~mnt~~ porphyry or quartz latite chlorite mod.

77 dark greenish brown, plag & hbld phenocrysts make up ≈ 30% of rock, aphanitic groundmass, andesite?

78 Tqdp?, strong chlorite alteration granodiorite

79 Tda dacite dike dacite

80 Kan weakly altered andesite porphyry

81 Tgdp granodiorite porphyry intrusive in bottom of shaft, weak-mod epidote

82 Kan biotite-epidote alteration to sericite

85 Tqdp? hbld-qtz-dior porphyry; all original hbld altered to biotite w/ minor chl-epid

84 ~~Tq~~ Trdp rhyodacite porphyry; 1/8"-1/4" plag. phenocrysts in aphanitic matrix; strong biotite, moderate sericite alteration; weak Cu oxide stain; thin quartz-K-spar veinlet w/ traces ~~of~~ limonite after chalcopyrite; no visible sulfides

85 aplite(?) dike; vfg granoblastic qtz texture w/ occassional large anhedral qtz crystals; small clots of biotite-chlorite, weak goethite boxworks after sulfides

86 granodiorite dike, porphyry

87 quartz monzonite?

88 light gray granodiorite porphyry; unaltered plag. phenocrysts up to 3/8" freely floating in aphanitic matrix which appears to contain abundant finely disseminated brown biotite; original biotite and/or hornblende also altered to biotite; small patches of unknown waxy, pale green mineral

89 pale pink quartz monzonite porphyry; unaltered ~~milky~~ white plagioclase phenocrysts 1/4" in aphanitic pinkish ground mass of K-spar and quartz; original biotite altered to chlorite; 1% finely disseminated magnetite

90 andesite, Kan, weak pyrite alteration; taken from outcrop ~~at~~ over KCC new ore zone

91 Tqmp quartz monzonite porphyry, original femics altered to chlorite and possibly biotite?
same rock as #89 ; no sulfides

92 light gray granodiorite(?) porphyry; plagioclase phenocrysts up to 1/4" and cloudy in a very pale gray aphanitic groundmass; good quartz phenocrysts; original biotite and hornblende show only partial alteration to chlorite w/ hornblende apparently more susceptible than biotite; very fine disseminated green chlorite flakes in groundmass; disseminated magnetite present; no sulfides but modest copper stain in groundmass and phenocrysts
<u>good</u> <u>neotocite</u> <u>stain</u>
also #92 intensely biotized fine grained andesite w/ weak copper oxide stain, modest limonite on fractures; no sulfides

~~93~~ 95 light gray agglomerate from outcrops 1/2 mile ~~south~~ southwest of ES-4; chlorite alteration; 2% magnetite

93 (I) light gray granodiorite; 30% clear plag. phenocrysts in aphanitic groundmass; small black biotite books; 1/2% magnetite; trace chlorite; some vfg brown flakes may be biotite; very weakly altered

(II) quartz monzonite porphyry; cloudy but hard shiny plag in

aphanitic pale pink groundmass; hbl + biotite altered to chlorite; total alteration very weak

94 very similar to 93 II but with dirty looking due to Fe stain, stronger chlorite, possible secondary biotite; traces Cu oxide

Sample No. A-80

Texture: Porphyritic, fine grained groundmass.

Mineralogy

Plagioclase
Epidote
Chlorite
Quartz
Sericite
Orthoclase
Magnetite
Hematite
Glass

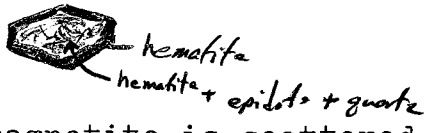
Subhedral plagioclase phenocrysts are abundant and show epidote and sericite alteration. Epidote is very abundant mostly as large clusters with minor orthoclase and chlorite. Chlorite is also scattered throughout the groundmass. Quartz and orthoclase are not very abundant but are present. The Groundmass is glassy in many areas. Some magnetite is present but most of it is oxidized to hematite.

Sample: Red Hill

Thin section texture: Porphyritic, fine-grained groundmass.

Mineralogy	Estimated %
plagioclase	45-55
epidote	
quartz	10
magnetite	
hematite	
sericite	
orthoclase	10-20
glass (?)	

Plagioclase occurs as subhedral phenocrysts up to 2mm. Moderate to strong alteration to epidote and sericite. The groundmass contains feldspar microlotes in some areas with some suggestion of flow orientation. Quartz and orthoclase occur in the groundmass and a small amount of glass may be present. Hematite is fairly abundant as fine-grained material apparently resulting from the alteration of some mineral that was present as phenocrysts. Small amounts of epidote and quartz occur with the hematite. Textures suggest that the replaced mineral may have been hornblende.



Fine-grained magnetite is scattered throughout the groundmass and shows little or no alteration to hematite.

Rock Name: Estimates of abundances probably not very accurate because of the fine-grained groundmass. Staining hand sample indicates that orthoclase is fairly abundant in the groundmass. Probably close to latite.

Sample No. B (unlabeled porphyry from mine)

Thin section texture: Porphyritic, fine grained groundmass.

Mineralogy	Est. %
plagioclase	45-50
quartz	15-20
orthoclase (& perthite)	25
biotite, chlorite	5
sericite	
calcite	
sphene	
sulfides	

Plagioclase-Subhedral phenocrysts. Moderate sericitic alteration.

Quartz-Fine grained in groundmass. Also quartz veins.

Orthoclase-Groundmass, mostly unaltered. A few fairly large grains of perthite are present. Fine grained orthoclase abundant adjacent to small quartz veins.

Biotite-Variable grain size (0.1-2mm). Most grains show some replacement by chlorite. Some almost complete.

Rock name: Quartz letite porphyry.

Sample No. A-A

Thin section texture: Fine to medium grained, porphyritic.

Mineralogy	Est. %
plagioclase	50-60
quartz	5-10(excluding veins)
biotite	25-30
sphene	
sericite	
clay minerals(?)	
opaques(Magnetite)	
calcite (mostly in veins)	
sulfides (in veins)	
chlorite	
epidote	

Plagioclase-Subhedral to euhedral phenocrysts and anhedral to subhedral smaller crystals in groundmass. Smaller grains are andesine. Phenocrysts are zoned and moderately altered to sericite and possibly clay minerals. Smaller grains are fairly fresh appearing.

Quartz-Fairly abundant in groundmass. Also in small veinlets cutting the rock with calcite and sulfides(?).

Biotite-Fine grained scattered throughout groundmass. Small amounts occur in the quartz veins and biotite may be slightly more abundant adjacent to veins than at some distance from them although the difference is slight if at all. Some of the biotite is in clusters while other is more or less evenly distributed throughout the groundmass. Good brown biotite.

Chlorite-In a few areas fairly large clusters of chlorite occur, intergrown with biotite. Small amounts of epidote are associated with the chlorite. Chlorite appears to be replacing biotite in these areas.

Sample # 42

Hand Sample: Fine- to medium- grained, porphyritic. Greenish-gray.

Thin section texture: Fine- to medium- grained, hypautiomorphic, seriate to porphyritic.

granodiorite

Mineralogy	Approx. %
plagioclase	50
orthoclase	20
quartz	20
hornblende	5
epidote	
magnetite	
chlorite	
apatite	
sericite (?)	

Plagioclase occurs as fairly large subhedral to euhedral crystals averaging about 2mm in length. Some are zoned. With uncrossed nicols the plagioclase appears slightly cloudy but with crossed nicols most grains appear to be unaltered. A few grains contain flecks of epidote and very small amounts of what appears to be sericite. Orthoclase occurs as anhedral grains avering about 1mm in diameter. It is unaltered. Quartz is present as anhedral grains about 0.5mm in diameter.

Fairly large subhedral crystals of hornblende are present. They contain numerous inclusions of the other minerals. Some epidote is associated with hornblende but most of the hornblende is fresh. Epidote occurs as a minor alteration product of plagioclase and as clumps of crystalw up to about 1mm in diameter. In some cases it is intergrown with chlorite. Chlorite also occurs as irregular flacks. The relationship of hornblende, epidote and chlorite is not clear. Most of the hornblende appears fresh. Most of the epidote is present as fairly larfe masses of pure epidote or with chlorite. Some chlorite is independent of other minerals.

Sample # 43

Hand sample: Fine- to medium- grained porphyritic. Light gray.

Thin section texture: Porphyritic, fine-grained groundmass with medium- to coarse-grained phenocrysts.

Mineralogy	Approx. %
plagioclase	45
orthoclase	25
quartz	20
chlorite, epidote, magnetite, sericite, sphene, calcite	10

quartz monzonite porphyry

Plagioclase- Phenocrysts ranging in size from about 2mm to 6mm. Most grains show some alteration, usually to epidote. Some of the larger grains are altered to fairly coarse-grained sericite with some calcite. Chlorite occurs within a few plagioclase sites.

Typical features of mineralized grp stocks

Orthoclase- Very fine-grained; occurs only in groundmass.

Quartz- Fine-grained in groundmass.

Epidote- Alteration product of plagioclase or intergrown with irregular masses of chlorite and occassionally calcite.

Chlorite- Irregular masses usually associated with epidote.

Magnetite- Almost always associated with chlorite.

JKW

The chlorite and epidote masses probably represent completely altered mafic minerals.

Sample # 44

Hand Sample: Gray, medium- grained with iron staining.

Thin section texture: Fine- to medium- grained, porphyritic.

<u>Mineralogy</u> andesite porphyry dike?

plagioclase
epidote
hornblende
chlorite
orthoclase
magnetite
hematite
apatite

<u>Plagioclase</u>- Fairly fresh, a slight amount of epidote alteration.
<u>Hornblende</u>- Minor mineral, very "ragged".
<u>Epidote</u>- Fairly abundant, usually in fairly large patches. commonly associated with chlorite, replacing hornblende in some cases.
<u>Orthoclase</u>- Fine-grained, seems to be more abundant around masses of chlorite and epidote.
<u>Magnetite</u>- Very abundant, some fairly coarse- grained. Commonly surrounded by a red translucent material (hematite ?). Rock is stained around most grains.

This rock appears to be very similar to the porphyritic andesite from the core. Plagioclase is present in similar amounts. Some hornblende remains whereas in the core it has been completely replaced. Iron oxides are more abundant than in most of the core samples that I've looked at. Plagioclase is less altered than in the shallow samples from ES-1.

Sample #45

Hand Sample: Light tan, porphyritic.

Thinsection texture: Porphyritic, Very fine-grained groundmass.

Mineralogy

quartz latite porphyry

plagioclase
quartz
sericite
biotite(?)
epidote
calcite
orthoclase
magnetite(?)
apatite
sphene

Plagioclase- Subhedral to euhedral phenocrysts up to 2mm in length. Most grains are altered to calcite and sericite.
Quartz- Rounded and partially resorbed phenocrysts up to 1mm in diameter.
Mica- Phenocrysts 1mm or less in length are intergrowths of sericite and a pale green mica with slightly lower birefringence (hydrobiotite ?) Also included in these masses are fine-grained sphene or some related mineral. The shapes of these masses suggest that they are replacements of biotite.
Orthoclase- Some very fine-grained orthoclase occurs in the groundmass.
Epidote- only a few scattered grains are present.

Sample # 46

Hand Sample: Light gray, porphyritic.

Thinsection texture: Porphyritic, very fine-grained groundmass.

Mineralogy

quartz latite porphyry (possibly rhyolite)

plagioclase
mica
quartz
magnetite
leucoxene
calcite
orthoclase
apatite

Plagioclase- Phenocrysts, altered to sericite and biotite (or hydrobiotite) with minor calcite.

Quartz- Rounded and partially resorbed phenocrysts.

Mica- Small phenocrysts of intergrown sericite and greenish brown biotite (hydrobiotite ?). Probably forming after biotite.
Groundmass- Too fine-grained to identify all minerals. Staining indicates that orthoclase is fairly abundant.

This rock appears very similar to #45. I can not estimate mineral percentages because of the fine-grained groundmass. Plagioclase is the most abundant phenocryst in both rocks with the intergrown micas being slightly more abundant than quartz.

Sample # 47

Hand Sample: Light tan, porphyritic.

Thin section texture: Fine- to medium-grained porphyritic.

Mineralogy	Approx. %
plagioclase	50
quartz	25
orthoclase	15
biotite, hornblende, magnetite	10
chlorite	
sericite	

granodiorite porphyry

Plagioclase- Subhedral phenocrysts up to 3mm in length: zoned. Almost no alteration; a few grains are slightly altered to sericite.

Hornblende- Subhedral phenocrysts up to 5mm in length. Poikilitic inclusions of other minerals common.

Biotite- Phenocrysts avering about 1mm. Partially replaced by chlorite and magnetite in some parts of the section.

! Groundmass- Fine-grained, appears to be made up of about equal amounts of quartz and orthoclase. A few quartz phenocrysts are also present.

Sample NO. 80

Thin section texture: Mostly fine-grained, porphyritic with well-developed flow structure.

Mineralogy	Estimated %
plag. (andesine)	70-75
hornblende	10
magnetite	2-4
chlorite	10
epidote	3-5
calcite	tr.
quartz	tr.
clay min. (?)	tr.

The rock is dominately plagioclase which occurs as euhedral laths with a maximum length of 1.4 mm. The laths show a subparallel orientation indicating flow. Plagioclase is not badly altered; some grains are cloudy while others contain small patches of epidote. Hornblende is present as euhedral grains with a maximum diameter of 2 mm, most of the grains are less than 1 mm. Most of the larger grains are unaltered; some are stained with iron oxide. The grains that are altered are altered to chlorite. Chlorite is fairly abundant throughout the groundmass as small irregular grains. Epidote occurs as an alteration product of plagioclase and in the groundmass. Fine-grained magnetite is abundant. A small amount of quartz is present in the groundmass.

Rock Name: Andesite porphyry

Sample No. 81

Thin section texture: Fine-to medium-grained; porphyritic.

Mineralogy	Estimated %
plag. (andesine)	50-55
quartz	~10
opaque	~1
orthoclase	5-10
biotite	15-20
epidote	5-7
clay minerals	tr.
apatite	tr.

plagioclase occurs as zoned subhedral phenocrysts up to 3 mm in length. Most crystals are fresh, some are slightly cloudy(clay minerals?) and some are slightly altered to epidote. Quatrz occurs as rounded embayed phenocrysts and in the groundmass. Biotite occurs as large, up to 3.5 mm masses of very fine-grained biotite intergrown with epidote. The biotite is greenish brown with intermediate birefringence. These intergrowths of biotite and epidote appear to be replacements of some mafic mineral, probably hornblende. Orthoclase is present in the groundmass but because of the fine-grain size it is difficult to estimate exactly how much is present.

Rock Name: Probably a dacite porphyry

Sample No. 82

Thin section texture: Fine-grained porphyritic.

Mineralogy	Estimated %
plagioclase	50-55
quartz	5 or less
biotite	~35
epidote	1-3
opaques	1-3
sericite	tr.
chlorite	tr.
glass (?)	<5

Plagioclase occurs as subhedral crystals with a maximum lenght of 1 mm; many crystals appear to be broken and angular. Most is fresh but some are altered to a fine-grained sericite. Quartz is finer-grained than plagioclase and is very angular. The groundmass is mostly a very fine-grained biotite. Some epidote is present in the groundmass. A few coare- grained patches of epidote are present. A fine-grained opaque mineral, probably magnetite, is fairly abundant. Minor amounts of glass appear to be present in the groundmass.

See the X-ray pattern for this rock.

Rock name: Probably andesite. Much of the plagioclase and quartz appear broken.

Sample no. 83

Thinsection texture: Porphyritic, fine grained groundmass.

Mineralogy	Estimated %
plag. (andesine)	40-50
biotite	~10
quartz	20-25
orthoclase	10-20
opaques	tr.
chlorite	tr.
epidote	tr.
sericite	tr.

Plagioclase occurs as subhedral phenocrysts up to 6 mm in length. Mostly very fresh; minor amount of fine-grained serictitc alteration. Biotite occurs as clusters of fine-grained biotite with small amounts of chlorite and epidote. The shape of somes of these clusters suggest that they may be replacements of hornblende crystals. Chlorite makes up as much as 40% of some of the clusters but most are nearly all biotite. Fine-grained quartz occurs in the groundmass and a few larger rounded grains are present. Orthoclase only occurs in the groundmass and it is difficult to estimate how much is present.

Rock Name: Porphyritic quartz latite.

Sample No. 84

Thin section texture: Fine-grained groundmass with larger patches of sericite.

Mineralogy	Estimated %
quatrz	35-45
sericite	20-30
chlorite	5-8
orthoclase	20-25
sphene	tr.
hematite	tr.

Quartz is very fine-grained and appears to make up a large part of the groundmass where it occurs as interlocking grains. A few larger grains are present. Large masses of fine-grained sericite are abundant. Individual masses may be as large as 3 mm in diameter. Chlorite is sometimes associated with the sericite as is orthoclase. These masses appear to be an alteration product of some mineral (plagioclase ?). Small patches of sericite are scattered throughout the groundmass intergrown with quartz. Some chlorite is in patches not intergrown with sericite. Fairly large irregularly shaped crystals of orthoclase are sometimes associated with the patches of sericite. Some finer-grained crystals also occur in the groundmass. sphene and hematite are associated with chlorite.

Rock name: ? The rock is badly altered. The groundmass resembles a fine-grained quartzite but may contain moderate amounts of orthoclase. If the large patches represent altered plagioclase phenocrysts the rock was probably a porphyry of some type.

Sample no. 85

Thin section texture: Porphyritic; fine-grained groundmass.

Mineralogy	Estimated %
plagioclase	40-45
quartz	20-25
orthoclase	10 or less
biotite } chlorite }	10-15
sericite	tr.
hematite	1-2
magnetite	1-2
apatite	tr.

Plagioclase phenocrysts up to 4 mm in length. Fairly strong sericitic alteration. A few rounded phenocrysts of quartz are present but it occurs mostly in the groundmass and is very fine-grained. A small veinlet cuts the rock and is composed mostly of quartz with some hematite. Orthoclase is present in the groundmass. Biotite is mostly very fine-grained and is scattered throughout the groundmass and in larger clusters. The clusters commonly contain some fine-grained magnetite and chlorite and probably represent replaced mafic minerals. Some chlorite occurs in small patches without any biotite.

Rock Name: Quartz latite or dacite porphyry

Sample no. 86

Thin section texture: Porphyritic, fine-grained groundmass.

Mineralogy	Estimated %
plagioclase (andesine)	50
quartz	25-30
orthoclase	10 or less
chlorite } sericite }	10-15
sphene	tr.
magnetite	tr.
apatite	tr.
hematite	tr.

Plagioclase phenocrysts and some in the groundmass. Minor sericitic alteration of phenocrysts. Rounded and embayed phenocrysts of quartz; also occurs in the groundmass. Sericite is scattered throughout the groundmass and in fairly large clusters where it is intergrown with chlorite and is fairly coarse grained. In some areas chlorite is associated with hematite.

Rock Name: Dacite porphyry.

Sample no. 88

Thinsection texture: porphyritic, fine-grained groundmass.

Mineralogy	Estimated %
plagioclase	40-45
quartz	20-25
biotite	5
orthoclase	20-25
chlorite	tr.
epidote	tr.
opaques	tr.
sericite	tr.
apatite	tr.

Plagioclase occurs as subhedral phenocrysts up to 4 mm in length. Mostly very fresh, minor sericitic alteration near margins of some grains. Some plagioclase is present in the groundmass. A few small phenocrysts of quartz are present but more commonly quartz occurs as fairly small clusters of grains that are rounded and embayed. Quartz appears to be fairly abundant in the groundmass and a small quartz veinlet cuts the rock. Biotite phenocrysts up to 1 mm in diameter show various stages of replacement by chlorite and minor epidote. Some very-fine-grained biotite is scattered throughout the groundmass. A few small phenocrysts of orthoclase are present and the mineral also occurs in the groundmass.

Rock Name: Quartz latite porphyry.

Sample No.89

Thin section texture: Porphyritic, fine-grained groundmass.

Mineralogy	Estimated %
plagioclase	35-40
quartz	25-30
biotite	tr.
orthoclase	20-25
chlorite	5
sphene	tr.
epidote	tr.
sericite	tr.
opaques	tr.

Large subhedral phenocrysts of plagioclase are zoned. Slight to moderate sericitic alteration. Quartz phenocrysts are rounded and embayed, abundant quartz in the groundmass. Biotite phenocrysts are about 95% replaced by chlorite. Fine-grained cloudy orthoclase occurs in the groundmass. Opaques are magnetite and hematite.

Rock Name: This rock is very similar to #88. The plagioclase is slightly more altered to sericite and biotite phenocrysts are more strongly altered to chlorite. The finer grained biotite in #88 is not present in this sample.

Sample No. 90

Thin section texture: Fine-tomedium-grained porphyritic.
Flow structure.

Mineralogy
plagioclase
epidote
hornblende
chlorite
opaques
apatite
quartz (veinlet)

Plagioclase occurs as laths with a maximum length of 1.5 mm with a subparallel alignment in most parts of the slide. It is mostly fresh; some grains are slightly cloudy. Hornblende is present as small prisms often in clusters but scattered throughout the groundmass. It is fairly abundant. Epidote occurs in fairly large, roughly spherical clusters. Chlorite is not very abundant occuring in the groundmass and along a small fracture. Very fine-grained magnetite is fairly abundant. A very small amount of glass may be present in the groundmass.

Rock name: andesite

See the X-ray pattern.

Sample no. 92

Thin section texture: porphyritic, fine-grained groundmass.

Mineralogy	Estimated %
plagioclase	40-45
quartz	20-25
biotite	5
hornblende	5
orthoclase	20-25
sphene	tr.
epidote	tr.
apatite	tr.
chlorite	tr.
opaque	tr.
apatite	tr.

Large (2-4 mm) subhedral phenocrysts of plagioclase are strongly zoned. Very fresh. Some plagioclase in the groundmass. Quartz occurs as irregularly shaped phenocrysts and in the groundmass. Biotite occurs as phenocrysts up to 2 mm in diameter and shows slight chlorite replacement. Hornblende phenocrysts are up to 2mm in length and contain numerous inclusions of groundmass minerals. Hornblende is also slightly replaced by chlorite. Fine-grained orthoclase occurs in the groundmass. Opaques are magnetite and hematite.

Rock name: Quartz latite porphyry.

Sample no. 93

Thin section texture: porphyritic.

Mineralogy	Estimated %
plagioclase	40-50
quartz	25-30
orthoclase	20-25
chlorite	1-2
sphene	tr.
epidote	tr.
calcite	tr.
magnetite	tr.

Zoned subhedral plagioclase phenocrysts are up to 7 mm in length. Little or no alteration. Some smaller plagioclase grains are in the groundmass. Fine-grained quartz occurs in the groundmass along with orthoclase. Clusters of chlorite occur throughout the rock along with small amounts of sphene and epidote.

Rock name: Quartz latite porphyry

Sample no. 93-A

Thin section texture: porphyritic

Mineralogy	Estimated %
plagioclase	40-50
quartz	25
hornblende	2-3
biotite	4-6
orthoclase	15-20
magnetite	1-2
apatite	tr.
calcite	tr.
epidote	tr.
chlorite	tr.

Plagioclase phenocrysts are are subhedral and zoned. Some plagioclase occurs in the groundmass. Quartz occurs as rounded embayed phenocrysts and in the groundmass. Hornblende is present as euhedral phenocrysts. Biotite occurs as small phenocrysts and as finer-grained biotite in clusters and disseminated throughout the groundmass. The phenocrysts show minor chlorite replacement and some chlorite occurs with the finer grained biotite. A small pocket of calcite is present.

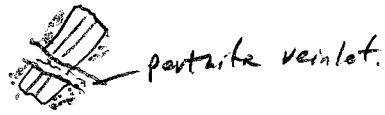
Rock Name: Quartz latite porphyry

Sample No. 94

Thin section texture: porphyritic.

Mineralogy	Estimated %
plagioclase	30-40
quartz	25-30
biotite	5
perthite	5-10
orthoclase	1o-15
sericite	tr.
epidote	tr.
chlorite	tr.
sphene	tr.
magnetite	tr.

Plagioclase occurs as phenocrysts up to 4 mm in length. minor sericitic alteration is present. Quartz appears to be abundant in the groundmass. Biotite occurs as clusters of fine-grained biotite, sometimes associated with sphene and small amounts of epidote and chlorite. Orthoclase occurs in the groundmass although it is difficult to say how much is present. A few fairly large grains of perthite are present and a veinlet of perthite cuts part of the thin section.



Rock Name: Probably quartz latite porphyry.

Sample No. 95

Texture: Porphyritic, fine grained.

Mineralogy

Plagioclase
Chlorite
Sericite
Orthoclase
Magnetite
Hematite
Epidote
Quartz
Glass

Plagioclase phenocrysts are abundant and show moderate alteration to sericite and epidote. Some fine grained laths occur in the groundmass. Chlorite is also abundant in the groundmass; and occassionally as large patches apparently replacing some mineral (hornblende ?). These large patches commonly have veins of very fine grained magnetite. Other more irregular patches of chlorite are present intergrown with magnetite. Some of the magnetite is oxidized to hematite. One large patch of sericite is present associated with minor amounts of quartz and intergrown with chlorite along the margins. Some orthoclase is present in the groundmass, and in some areas glass is present.

Sample No. 100

Texture: Porphyritic, fine grained groundmass.

Mineralogy

Plagioclase
Epidote
Orthoclase
Sericite
Chlorite
Sphene
Calcite
Magnetite
Hematite
Glass

Plagioclase occurs as phenocrysts that are altering to sericite and calcite. Most phenocrysts contain "veinlets" and irregular patches of orthoclase. Some are more than $\frac{1}{2}$ orthoclase. Epidote is scattered throughout the slide and is sometimes associated with calcite, fairly coarse orthoclase, and some chlorite. The groundmass is made up of glass and minute feldspar laths. Some orthoclase phenocrysts are present. Most of the magnetite is oxidized to hematite.

Sample No. 103

Texture: Porphyritic, some suggestion of flow.

Mineralogy

Plagioclase
Chlorite
Magnetite
Hematite
Quartz

About 75-80% of the rock is composed of zoned plagioclase laths packed together with a crude parallel orientation. Maximum grain size is about 2mm. These are surrounded by a groundmass of fine grained plagioclase and some quartz. Patches of chlorite and magnetite are present in some areas apparently replacing some mineral. Some of the magnetite is oxidized to hematite.

No.	Hand Specimen	Thin Section
1	biotite granodiorite (float) porphyry	
2	no specimen	
3	fine-grained granodiorite ?	
4	porphyritic andesite	
5	no sample	
6	porphyritic andesite	
7	porph. andesite ?	
8	andesite ? sericitized	
9	no sample	
10	f.g. diorite	
11	propylitized porph. andesite (agglomerate)	
12	chloritic alt. f.g. andesite (agglomerate) ~~much, mag.~~	
13	" " " "	much magnetite
14	bleached, sericitized porph andesite ?	
15	dirty por. granodiorite ?	
16	epidotized por. hbld. qtz diorite	
17	" " " " (with * emprite stain ?)	
18	pale green por. andesite? (same as # 11)	
19	wk. epidote por hbld qtz diorite? (no apparent quartz) = #16	
20	fragmental andesite; trace cpp matrix similar to # 12, 13	prop. alteration
21	epidotized por. hbld qtz dior. (but no apparent quartz)	
22	por. granodiorite (no apparent qtz)	
23	propylitized hbld granodiorite porphyry	
23	aphanitic andesite	
23	epidotized aphanitic andesite	
23	light green propylitized por. andesite	
24	no sample	

No	Hand Specimen	Thin Section
25	quartz diorite porphyry	
26	chloritized, silicified andesite ? tr pyrite	
27	porphyritic latite	
28	chloritized, silicified? por. andesite tr. pyrite	
29	fragmental, pieces quartz lat. in andesitic? matrix ≈ #26	
30	qtz latite intruding andesite?	
31	qtz latite (qtz monz?). white plag in light gray aphanitic groundmass	
32	no sample	
33	hbld qtz monz similar to #31, more pink groundmass	
34	no sample	
35	no sample	
36	chloritized, weakly porph. f.g. quartz monzonite (latite?)	andesite
37	chloritized qtz mon. porphyry	dacite?
38	porph qtz mon.; ~~aphanitic groundmass~~ (chloritized)	
38	chloritized biotite qtz. diorite porph.	
38	" qtz diorite porph. (2 pieces)	
39	f.g. qtz dior porph.; chloritized, much magnetite	
40	f.g. dior(?) porph; chloritized, " "	andesite
41	f.g. dior or qtz dior porph. chloritized	andesite?
42	qtz diorite (field name granodiorite)	granodiorite
43	porph. hbld quartz latite or qtz monzonite f.g. groundmass K-spars sericitized; rest chloritized	qtz mzt porphyry
44	weakly porph andesite,? groundmass aphanitic = #23, ≈ #36	andesite porph.
45	pink porph quartz latite, white plag. in aphanitic groundmass	qtz lat. por.
46	" " " more apparent qtz, more tan in color	qtz lat. por.
47	hbld qtz monz porphyry	granodiorite por.
48	hbld qtz dior (granodiorite?) porph	granodiorite por.

No	Hand Specimen	Thin Section
49	granodiorite (qtz monz?) porphyry	granodiorite por.
50	f.g. qtz dior porphyry	andesite porph.
51	aphanitic andesite ?	dacite
52	weakly chloritized andesite porphyry	
53	weakly chloritized qtz diorite porphyry	
54	propylitized porph andesite	
55	intensely silicified quartz diorite?	
56	chloritized, weakly sericitized, porph andesite?	dacite
57	fine grained qtz monzonite? equigranular ±	qtz lat. porph.
58	quartz diorite	
59	f.g. porphyritic qtz drt, propylitized	andesite
60	qtz dior. porph. propylitic alt.	
61	dacite? porphyry, good chlorite, wk sericite?	?
62	qtz drt, f.g.; plag phens in vfg groundmass – well sericitized	
63	hbld grndt porph; K-spars seritized, plag fresh; phen ≥ grdmass probably a little bleached	
64	qtz drt porph; strong epidote, weak-mod chl	
A-65	hbld grndt porph, K-spar sericitized, plag → ± epidote hbld → epidote + chl + hematite;	
B-65	hbld qtz drt por? differs from A in that plag phenocrysts are bigger, less hbld; nearly all phenocrysts have pink interior w/ white margin, very little sericite; good epidote ⊠-als, hbld → epidote + chl	quartz apatite porphyry
66	intensely altered qtz drt?; strong sericite + calcite from plag.; hbld → chlorite + lim; good hematite occasionally in large clumps after biotite?	

No

67 porph. dacite ?; dark green dirty looking, small white plag phenocrysts in aphanitic groundmass, entire rock well sericitized; probably same as #61

68 dacite? porphyry wk chlor-seric-epid; lim after mafics?

69 contaminated qtz drt

70 Kan fine grained andesite - mod chlorite, strong magnetite

71 Kan andesite porphyry - mod chlorite, strong magnetite

72 f.g. andesite agglom., yellow-green color, weak sericite, weak chlorite, strong limonite 60J40G w/ orange tinge limonite after mafics?

73 porphyritic ~~dacite~~ latite? - qtz-plag-hbld phenocrysts in aphanitic matrix, weak sericite-chlorite latite or qtz lat. <10% qtz

74 light gray qtz diorite dike — plag-hbld phenocrysts in aphanitic matrix; mod. epidote

75 andesite? porphyry str. chlor. wk epid-seri dacite (or andesite)

76 f.g. qtz ~~mzt~~ porphyry or quartz latite chlorite mod.

77 dark greenish brown, plag & hbld phenocrysts make up ≈ 30% of rock, aphanitic groundmass, andesite?

78 Tqdp?, strong chlorite alteration granodiorite

79 Tda dacite dike dacite

80 Kan weakly altered andesite porphyry

81 Tgdp granodiorite porphyry intrusive in bottom of shaft, weak-mod epidote

82 Kan biotite-epidote alteration to sericite

83 Tqdp? hbld-qtz-dior porphyry; all original hbld altered to biotite w/ minor chl-epid

ES 1	747	Clay, ser, + $CaCO_3$ alt. intense."
	1011	" w. epidote
	1103	" w. " + chlorite
	1620	" "
	2037	" " v. st. FeOx soak + after Py.
	2071	" "
	2565	" , Ser + v. st. FeOx soak + after mafics.
	2136	clay, ser., qtz. string. Few fold remain.
	2469	" " Plag. remain. Biot.
	2493	" " " " "Zoned"
	2731	Alt. mod to wk. Micro. cryst. g.M. st. FeOx Soak
	2746	" " Micro. to v.f.g. g.M. Opaque Blebs
	2880	clay + chlorite of g.M., v. st.
	3077	" " " " . Shattered Phen.
	3189	" " " "Glass?"
	3229 Rock	wk. clay of g.M. chlorite string. Qtz. string.
	3229 Vein	v.f. to med. gr. $CaCO_3$
	3275	chlorite Glassy + micro. cryst. g.M.
ES 2	1106	Mod. to wk. Clay, Ser. + $CaCO_3$ alt.
	1106	Some epidote others mod. to st.
Show me Biot. alt.	2773	Clay, Ser, minor chlorite alt. Glassy G.M. Rare Biot.
	2869	v. st. clay + chlorite alt. ~~loc. $CaCO_3$~~
	3131	st. clay + loc. chlorite alt. G.M. esp.

ESI 1971
2 2688

Paul E. ✓ ECH ✓ JJ

Nail Keg
Safford AREA F

P.O. Box 872

Douglas, Arizona, 85607
March 13, 1971

GEOEX
Cable: GEOEX
REC'D MAR 1971 REC'D
BOX 5964 TUCSON, ARIZONA 85703
Phone: (AREA 602) 623-0578

Mr. Walter Heinrichs
Heinrichs Geoexploration
Box 5964
Tucson, Arizona, 85703

Re: GEOX Job # 616

Dear Mr. Heinrichs:

Enclosed are descriptions of the two samples you sent. I hope we read the labels on the rocks correctly. They are being returned under separate cover with the slides.

Sample 10-G shows only "dry" thermal metamorphism. In 36-E, however, this is superimposed with K-metasomatism. Alteration in this sample, though weak, is encouraging and reminiscent of that at Safford (for one example).

Sincerely,

Sidney A. Williams

Sidney A. Williams

saw/bj

BOB:
These specimens are mentioned in the Robinson report on the Nail Keg, etc. 36 E shows "biotite" alteration (or K-metasomatism if you prefer), and came from somewhere near the San Juan Mine. Specimen 10G came from an exposure south of the Butte fault and was agglomerate exposed in a canyon bottom beneath basalt.

10-G

The specimen is a meta-andesite originally composed of phenocrysts o f plagioclase and hornblende set in a matrix of slender plagioclase laths showing fluidal structure. The epizonal metamorphism has been mild.

The most notable change is complete replacement of hornblende by coarse, prismatic epidote along with lesser amounts of pennine, quartz, calcite, and sphene. Tiny pennine flakes are also abundant in the interstices of the plagioclase microlites where there may initially have been glass. The plagioclase is but slightly altered to calcite, sericite, and occasionally, epidote.

Mineral percentages are esptimated as follows: plagioclase 70%, epidote 8%, pennine 17%, quartz 1%, calcite 2%, sphene 0.5%, sericite 0.5%, magnetite 0.5%, and apatite tr.

36-E

The specimen is a meta-andesite with phenocrysts of plagioclase and hornblende set in a microcrystalline and directionless matrix of plagioclase - The rock shows evidence of rapid chilling. Cognate xenoliths are widely scattered - most are coarser grained than the host. Epizonal metamorphism has been accompanied by K-metasomatism.

Original hornblende has been replaced by loose aggregates of stubby epidote prisms, quartz, pennine and calcite. This assemblage is in part replaced by extremely fine grained hydrobiotite. The place of cholrite in the matrix in 10-G is taken here by hydrobiotite also. Plagioclase is flecked with sericite and epidote. Thin, sinuous veinlets of sericite and epidote cut the fabric.

Minerals appear in the following estimated amounts: plagioclase 61%, epidote 5%, sericite 4%, pennine 2%, quartz 1%, calcite 4%, sphene 0.5%, hydrobiotite 22%, and apatite and magnetite in trace amounts.

Paul E. ✓ ECH ✓
JH

Neil Kay
Safford AREA

P.O. Box 872

Douglas, Arizona, 85607
March 13, 1971

GEOEX
Cable: GEOEX
BOX 5964 TUCSON, ARIZONA 85703
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REC'D MAR 1971 REC'D

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Sincerely,

Sidney A. Williams

Sidney A. Williams

saw/bj

Sample 36 E is supposed to represent the "biotite" or K-metamatic alteration near the San Juan Mine at Safford. Does it have any resemblance to the specimen from 2136 feet in hole ES-1 ?

10-G

The specimen is a meta-andesite originally composed of phenocrysts o f plagioclase and hornblende set in a matrix of slender plagioclase laths showing fluidal structure. The epizonal metamorphism has been mild.

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Mineral percentages are esptimated as follows: plagioclase 70%, epidote 8%, pennine 17%, quartz 1%, calcite 2%, sphene 0.5%, sericite 0.5%, magnetite 0.5%, and apatite tr.

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Minerals appear in the following estimated amounts: plagioclase 61%, epidote 5%, sericite 4%, pennine 2%, quartz 1%, calcite 4%, sphene 0.5%, hydrobiotite 22%, and apatite and magnetite in trace amounts.

PETROGRAPHIC ANALYSIS

Date 10-29-71

Analyst JAF

Sample No. P

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Dense, dark gray, fine-to medium-grained rock w/ sulfides & some quartz veinlets.

Thin section texture: fine-to medium-grained, porphyritic.

THIN SECTION MINERALOGY

Mineral	Chemical Composition
plagioclase ~ An_{44}	
quartz	
biotite	
chlorite	
K-feldspar ?	
magnetite	
sulfide	
Anhydrite ?	calcite

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Plagioclase occurs as phenocrysts up to about 1mm in length. Finer-grained plagioclase is also present. Quartz with probably some K-feldspar are finer-grained. Fine-grained biotite is scattered throughout the rock, some appears to be replacing chlorite. Anhydrite(?) and quartz occur in small veinlets.

This rock is similar to those from 3870' and 3900'. It is finer-grained in some areas.

PETROGRAPHIC ANALYSIS

Date 10-29-71

Analyst JAF

Sample No. P

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Dense, dark gray, fine- to medium-grained rock w/ sulfides & some quartz veinlets.

Thin section texture: fine- to medium-grained, porphyritic.

THIN SECTION MINERALOGY

Mineral	Chemical Composition
Plagioclase ~ An_{44}	
quartz	
biotite	
Chlorite	
K-feldspar ?	
Magnetite	
Sulfide	
Anhydrite ?	calcite

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Plagioclase occurs as phenocrysts up to about 1mm in length. Finer-grained plagioclase is also present. Quartz with probably some K-feldspar are finer-grained. Fine-grained biotite is scattered throughout the rock, some appears to be replacing chlorite. Anhydrite(?) and quartz occur in small veinlets.

This rock is similar to those from 3820' and 3900'. It is finer-grained in some areas.

PETROGRAPHIC ANALYSIS

Date 1-21-72

Analyst JAF

Sample No. K-3125' Dec 71

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Dark gray medium-grained rock. Veins contain Chalcopyrite. Little or no disseminated chalcopyrite.

Thin section Texture. Fine-to medium grained. Hypidiomorphic Granular.

THIN SECTION MINERALOGY

Mineral	Chemical Composition
Plagioclase	chlorite
orthoclase	Anhydrite
Quartz	Sericite
Biotite	Chalcopyrite
Black opaque (magnetite?)	Sphene
	Apatite

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Original rock was a quartz monzonite (?) a granodiorite composed of Plagioclase, biotite, orthoclase and quartz. The texture is almost Porphyritic with fairly large plagioclase xtals and smaller grains of the other three minerals. Away from the veins most of the minerals are fresh. Plagioclase contains a few specks of sericite and some of the biotite is partially converted to chlorite.

The Center of the vein is made up mostly of anhydrite and chalcopyrite. Secondary orthoclase is on either side of the anhydrite and all the plagioclase is destroyed near the vein. Some fairly coarse needles of sericite are in this zone but are not very abundant.

Chlorite is fairly abundant in the zone of secondary orthoclase. Biotite is more converted to chlorite in this zone. Quartz in the zone of alteration is similar to that in the "unaltered" rock. A minor amount of secondary biotite is present both near the vein and in the rock away from the vein, however most of the biotite is primary.

CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)

PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

Original mineralogy	Secondary minerals
Plagioclase	Chlorite
Orthoclase	Orthoclase
Quartz	Anhydrite
Biotite	Sericite
Magnetite	Sphene
Apatite	Chalcopyrite
	Biotite

PETROGRAPHIC ANALYSIS

Date 10-28-71

Analyst JAF

Sample No. 3820 (Core from Kennecott)

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Dark gray, dense, fine to medium-grained rock w/ sulfides & quartz veinlets

Thin section texture: fine-grained, slightly porphyritic

THIN SECTION MINERALOGY

Mineral	Chemical Composition
Plagioclase	
quartz	
biotite	
~~[illegible]~~	
Anhydrite ?	
K-feldspar	
Chlorite (minor)	
opaques (magnetite & sulfides)	

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

This rock is very similar to the sample from 3900'. It seems to be slightly finer-grained but ~~[illegible]~~ mineralogically identical. See the description of 3900'.

PETROGRAPHIC ANALYSIS

Date 10-28-71

Analyst JAF

Sample No. 3820 (Core from Kennecott)

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Dark gray, dense, fine to medium-grained rock w/ sulfides & quartz veinlets

Thin section texture: fine-grained, slightly porphyritic

THIN SECTION MINERALOGY

Mineral	Chemical Composition
Plagioclase	
quartz	
biotite	
~~[illegible]~~	
Anhydrite ?	
K-feldspar	
Chlorite (minor)	
opaques (magnetite & sulfides)	

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

This rock is very similar to the sample from 3900'. It seems to be slightly finer-grained but ~~[illegible]~~ mineralogically identical. See the description of 3900'.

PETROGRAPHIC ANALYSIS

Date 10-28-71

Analyst JAF

Sample No. 3900' (Core from Kennecott)

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Dark gray dense fine-grained rock w/ sulfides & some quartz veinlets.

Thin-section texture: fine- to medium-grained, slightly porphyritic

THIN SECTION MINERALOGY

Mineral	Chemical Composition
plagioclase	
quartz	
biotite	
chlorite	
K-feldspar	
Anhydrite (?)	
Sericite	
opaques	

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Plagioclase occurs as phenocrysts (not too abundant) and as smaller anhedral grains. The smaller grains are oligoclase. Quartz and K-feldspar are irregular grains mostly about 1mm or less. Several small veinlets cut the rock. These are composed mostly of quartz, K-feldspar and anhydrite(?). It is difficult to determine the relative proportions of quartz & K-feldspar because of their similar appearance. Fine-grained biotite is abundant away from the veins. Some is associated with chlorite and appears to be replacing it. Some of the larger plagioclase grains are flecked w/ sericite and coarser sericite is locally present. A mineral tentatively identified as anhydrite is fairly abundant mostly in veinlets w/ quartz. Minor chlorite is present and appears to be altering to biotite.

CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)

PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

The rock was probably a quartz monzonite or quartz latite(?) It is difficult to determine how much quartz is original & how much is secondary, veinlets are common. Biotite is fine-grained & in some areas appears to be replacing chlorite. It is fairly evenly distributed throughout the rock.

PETROGRAPHIC ANALYSIS

Date 10-28-71

Analyst JAF

Sample No. 3900' (Core from Kennecott)

HAND SAMPLE DESCRIPTION (textures, structures, mineralogy, field name)

Dark gray dense fine-grained rock w/ sulfides & some quartz veinlets.

Thin-section texture: fine- to medium-grained, slightly porphyritic

THIN SECTION MINERALOGY

Mineral	Chemical Composition
plagioclase	
quartz	
biotite	
chlorite	
K-feldspar	
Anhydrite (?)	
Sericite	
opaques	

MINERAL DESCRIPTIONS (Habit, Size, Zoning, Inclusions, Alteration, Texture, Relationships with adjacent minerals)

Plagioclase occurs as phenocrysts (not too abundant) and as smaller anhedral grains. The smaller grains are oligoclase. Quartz and K-feldspar are irregular grains mostly about 1mm or less. Several small veinlets cut the rock. These are composed mostly of quartz, K-feldspar and anhydrite(?). It is difficult to determine the relative proportions of quartz & K-feldspar because of their similar appearance. Fine-grained biotite is abundant away from the veins. Some is associated with chlorite and appears to be replacing it. Some of the larger plagioclase grains are flecked w/ sericite and coarser sericite is locally present. A mineral tentatively identified as anhydrite is fairly abundant mostly in veinlets w/ quartz. Minor chlorite is present and appears to be altering to biotite.

CHEMICAL COMPOSITION OF ROCK (Estimated from mineralogy and approximate mineral abundances)

PETROLOGIC INTERPRETATIONS (Gross chemical changes, paragenesis, origin)

The rock was probably a quartz monzonite or quartz latite(?). It is difficult to determine how much quartz is original & how much is secondary, veinlets are common. Biotite is fine-grained & in some areas appears to be replacing chlorite. It is fairly evenly distributed throughout the rock.