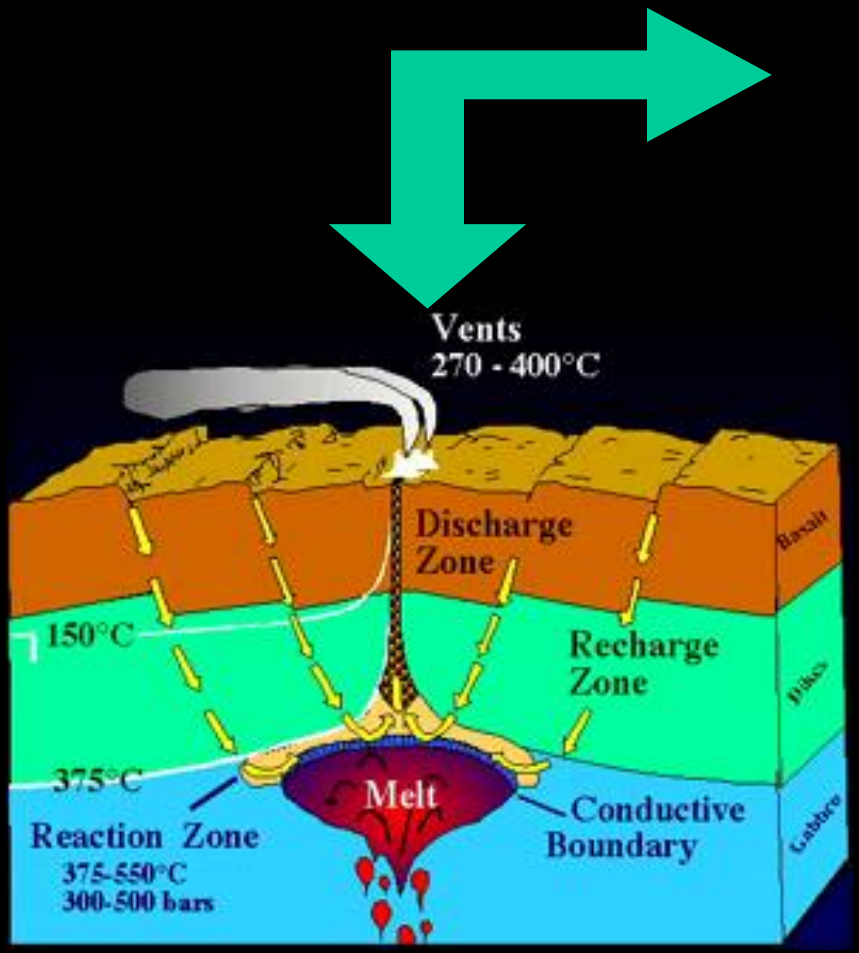
Geology and Minerals of NYC

Charles Merguerian

New York
Mineral Club Show
01 March 2003

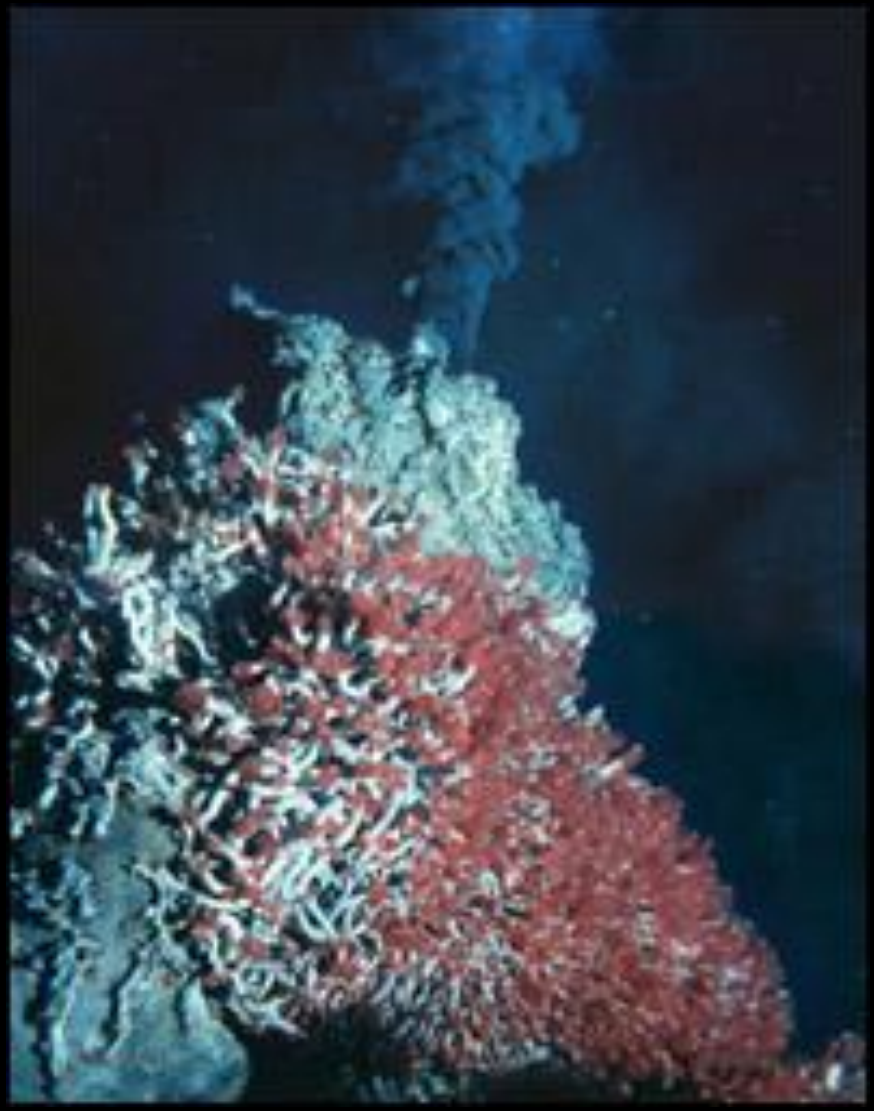
Mid-Atlantic Ridge

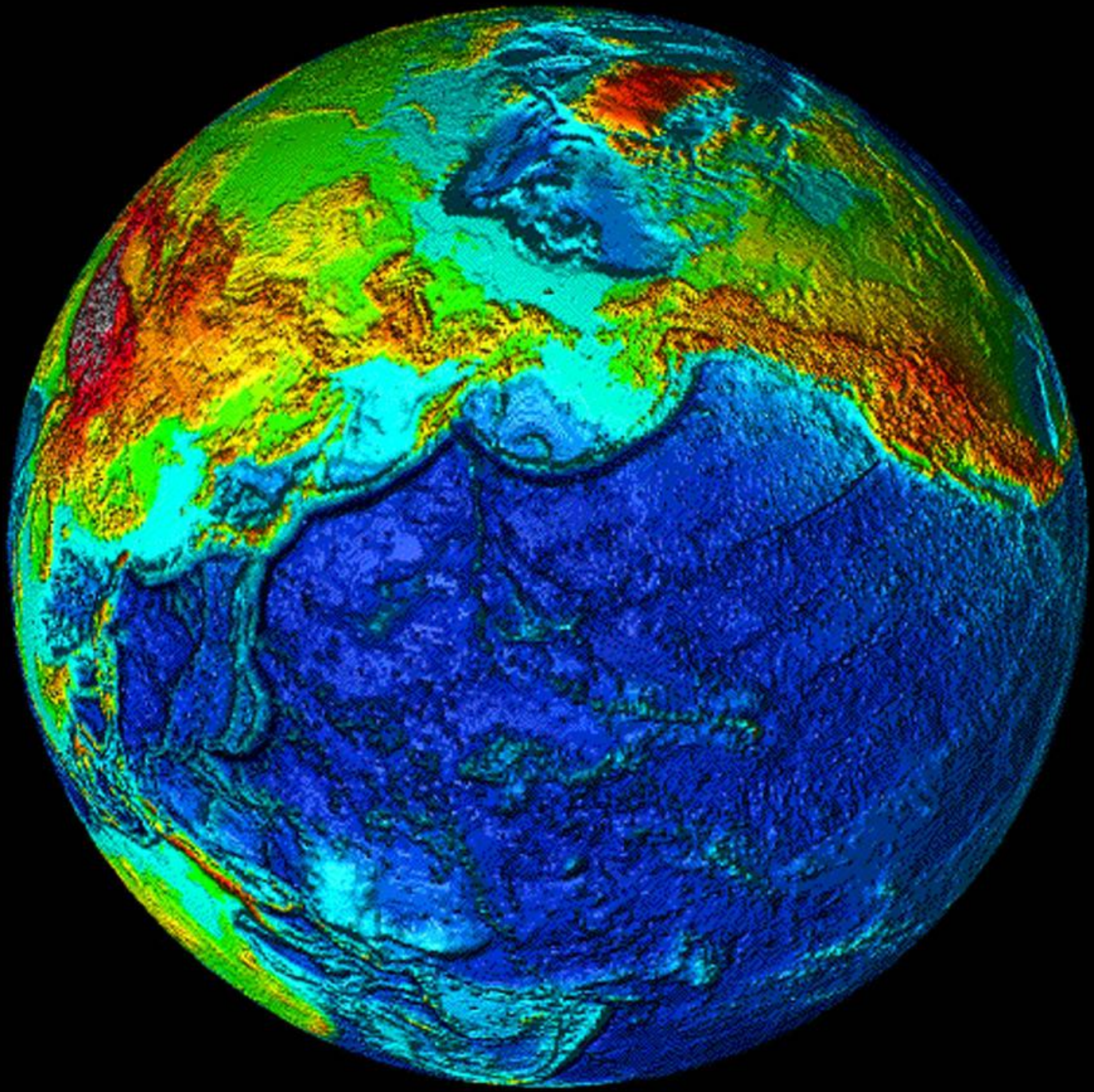


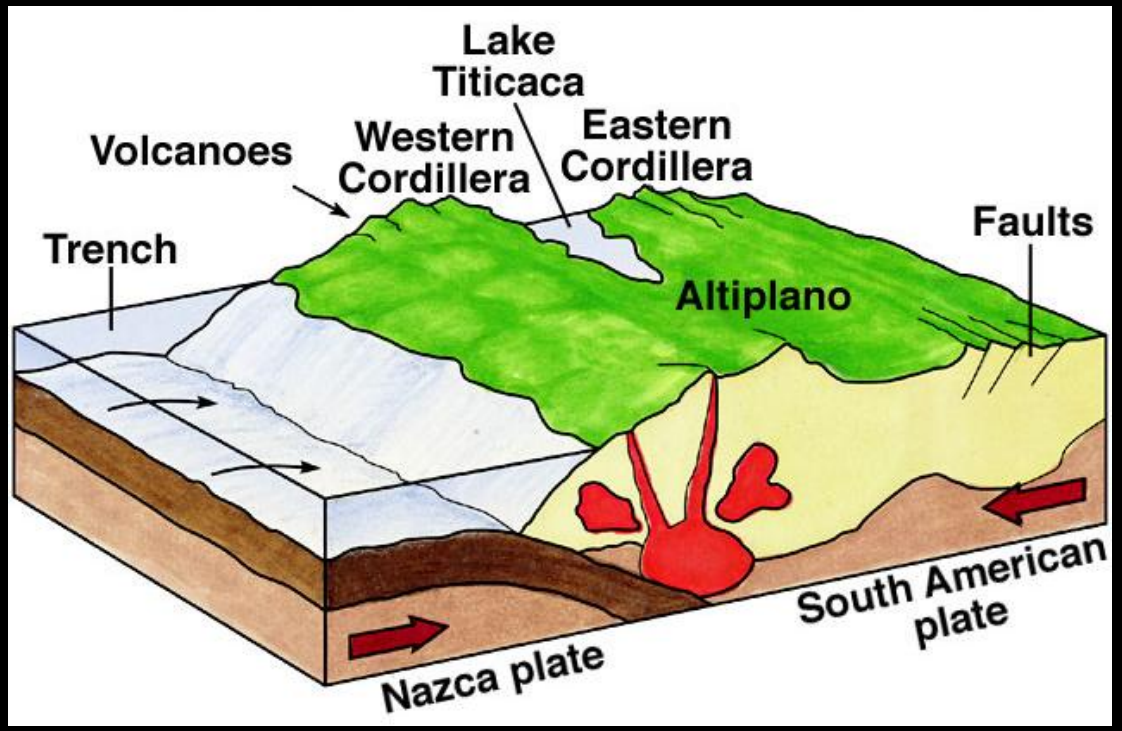
Pillow Basalts

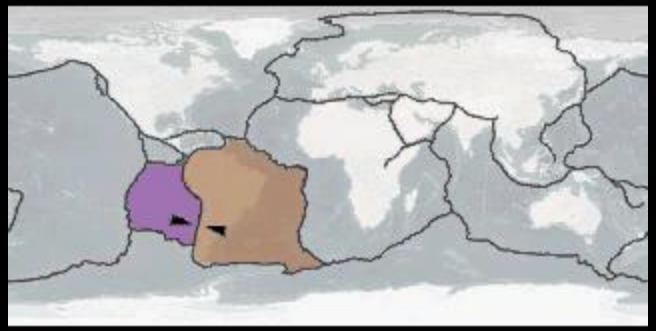
Pillow Lavas, Upper New St., Paterson, NJ

Black Smokers

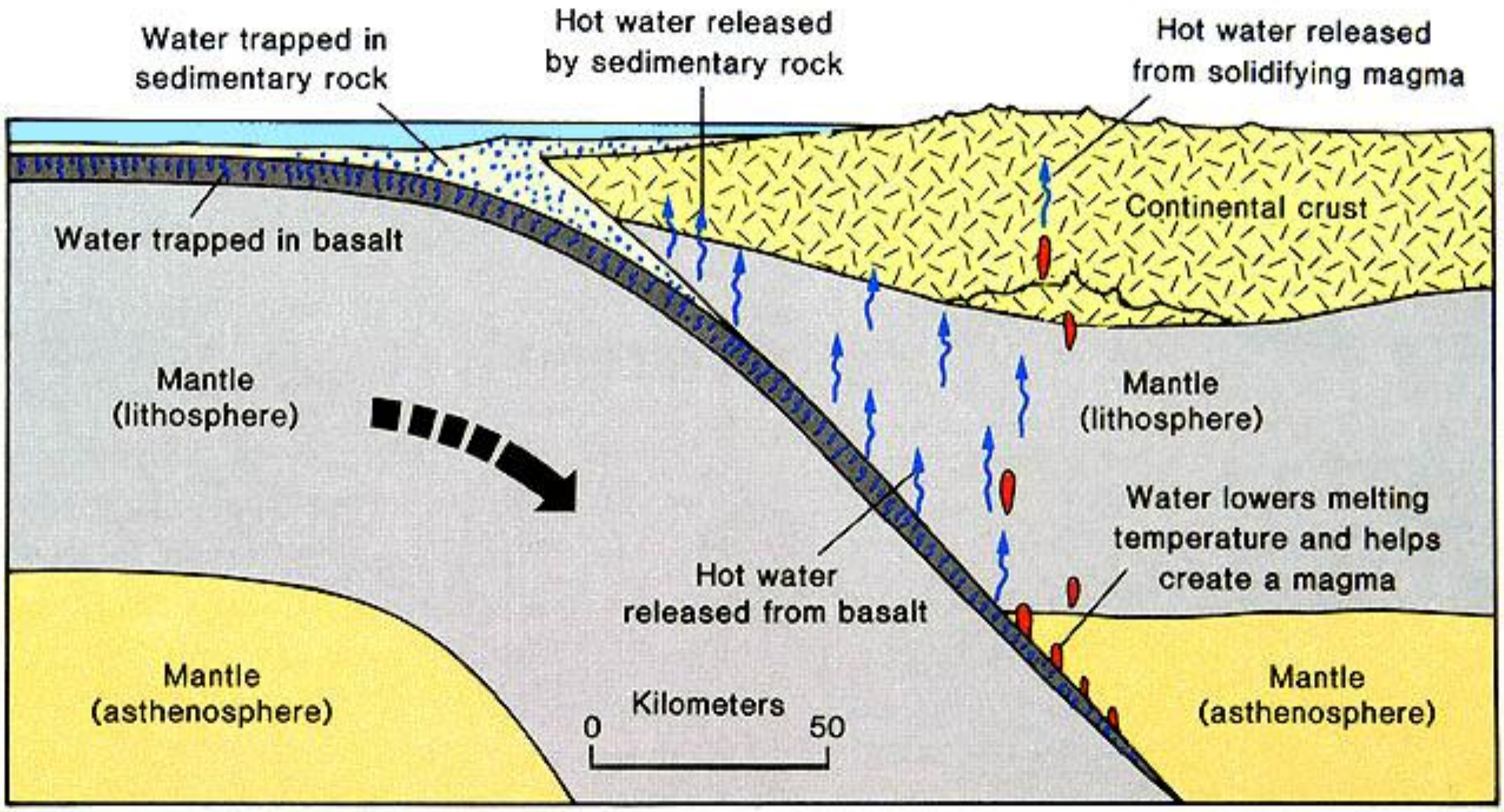





Lake
Titicaca
Volcanoes
Western
Cordillera
Eastern
Cordillera
Faults
Trench
Altiplano
South American
plate
Nazca plate



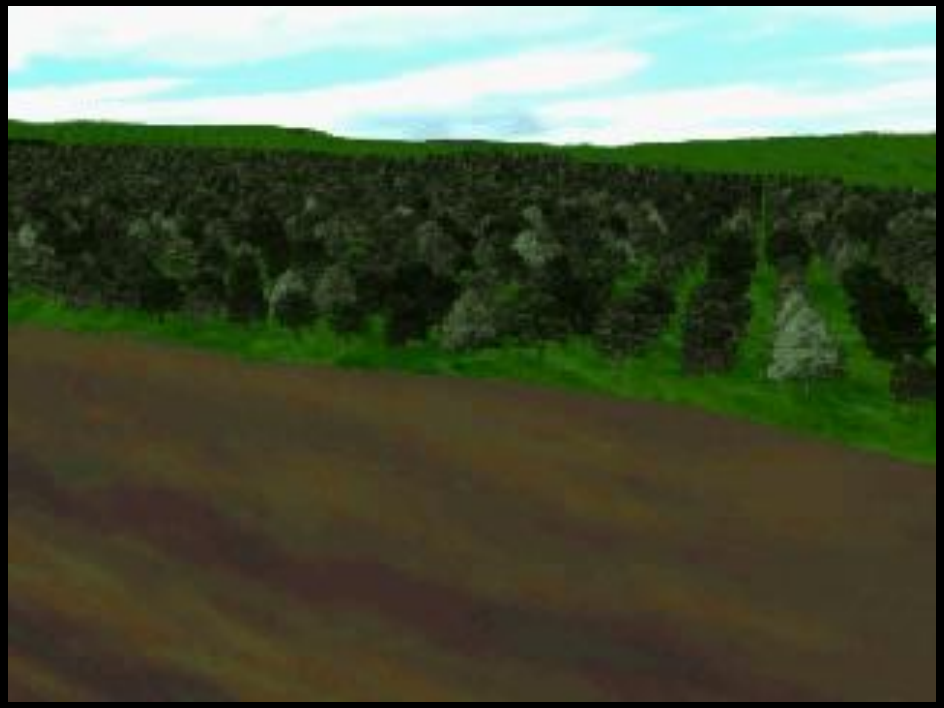
Movement of water at convergent boundary



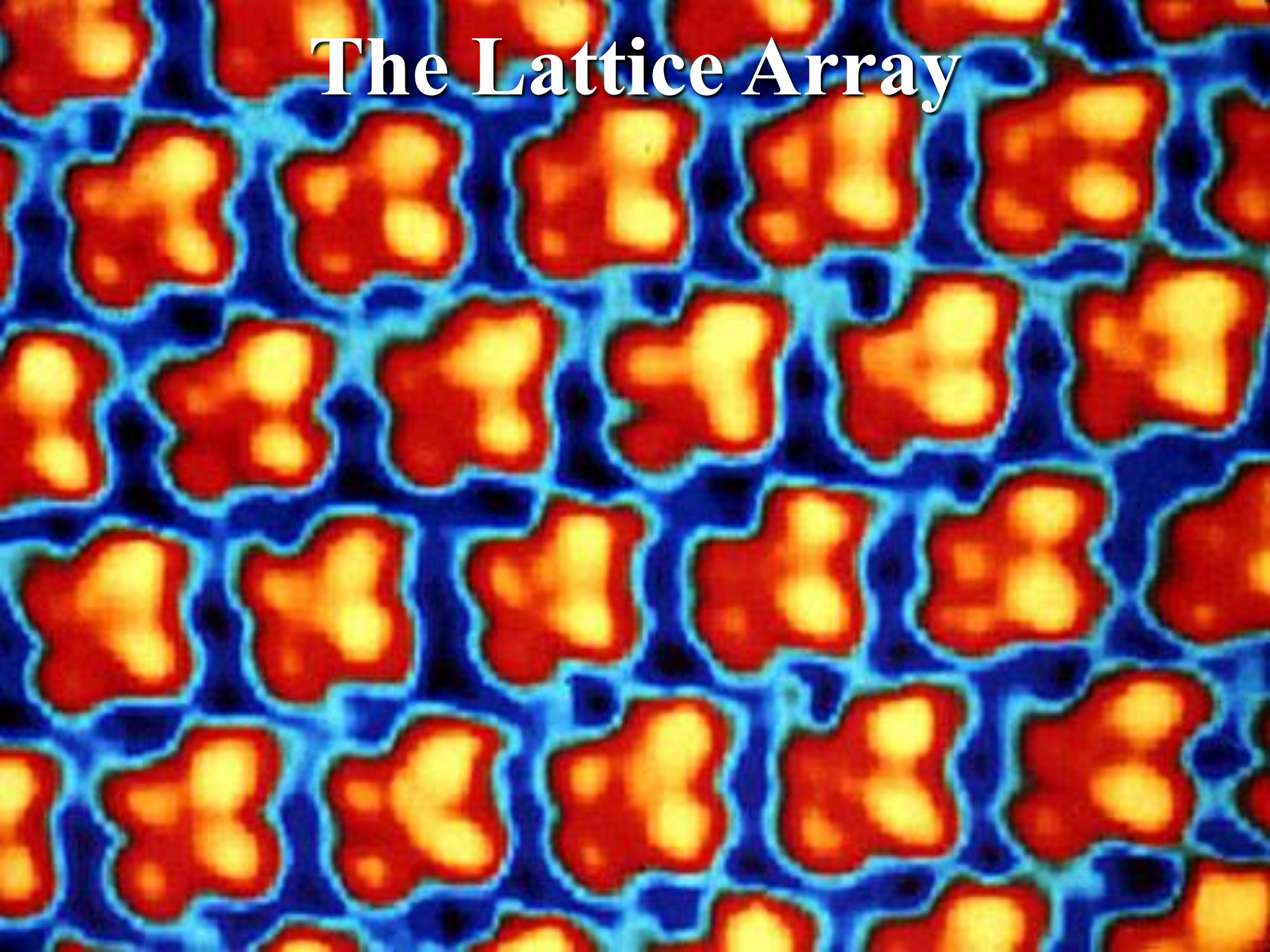

Mt. Fuji, Japan

Mt. Fuji, 1957 Rodan Birthplace

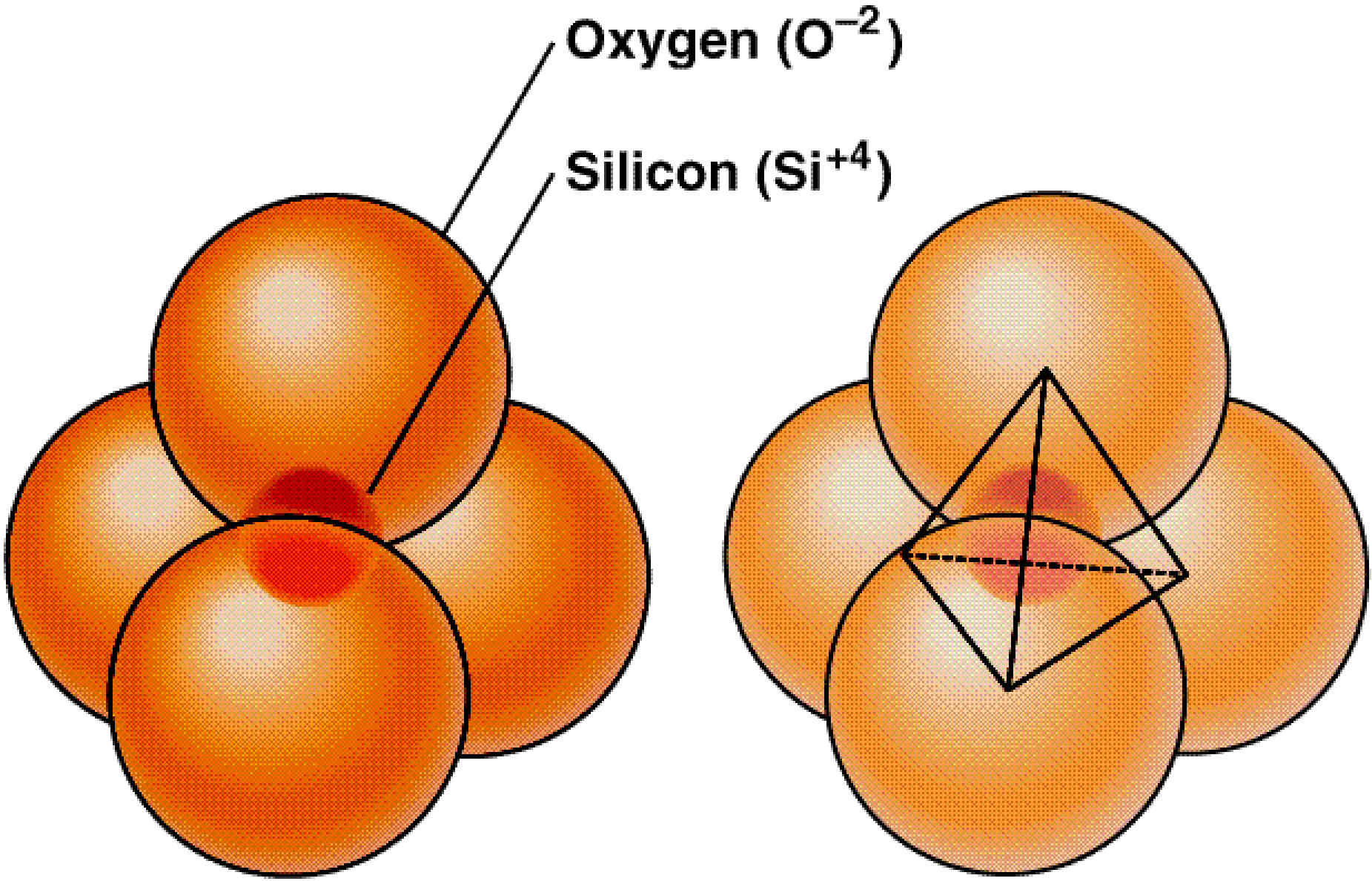
Down We Go



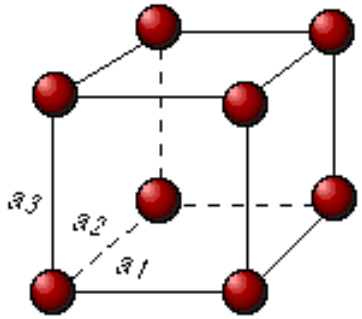
The Lattice Array

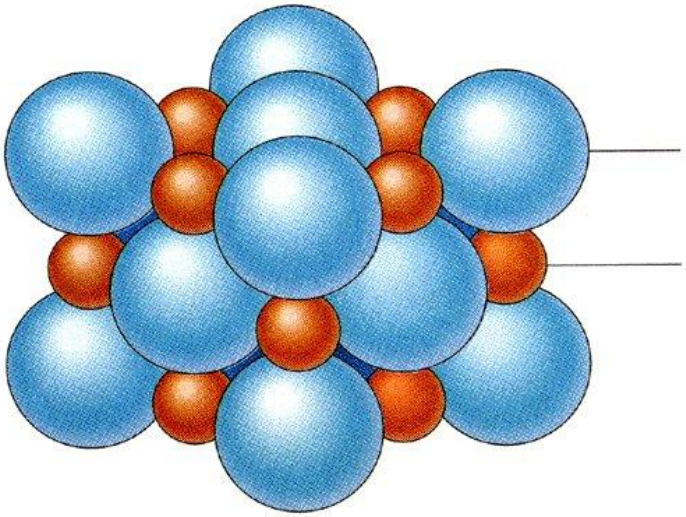


Silicon-Oxygen Tetrahedron

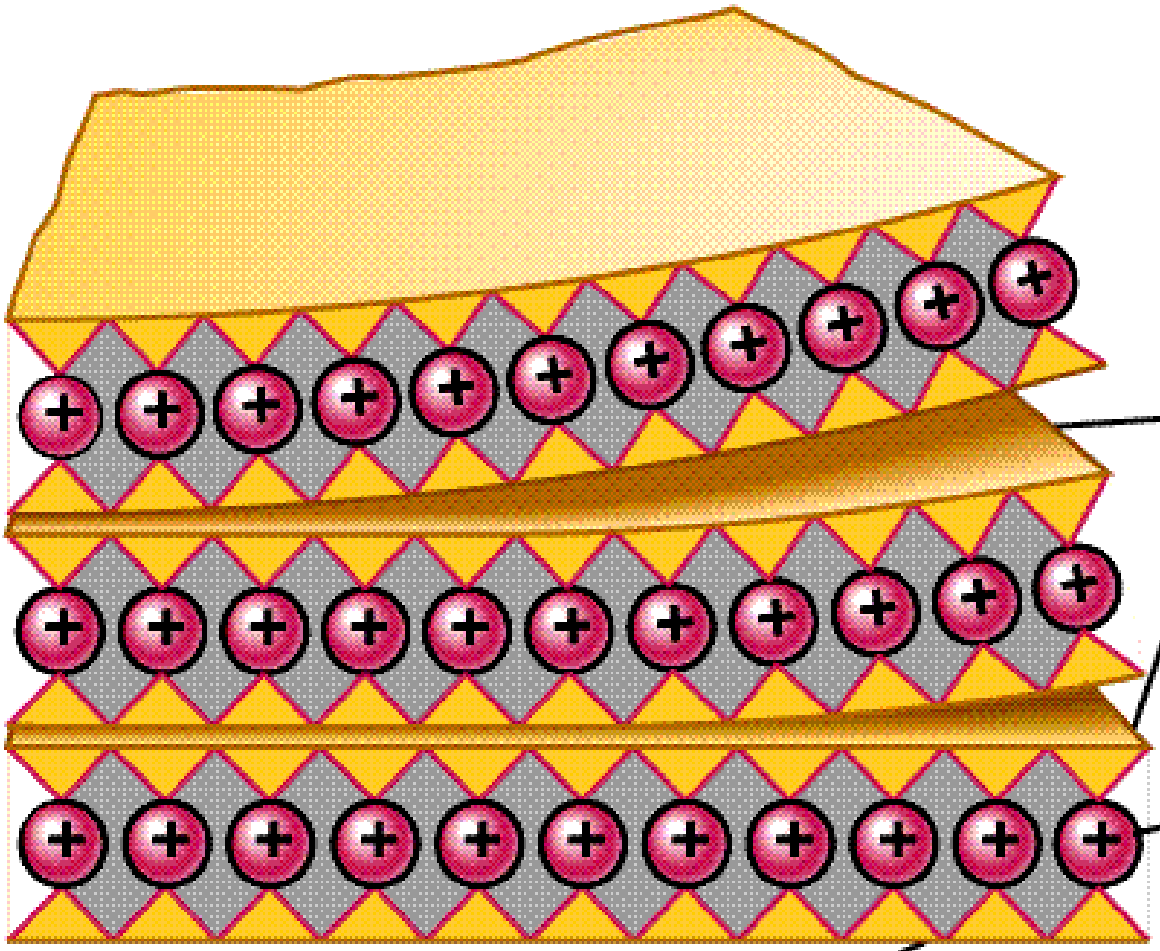


Cubic Cleavage Lattice Property





Mica Crystal Structure



Because of weak bonds, mica splits easily between "sandwiches"

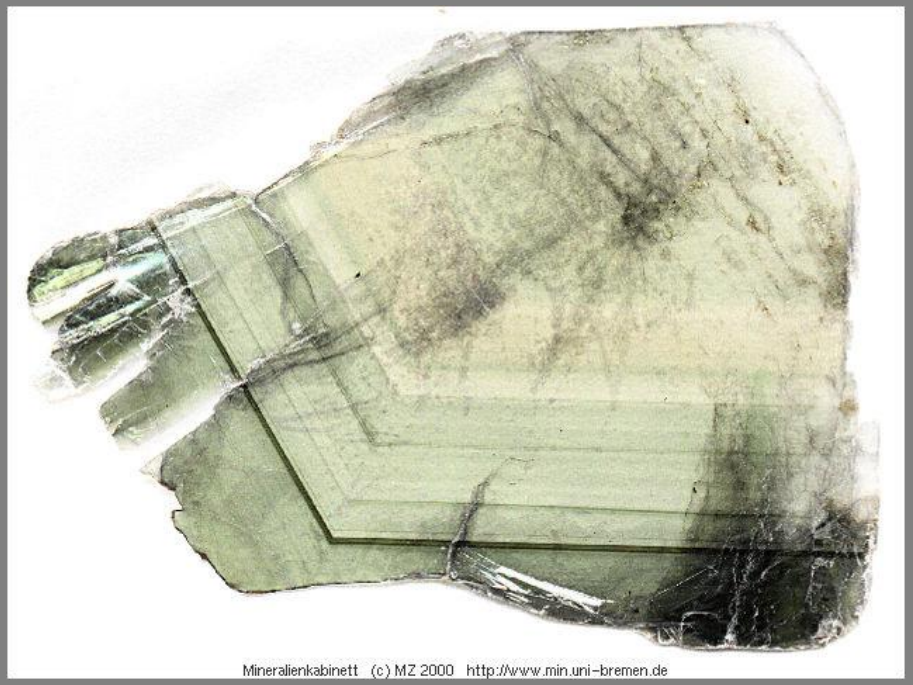
Positive ions, sandwiched between two sheet silicate layers

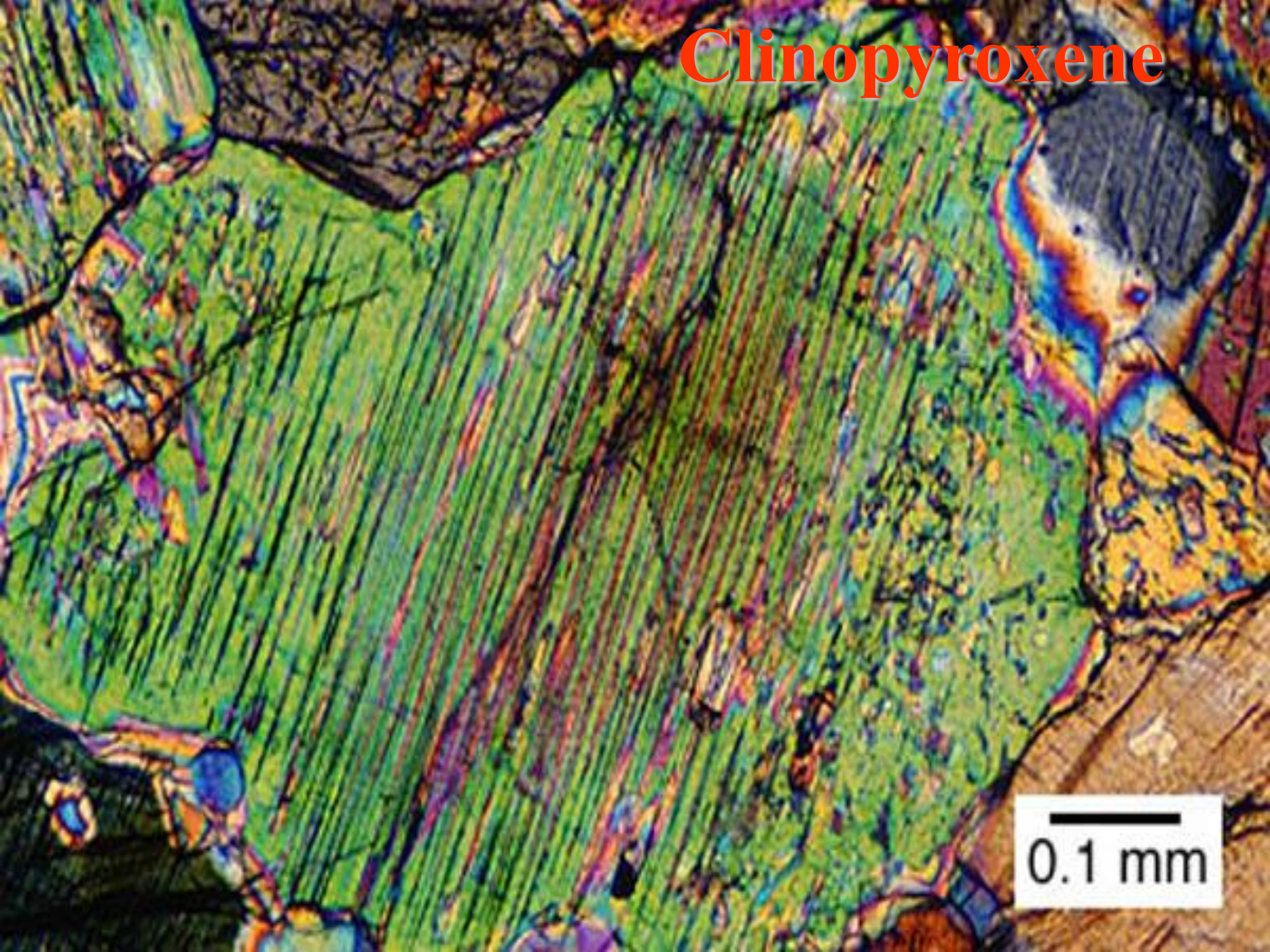
Sheet silicate layer

B

Mica Group

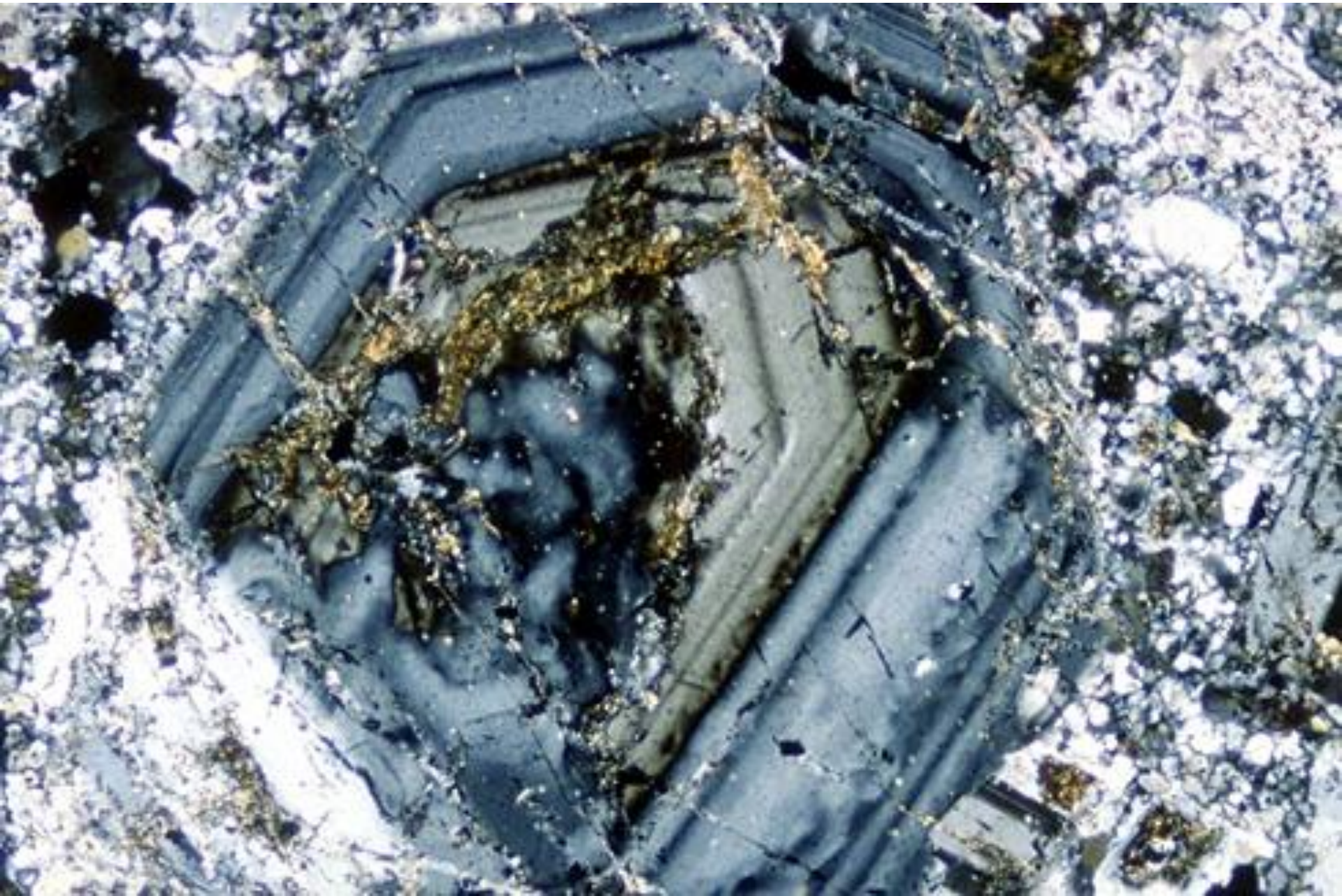

Mineralienkabinett (c) MZ 2000 http://www.min.uni-bremen.de


Mineralienkabinett (c) MZ 2000 http://www.min.uni-bremen.de


Clinopyroxene
0.1 mm


Labradorite (Plagioclase)

Oscillatory Zoned Plagioclase



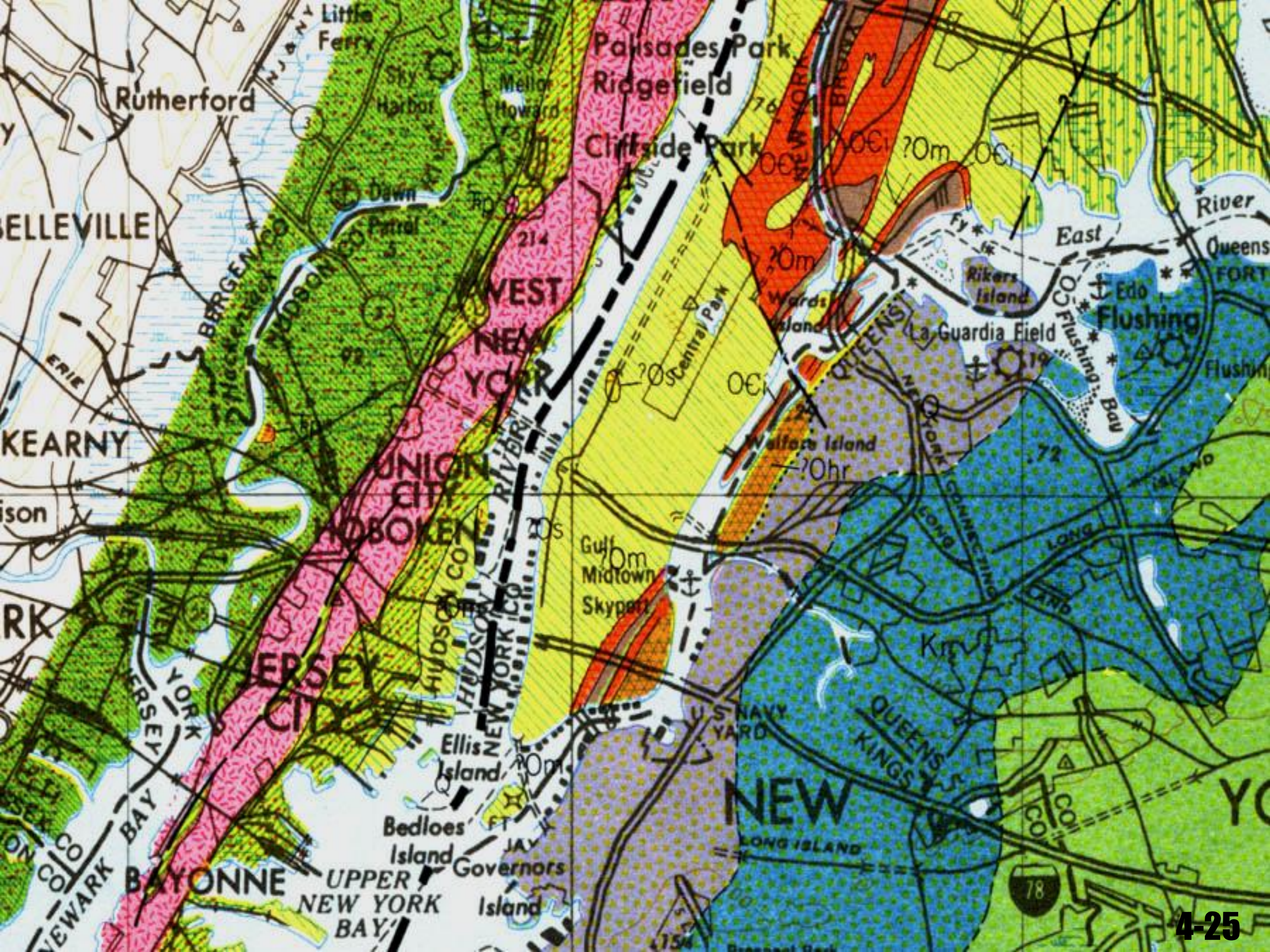
Zoning in Minerals

Classic Minerals of New York City

Download these images and plenty more at:

www.dukelabs.com

Olde New York


Little Ferry
Rutherford
Palisades Park
Ridgefield
Cliffside Park
BELLEVILLE
KEARNY
WEST NEW YORK
UNION CITY
HOBOKEN
JERSEY CITY
BAYONNE
UPPER NEW YORK BAY
NEWARK BAY
Ellis Island
Bedloes Island
Governors Island
Central Park
Wards Island
Welfare Island
Rikers Island
La Guardia Field
Flushing
Flushing Bay
East River
Queens
U S NAVY YARD
NEW
BERGEN CO
HUDSON CO
NEW YORK CO
QUEENS
KINGS
HUDSON RIVER
Midtown Skyport
?Om
?Os
?Ohr
OCi
Kr
78

W. G. LEVISON, PHOTO. PLATE No. 89 (1901)

EXCAVATION IN MANHATTAN SCHIST

Riverside Drive, 92nd to 93rd St., Manhattan Island, New York City

From: Manchester 1932

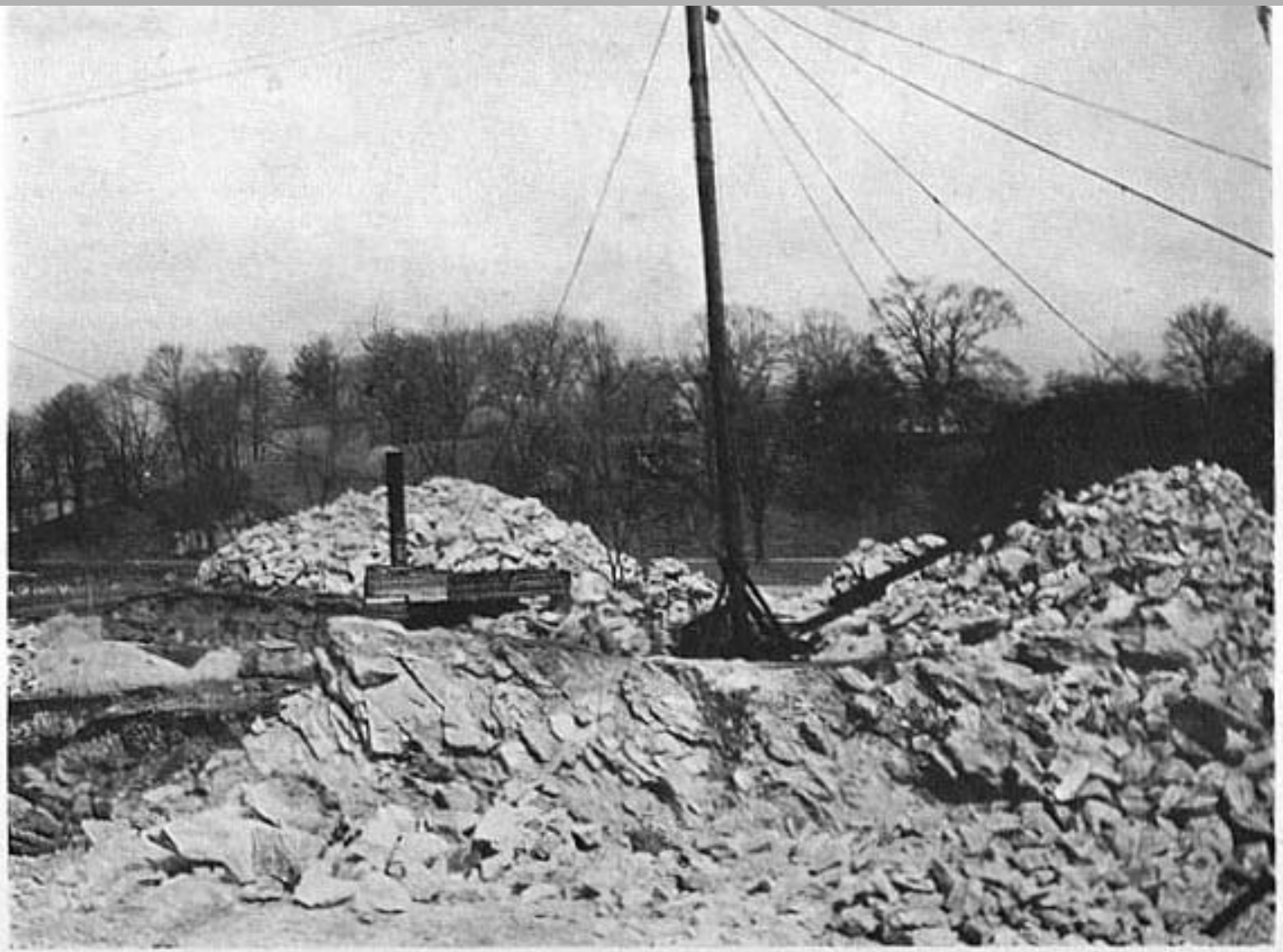


PLATE No. 90 (1913)

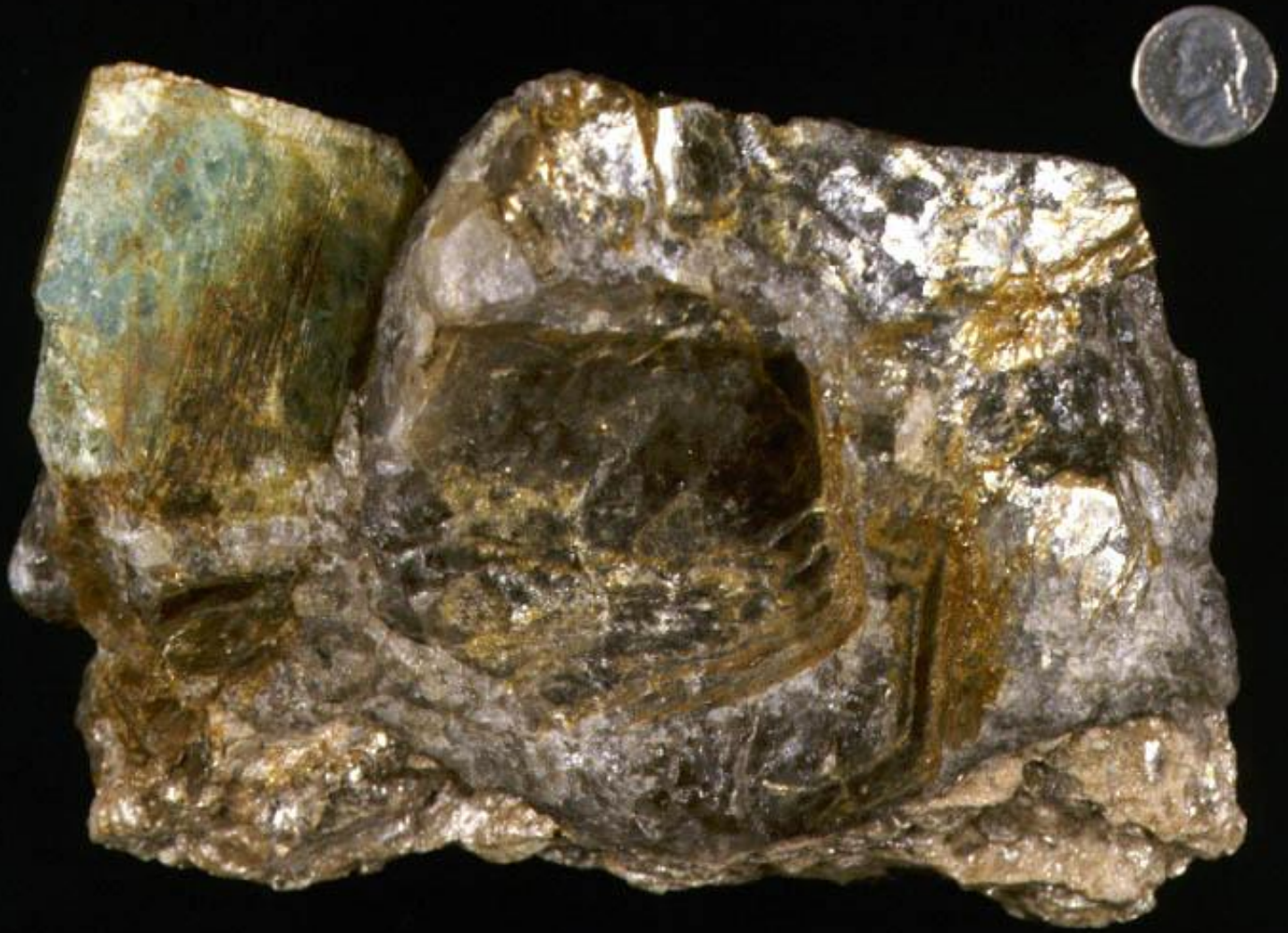
EXCAVATION IN INWOOD LIMESTONE

Broadway and 207th St., Manhattan Island, New York City

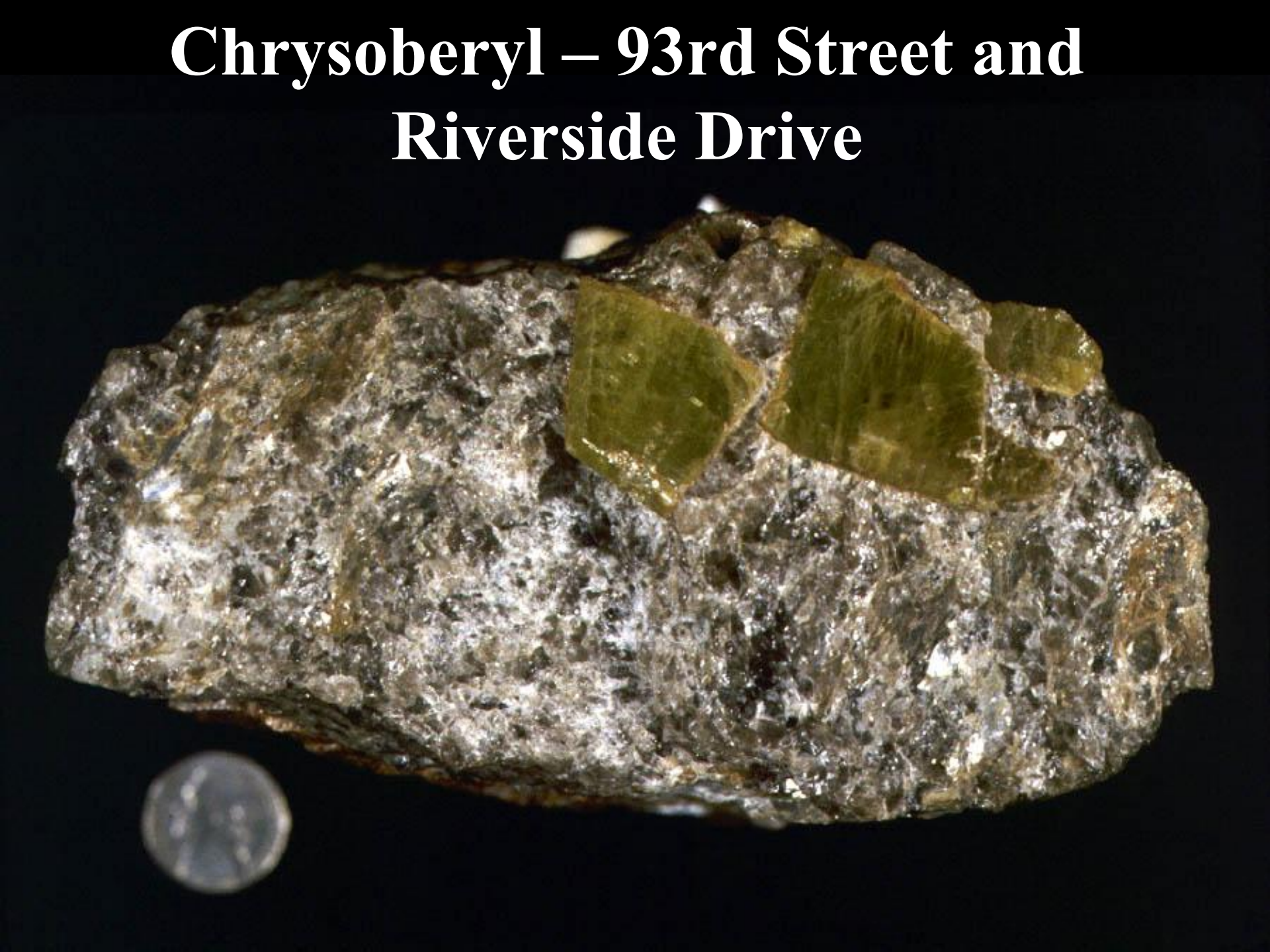
From: Manchester 1932


THE AMERICAN MVSEVM OF NATVRAL HISTORY
FOVNDED 1869

Beryl – 157th Street and Broadway

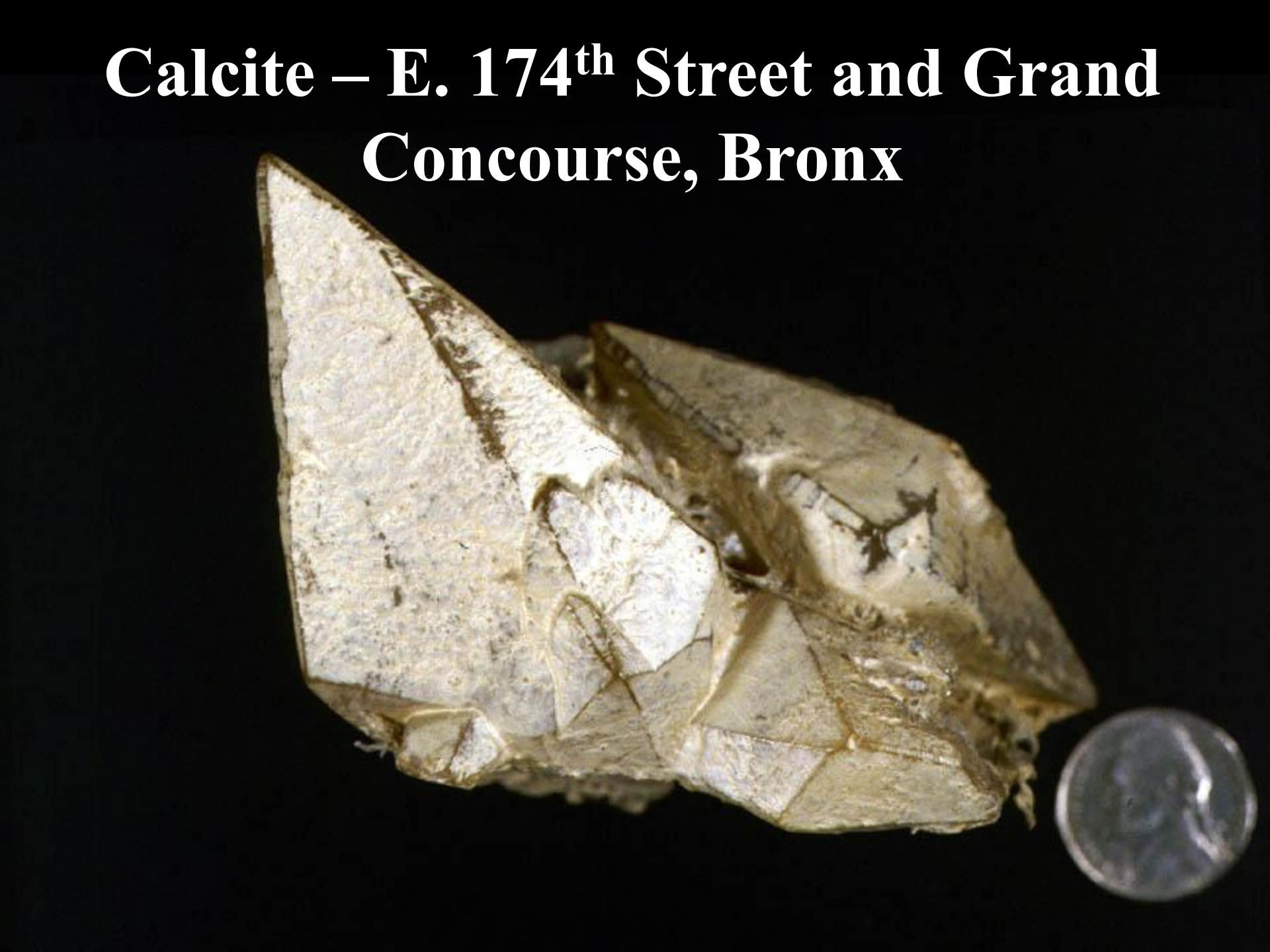


Chrysoberyl – 93rd Street and Riverside Drive

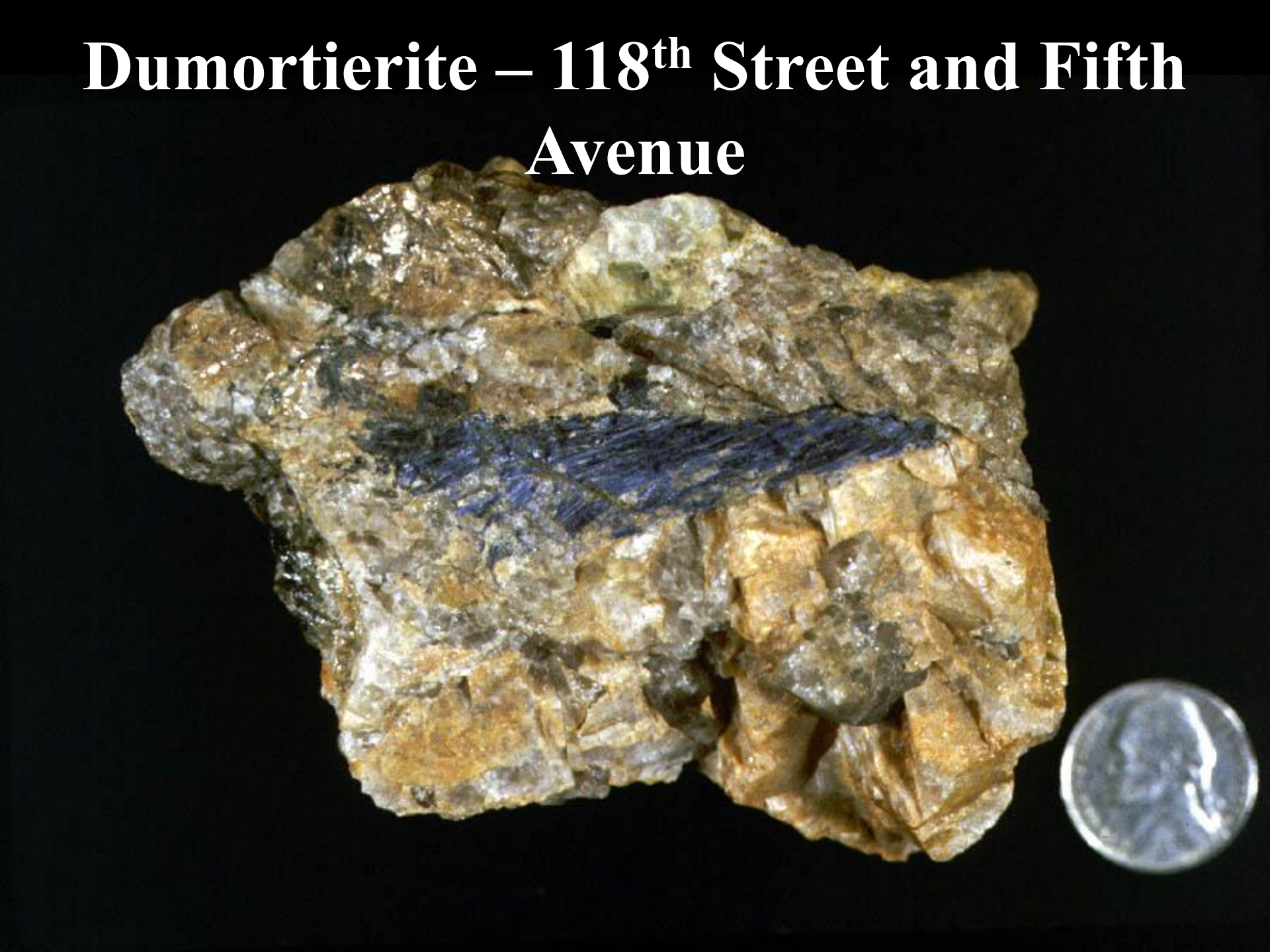


Tourmaline – 170th Street and Amsterdam Avenue

Calcite – E. 174th Street and Grand Concourse, Bronx



Dumortierite – 118th Street and Fifth Avenue

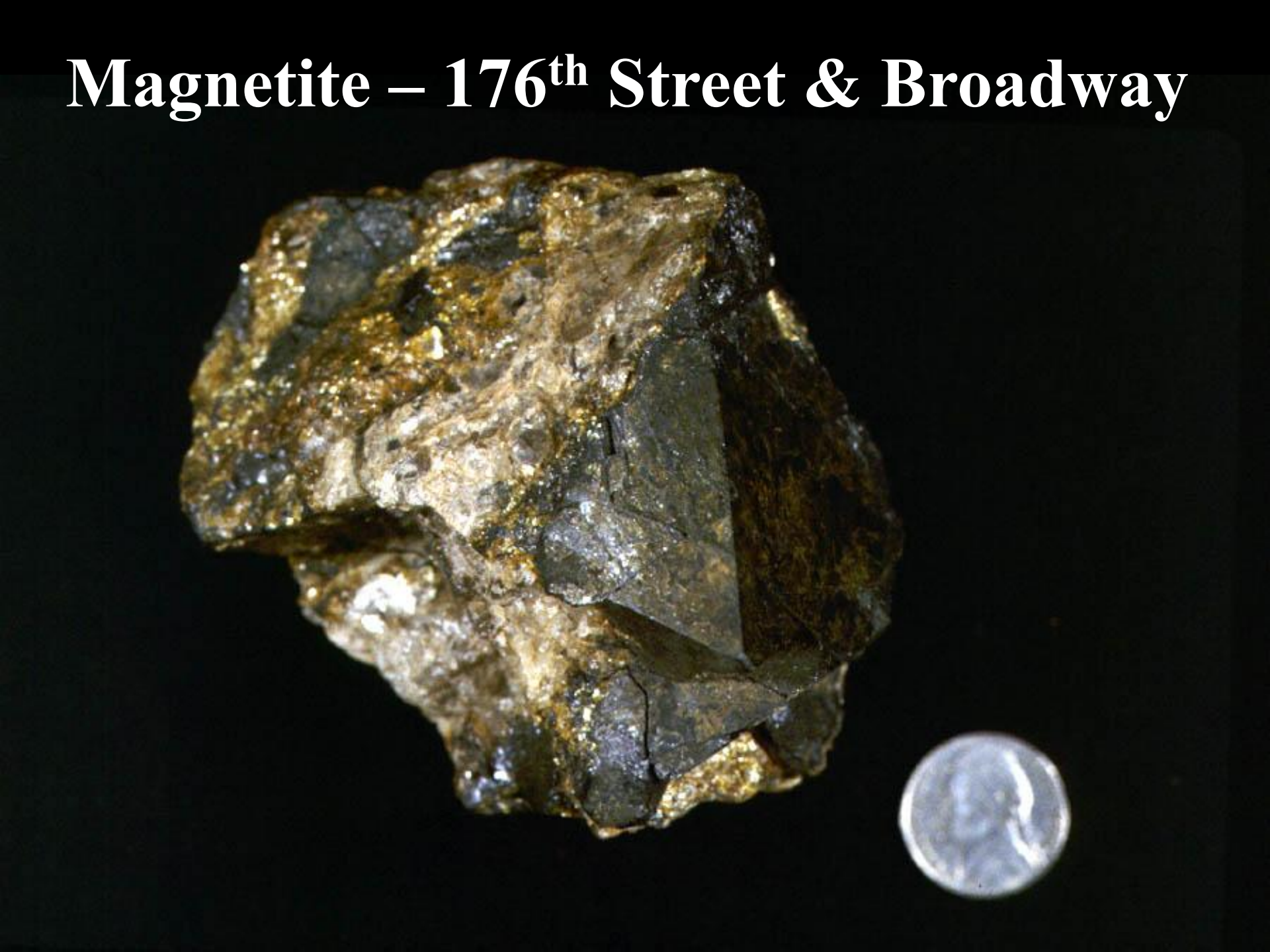


Tourmaline – 105th Street and Fifth Avenue

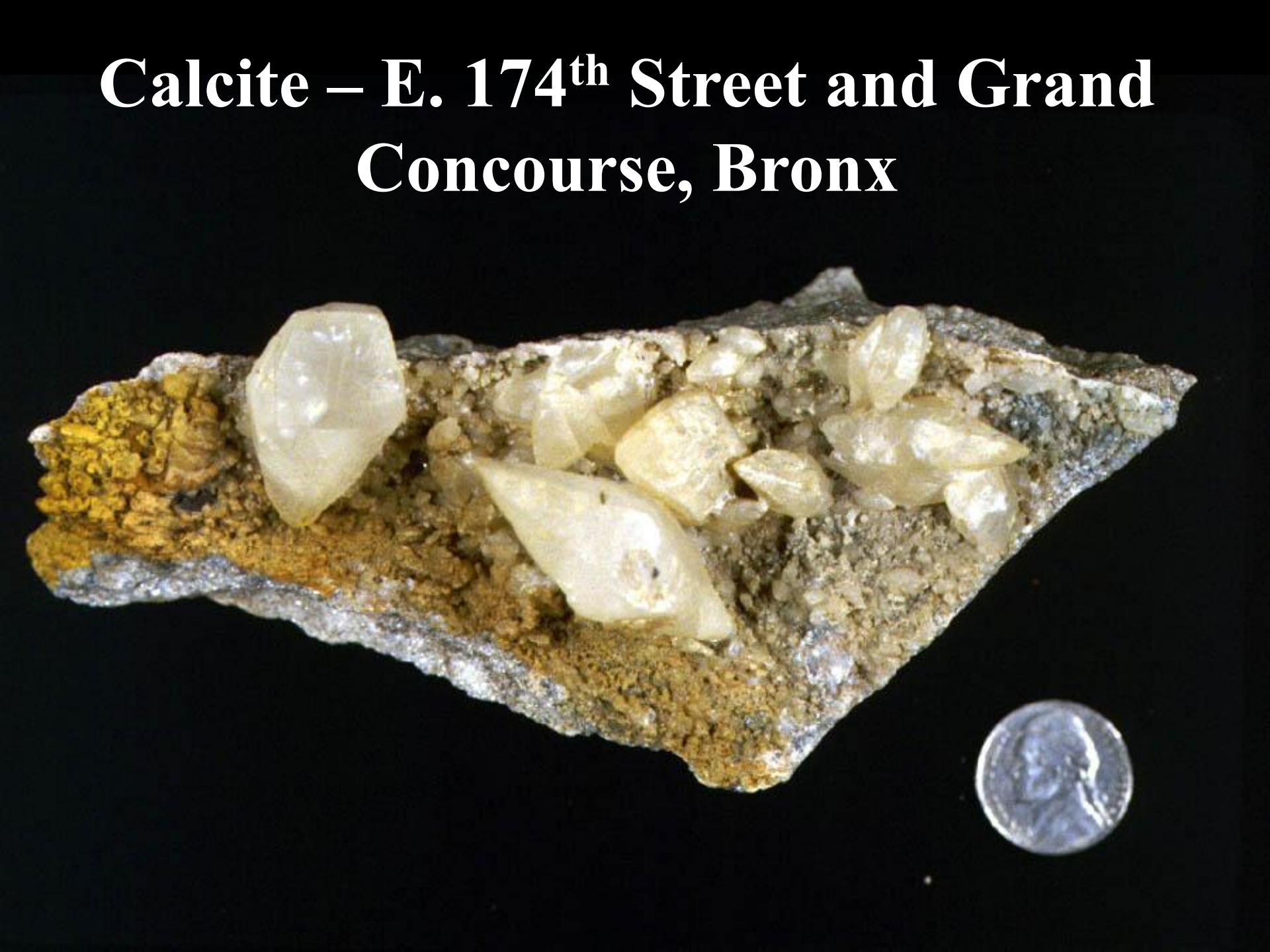
Famous “Sewer” Garnet

Garnet – 65th Street & Broadway

Magnetite – 176th Street & Broadway



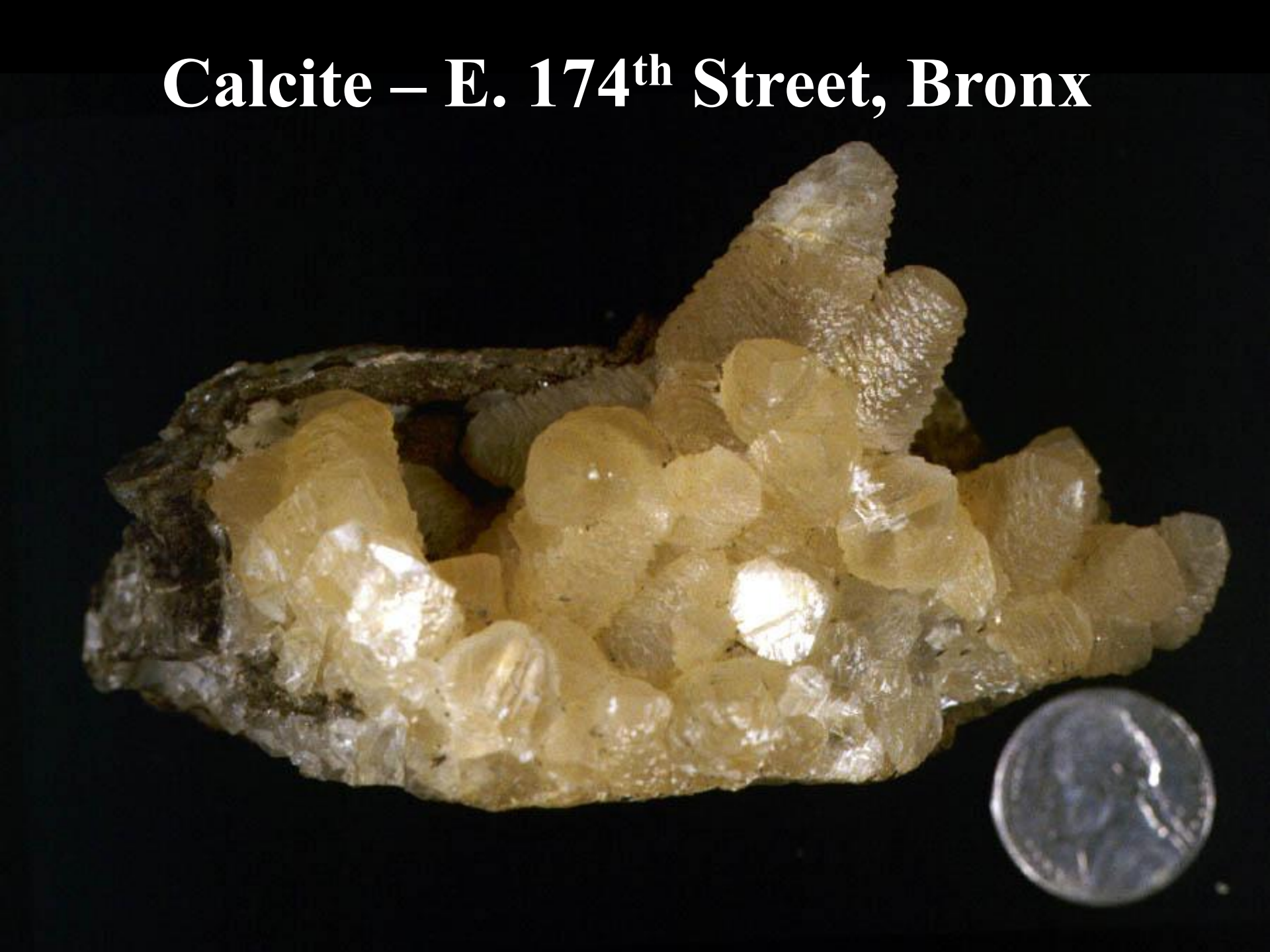
Calcite – E. 174th Street and Grand Concourse, Bronx



Beryl – 94th Street & Riverside Drive

Kyanite – 94th Street & Riverside Drive

Calcite – E. 174th Street, Bronx



Kyanite – 61st Street & Central Pk W

Chabazite and Stilbite – 45th Street and Second Avenue

Beryl – 190th Street and Amsterdam

Quartz – Westchester Avenue, Bronx

Malacolite – Harlem Ship Canal

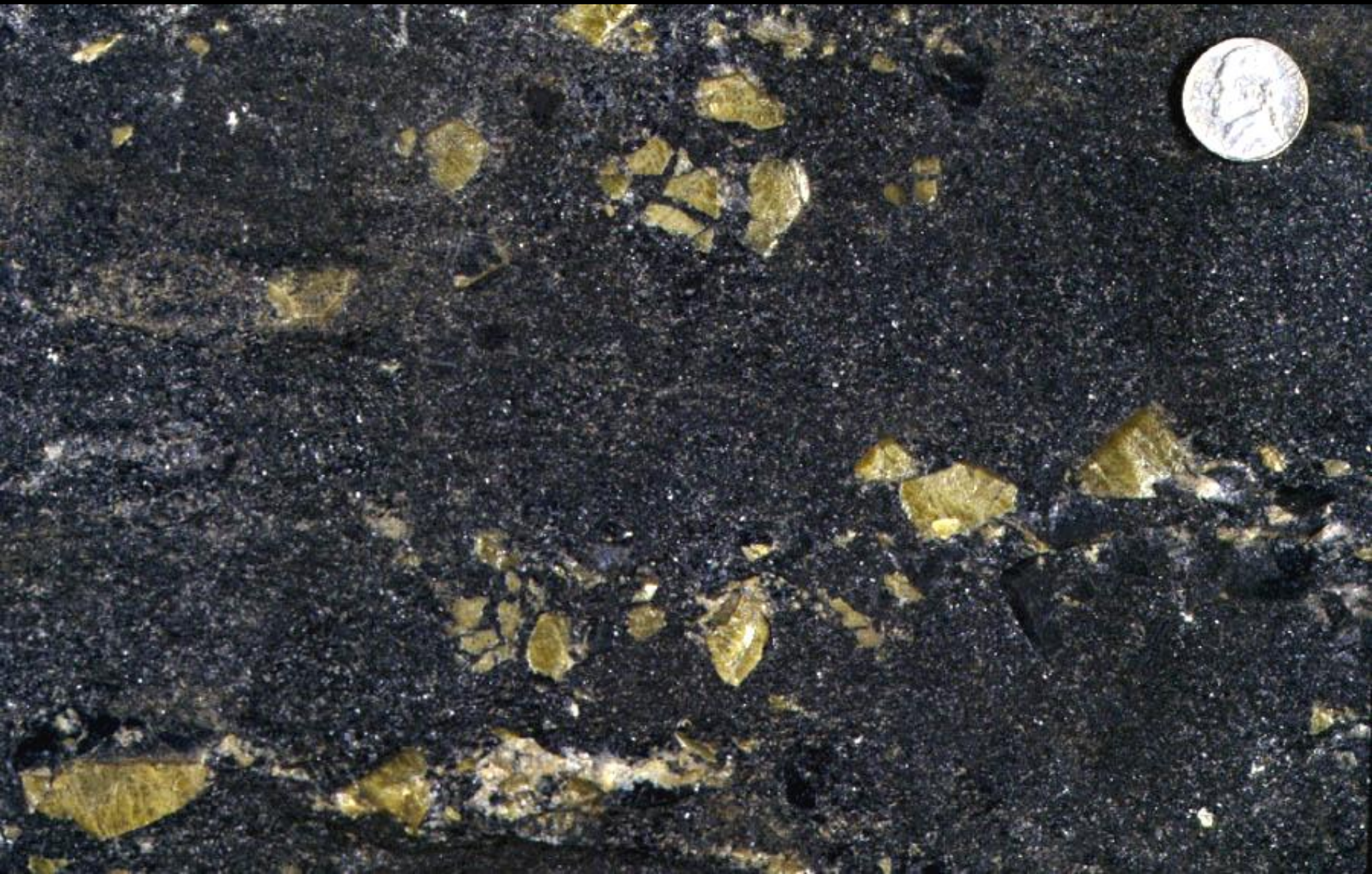
Chrysotile – 81st Street & Eighth Ave

Stilbite – 44th Street & Second Ave

Stilbite – 45th Street, between First and Second Aveues

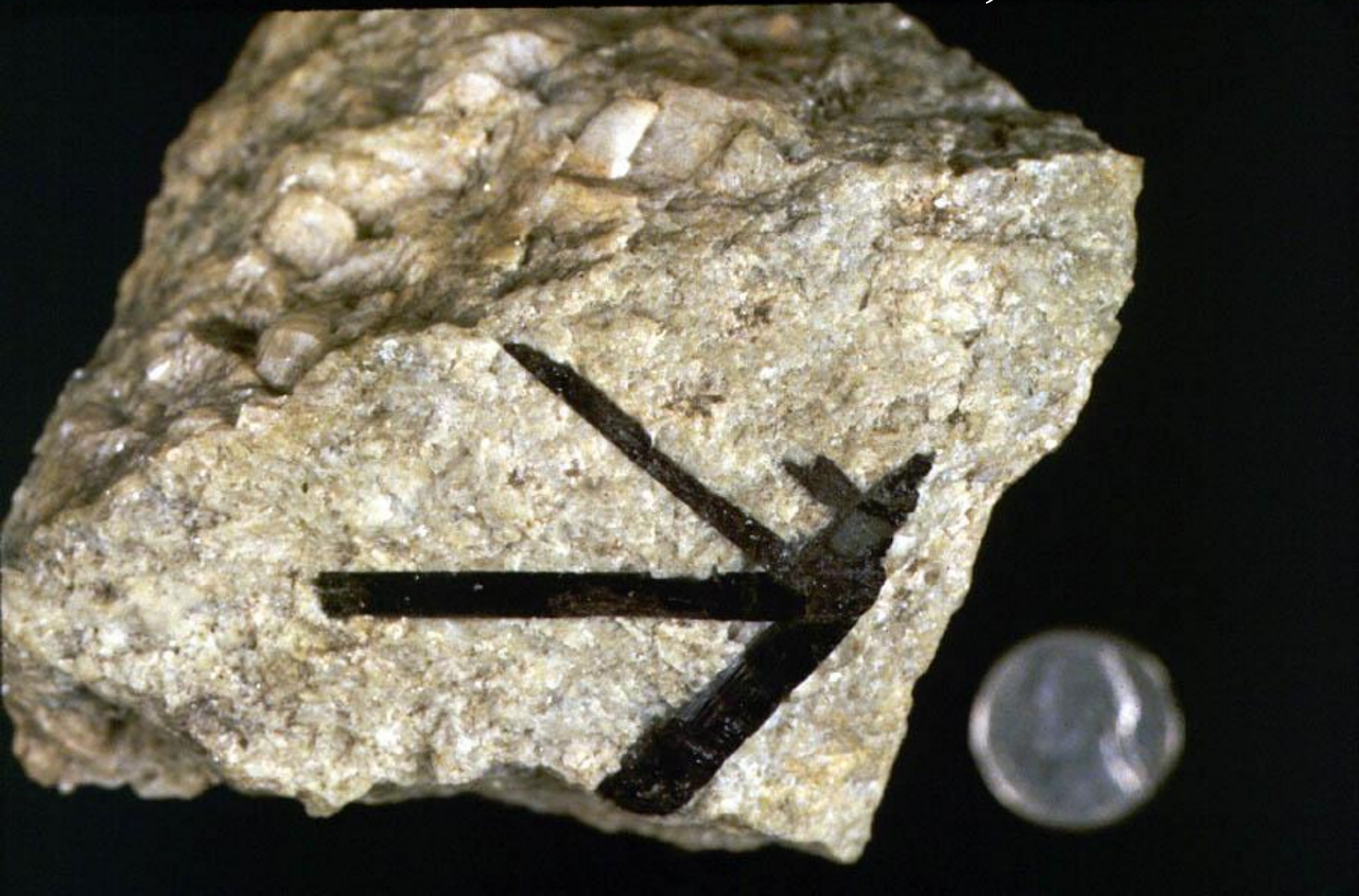
Titanite (Sphene) – 167th Street and Harlem River

Titanite – Fort George, Manhattan



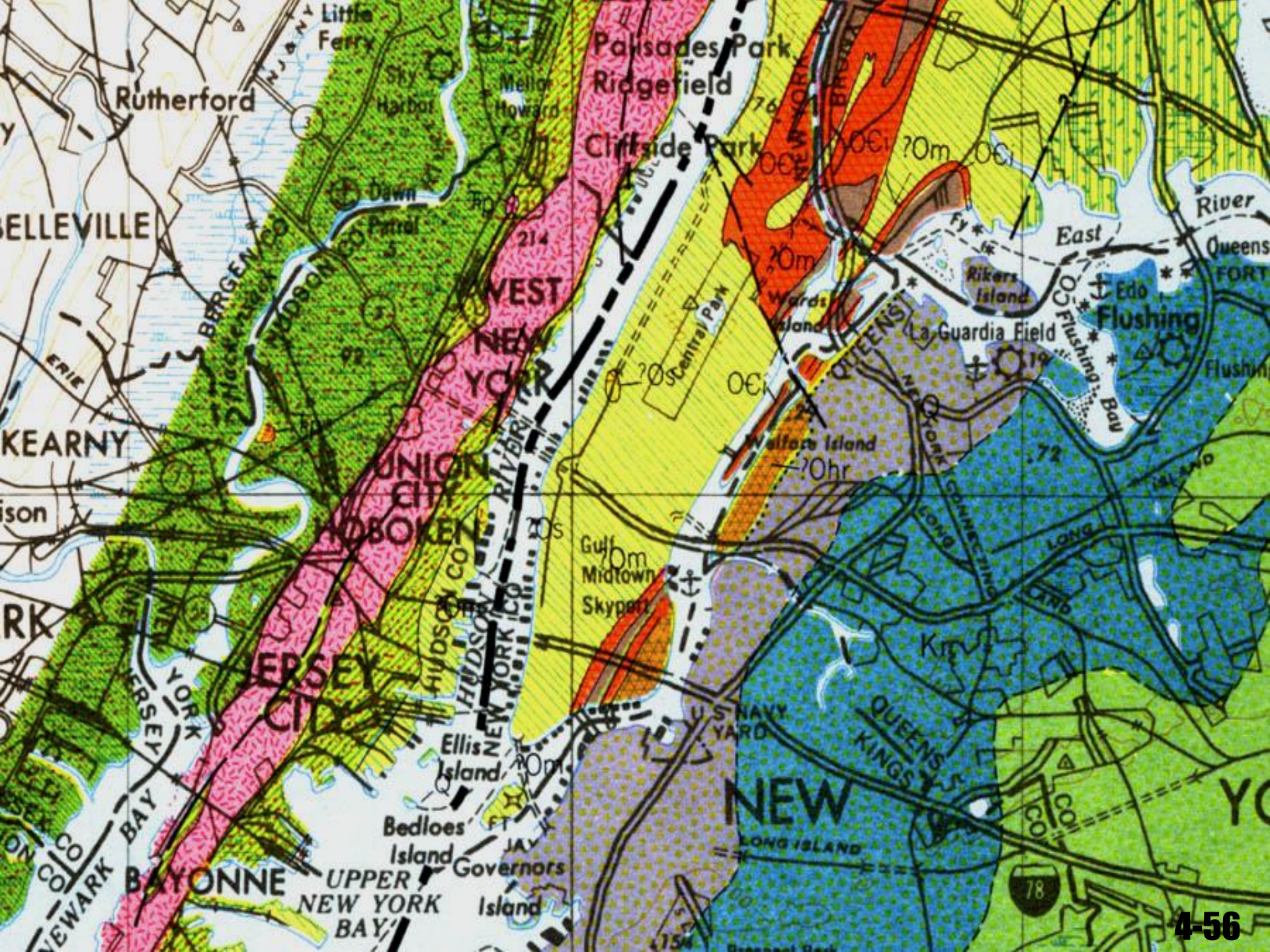
Titanite – Harlem Ship Canal

Tourmaline – Hunt's Point, Bronx

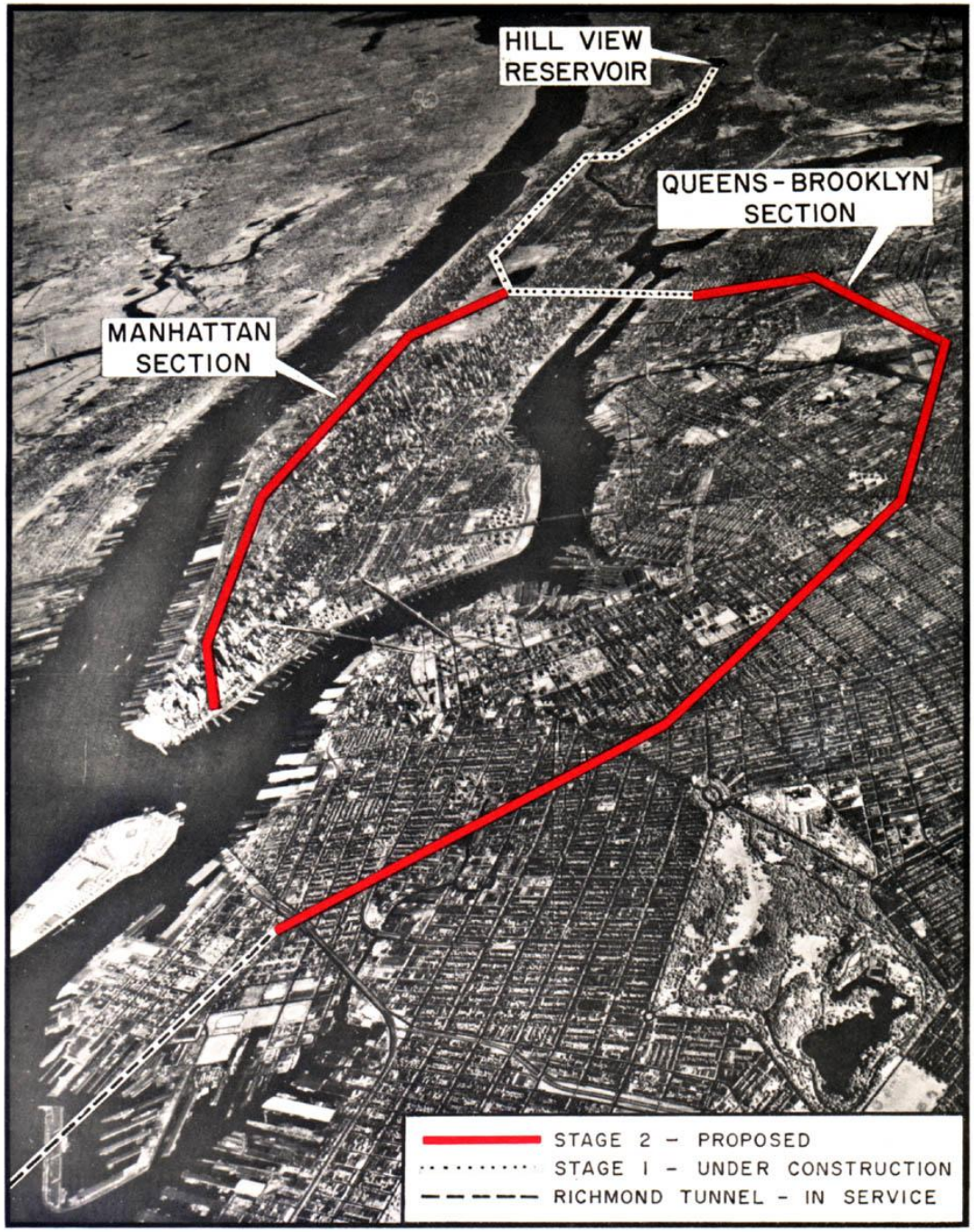


Sillimanite – Fort George, Manhattan

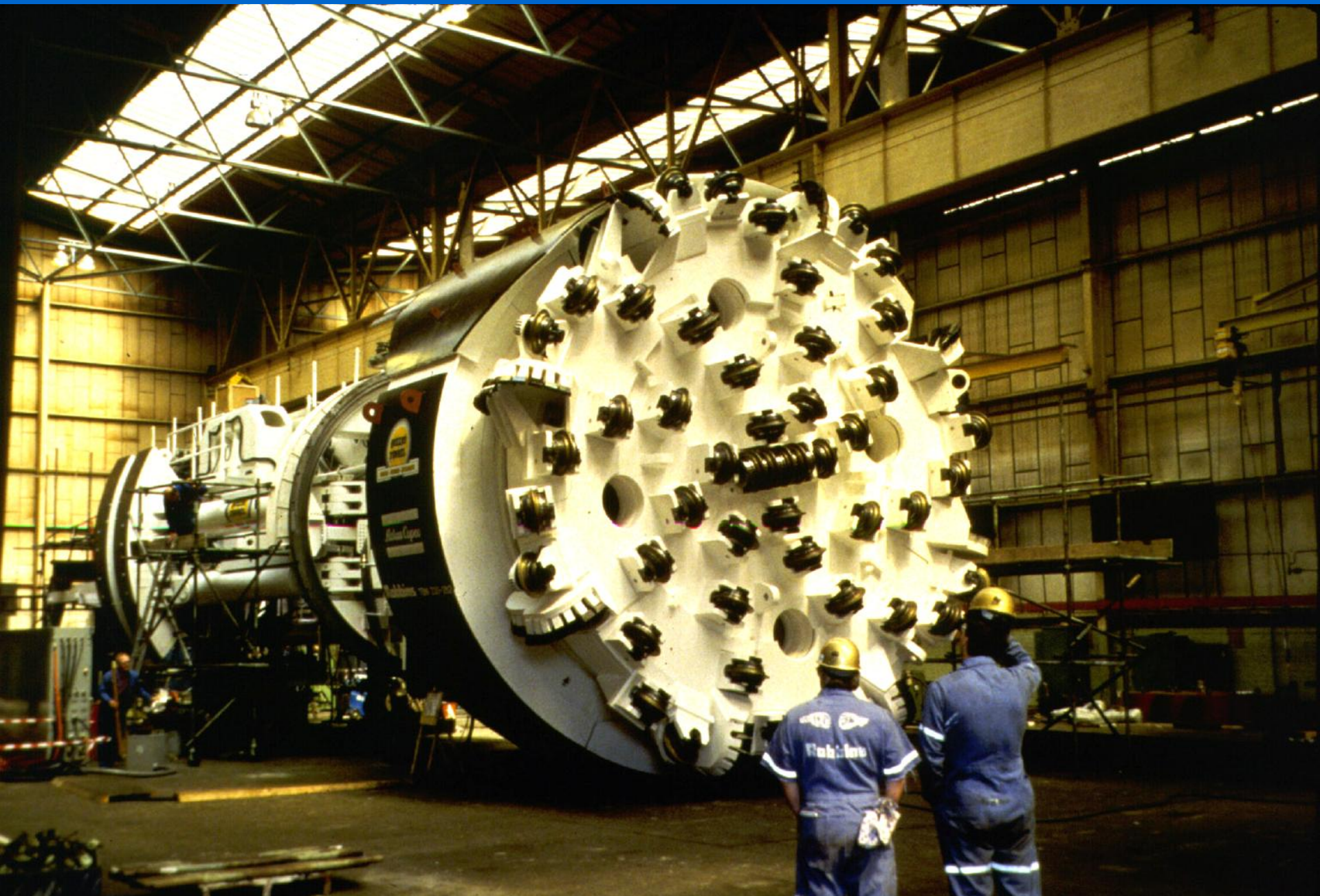
Mineralized Brittle Fault Zones of the Queens Tunnel


Little Ferry
Rutherford
Sky Harbor
Mellor Howard
Palisades Park
Ridgefield
Cliffside Park
Dawn Patrol
BELLEVILLE
BERGEN CO
HUDSON CO
WEST NEW YORK
Central Park
Rikers Island
Ward's Island
La Guardia Field
East River
Queens
Flushing
Flushing Bay
KEARNY
UNION CITY
HOBOKEN
Weiloes Island
Gulf
Midtown Skyport
JERSEY CITY
NEW YORK BAY
HUDSON CO
NEW YORK CO
QUEENS CO
LONG ISLAND CONNECTING LAND
Ellis Island
U.S. NAVY YARD
QUEENS
KINGS
NEW
LONG ISLAND
Bedloes Island
Governors Island
BAYONNE
UPPER NEW YORK BAY
78

NYC Water Tunnel System City Tunnel #3 Stage 2

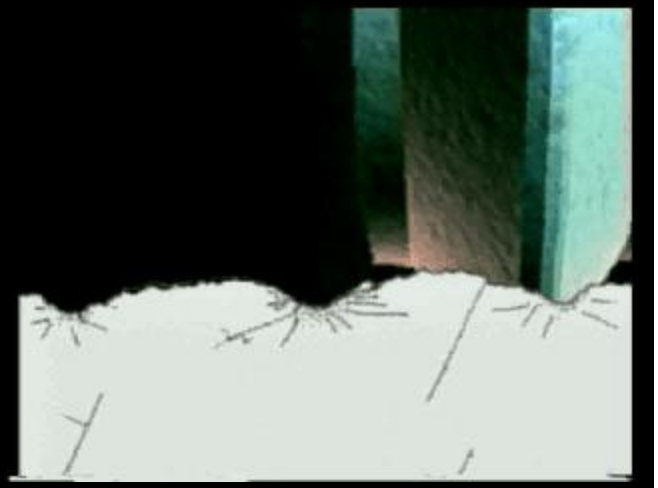


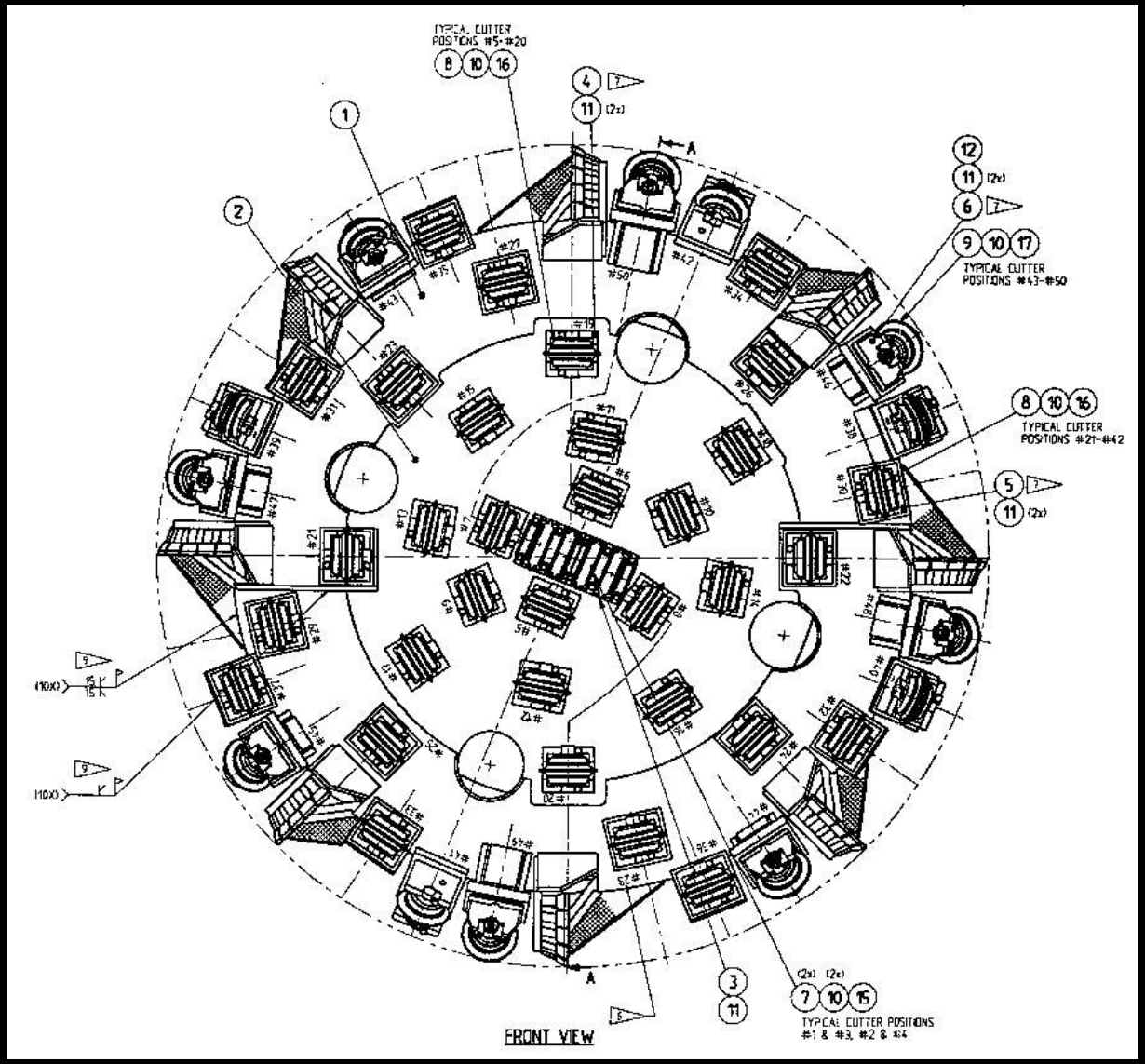
Robbins 235-282 HP TBM

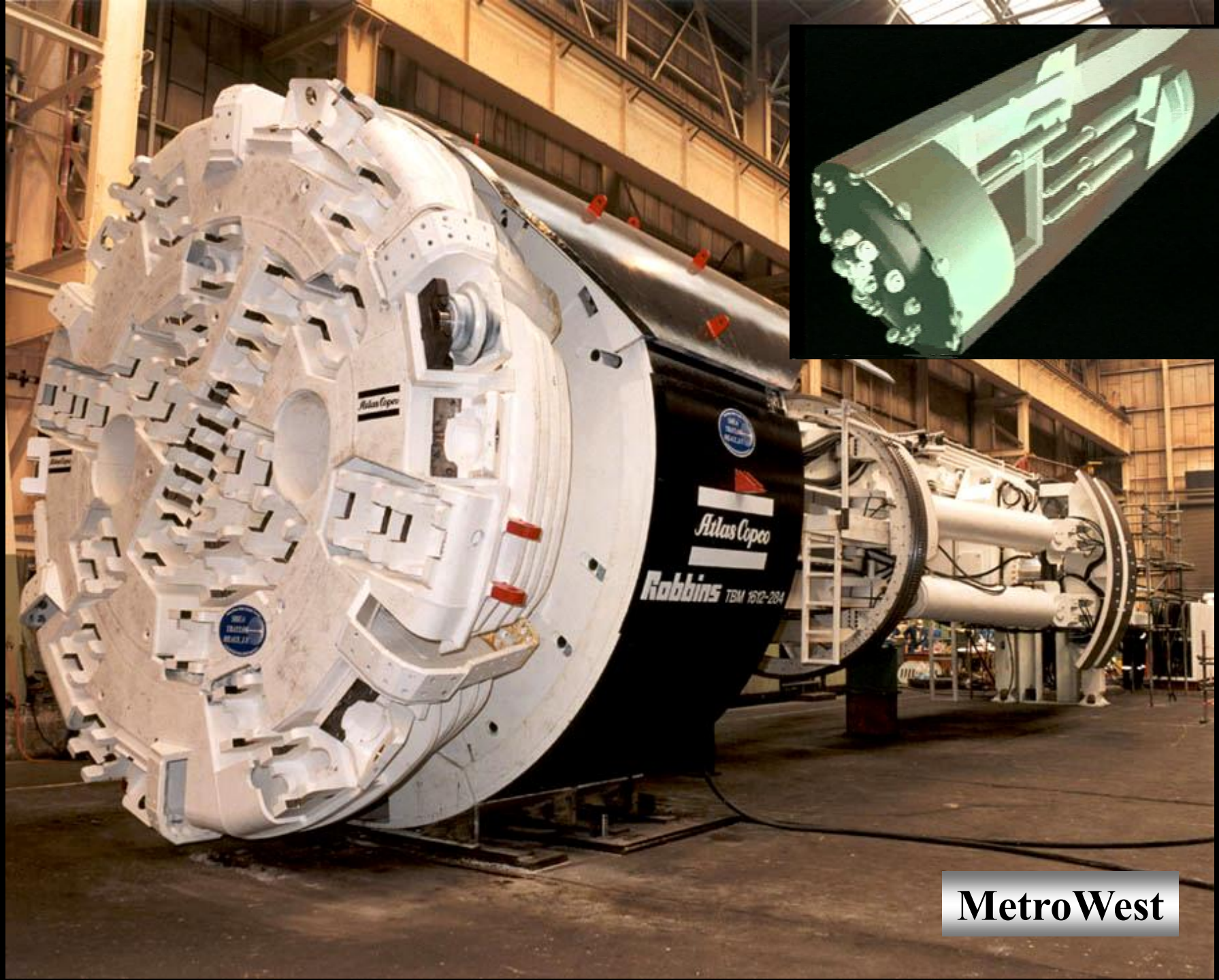



TBM excavation of ~25,000 linear feet of hard rock tunnel to 23’ 2” diameter at depths of ~750’

TBM Chip Production






Atlas Copco
Robbins TBM 160-284
MetroWest

Kerf Pattern in Hard Rock


Sorenberg Switz Herren TBM

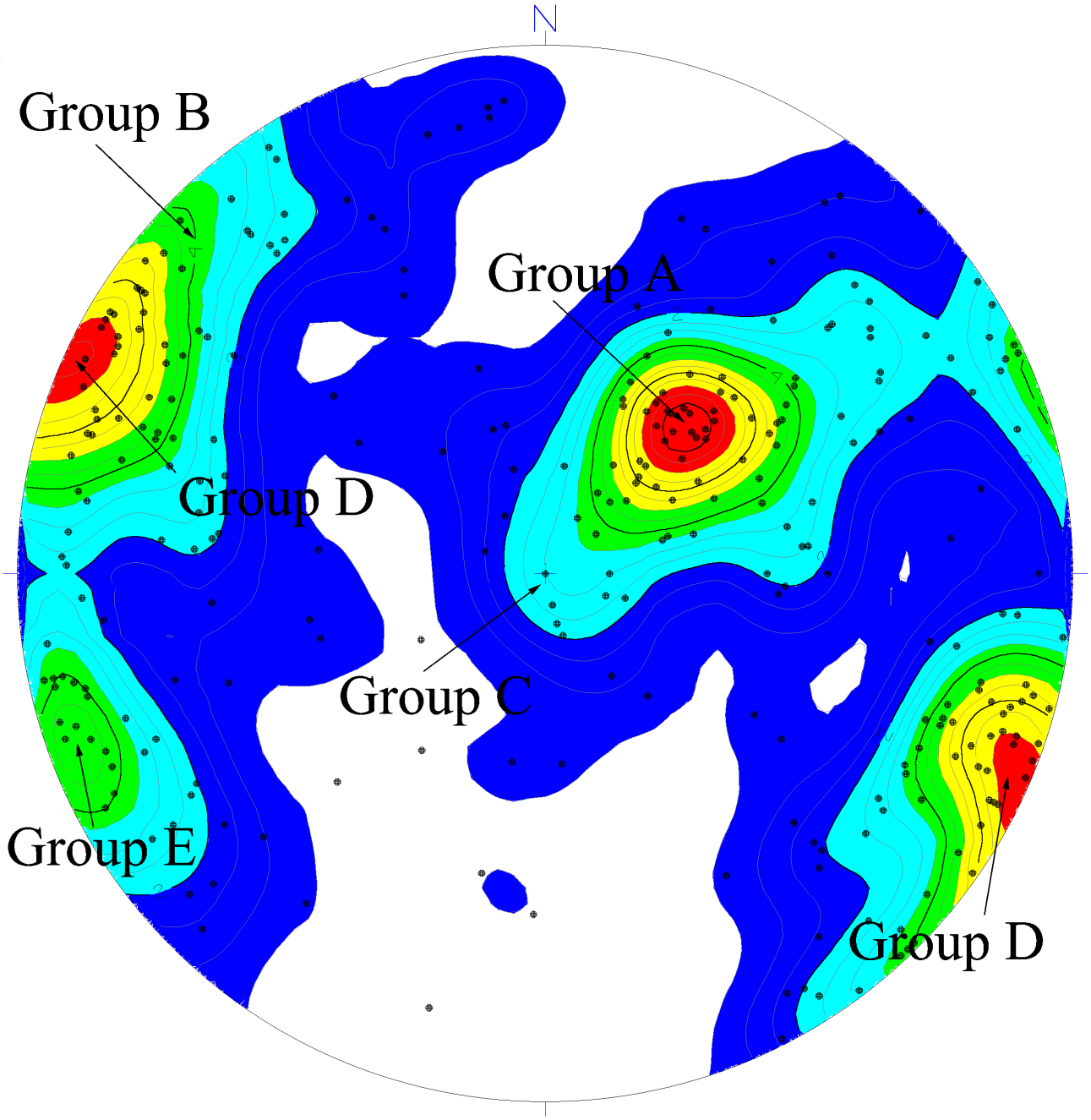
Blocky Ground


12:31PM
5/15/1998
00:24:59:29
In the Belly of the Beast

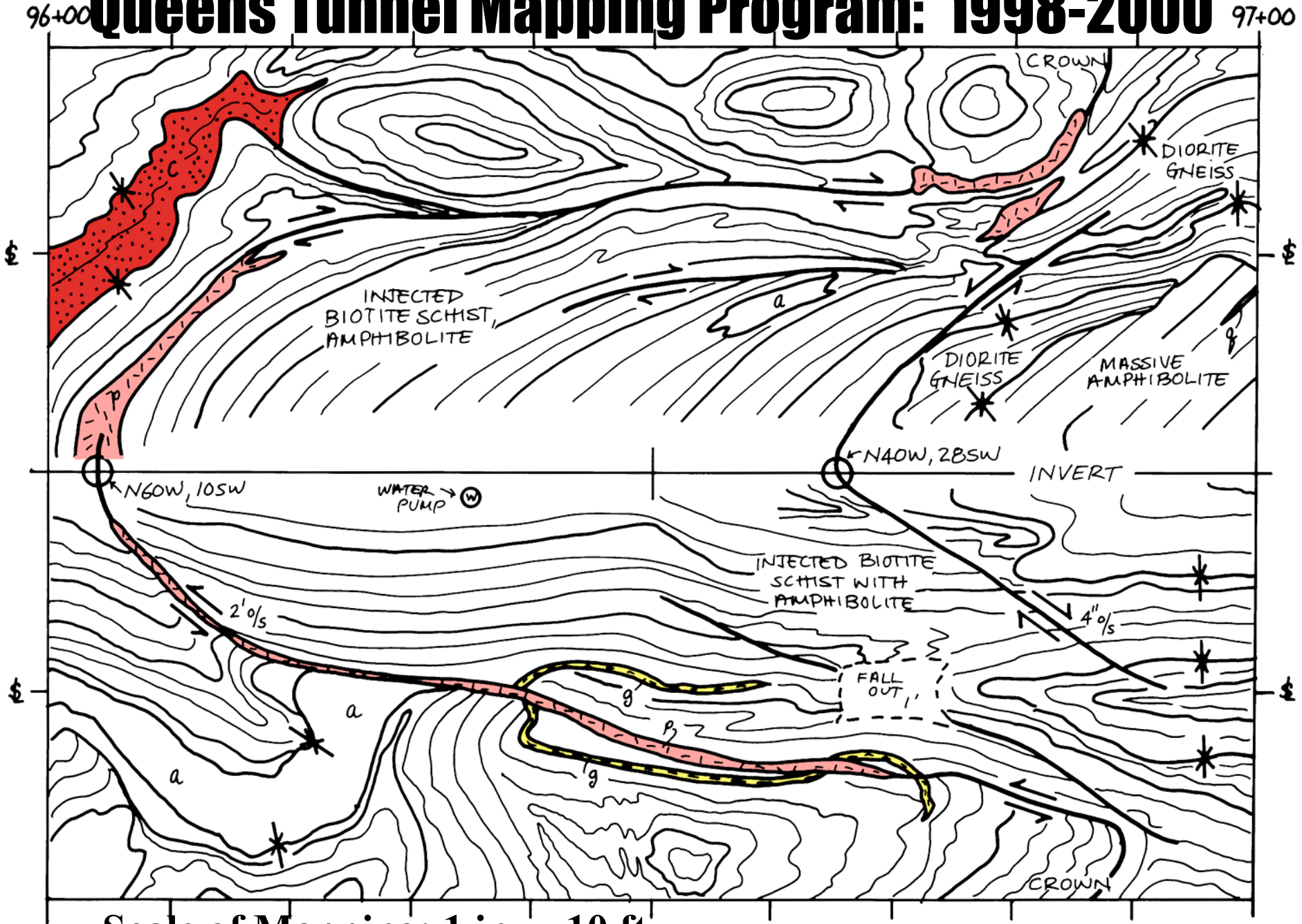
Brooklyn Tunnel TBM

Stage 2, City Tunnel 3

QT Faults



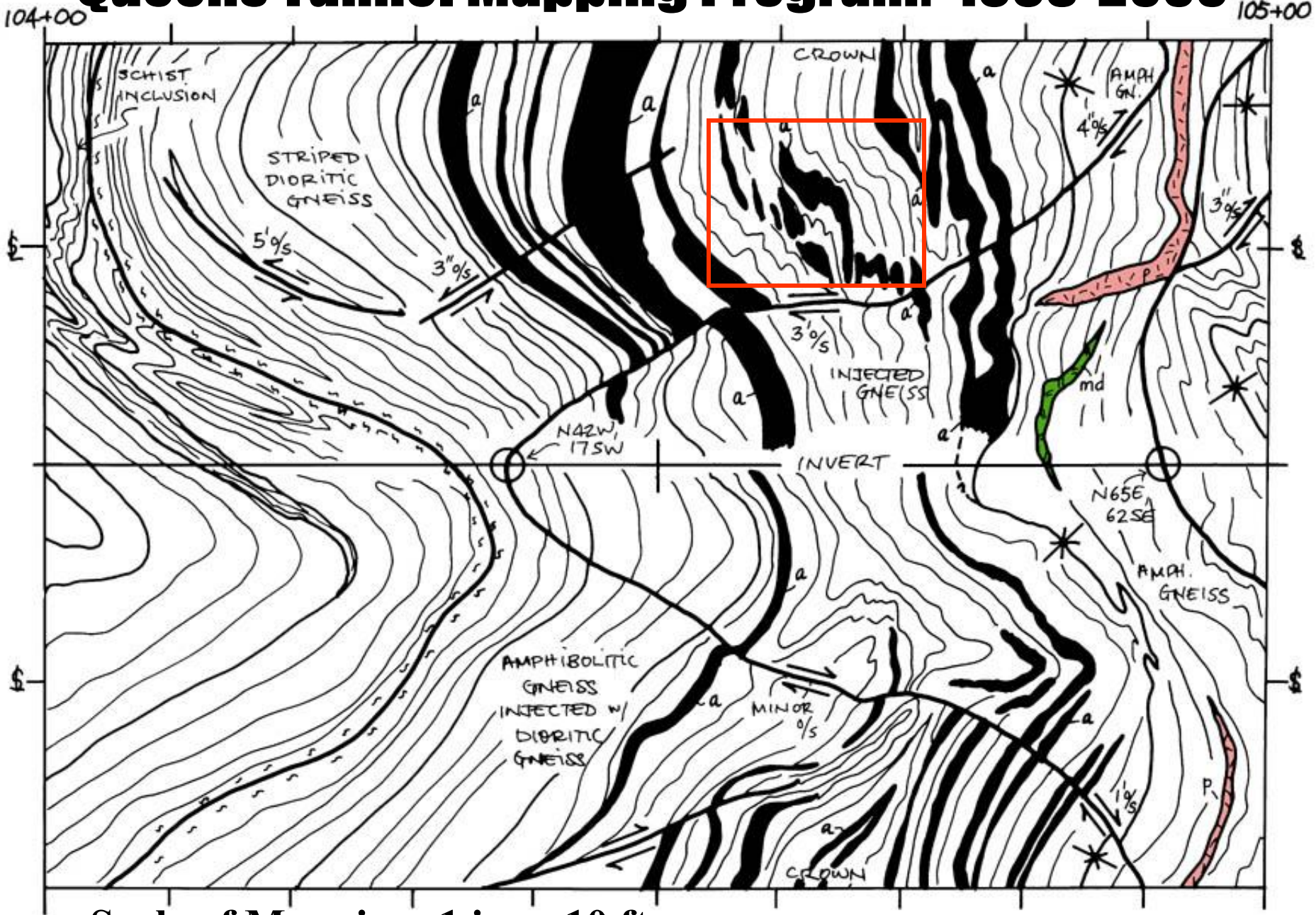
Queens Tunnel Mapping Program: 1998-2000



- **Scale of Mapping: 1 in. = 10 ft**

Subhorizontal Shear Zones

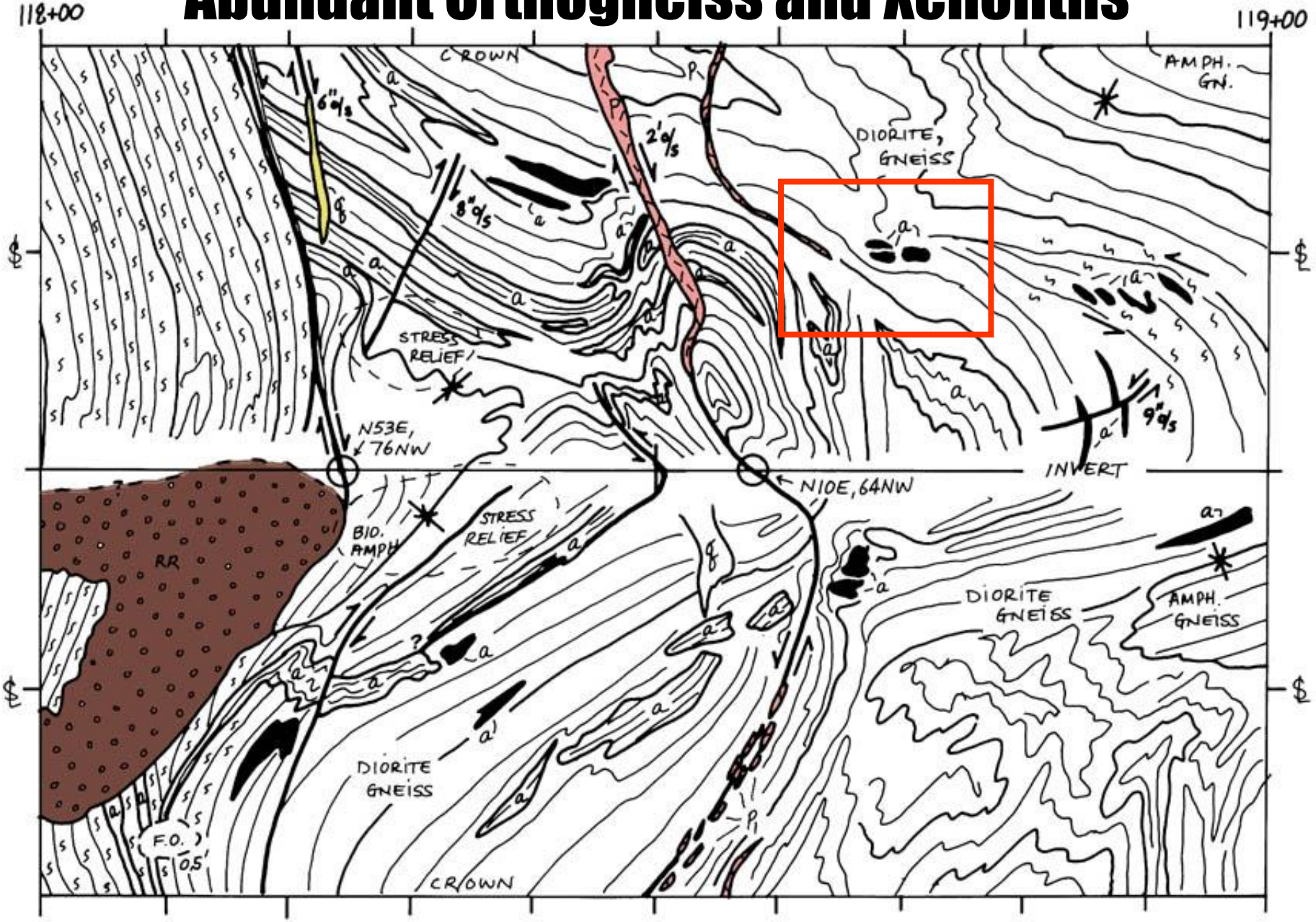
Queens Tunnel Mapping Program: 1998-2000



- **Scale of Mapping: 1 in. = 10 ft**


104+55
104+60
104+65

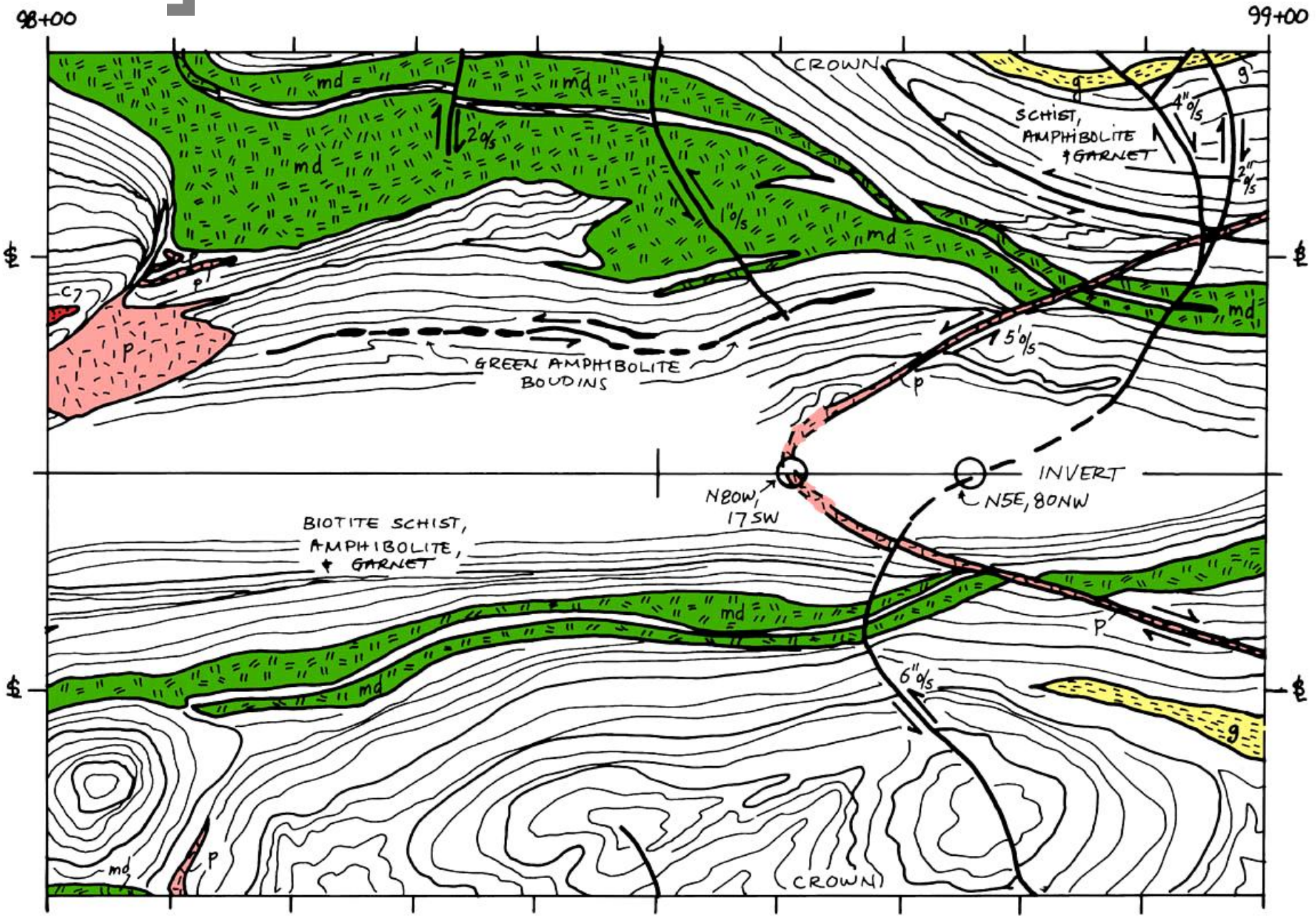
Abundant Orthogneiss and Xenoliths



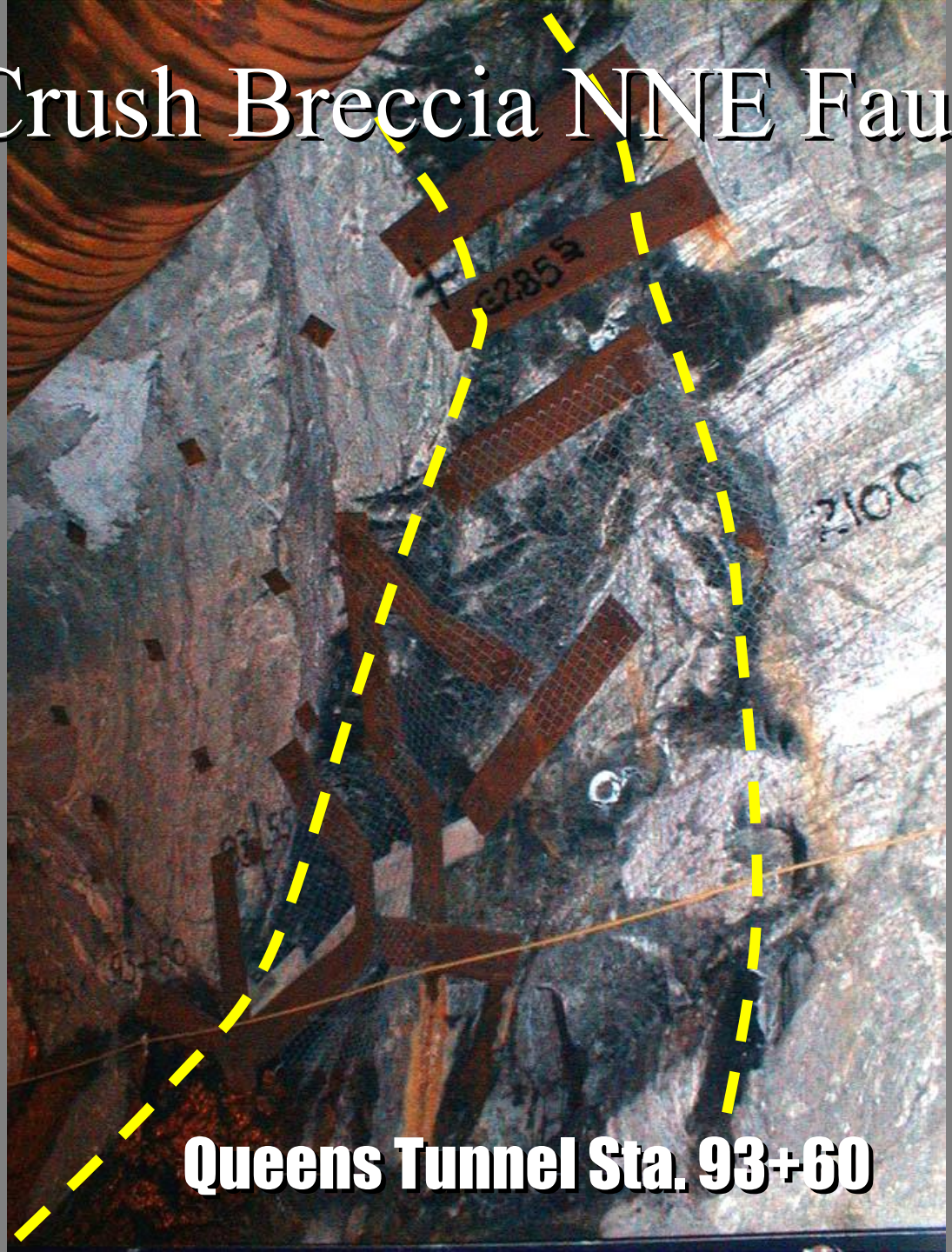
- **Scale of Mapping: 1 in. = 10 ft**

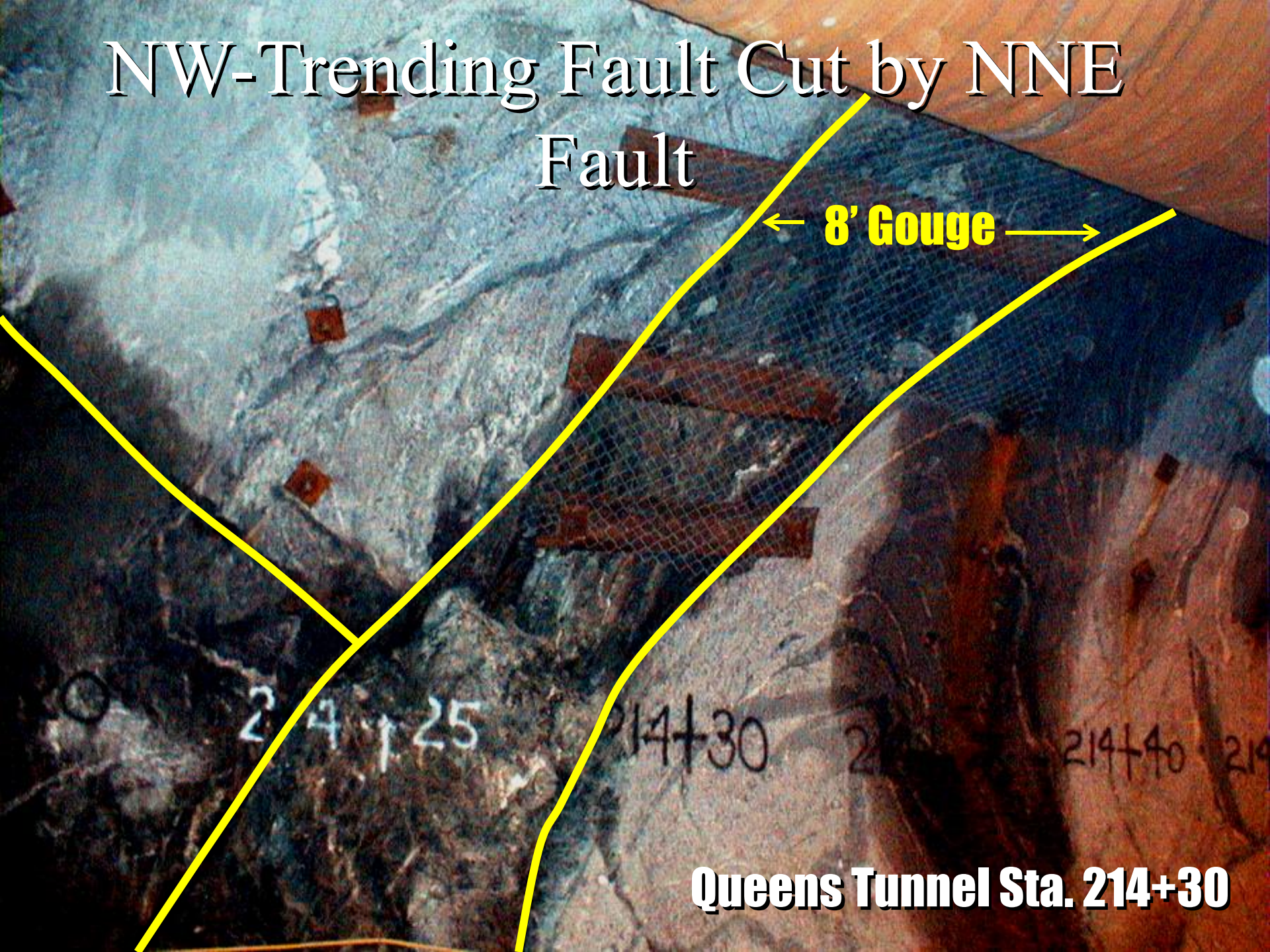

QT117 - Station 118+20, Left Wall
Abrupt change from steeply- to gently dipping foliation along steep D3 shear zone.


ADJ
118+
118


98+00
99+00
CROWN
SCHIST, AMPHIBOLITE & GARNET
4"o/s
2"o/s
1"o/s
2'o/s
15'o/s
6"o/s
md
p
g
GREEN AMPHIBOLITE BOUDINS
INVERT
N80W, 17SW
N5E, 80NW
BIOTITE SCHIST, AMPHIBOLITE, & GARNET
CROWN

Crush Breccia NNE Fault




NW-Trending Fault Cut by NNE Fault
8' Gouge
214+30
214+40
Queens Tunnel Sta. 214+30


NNW-Trending "Manhattanville" Strike-Slip Faults
Splays and Conjugate Joints
Fault Zone
Queens Tunnel Sta. 75+85

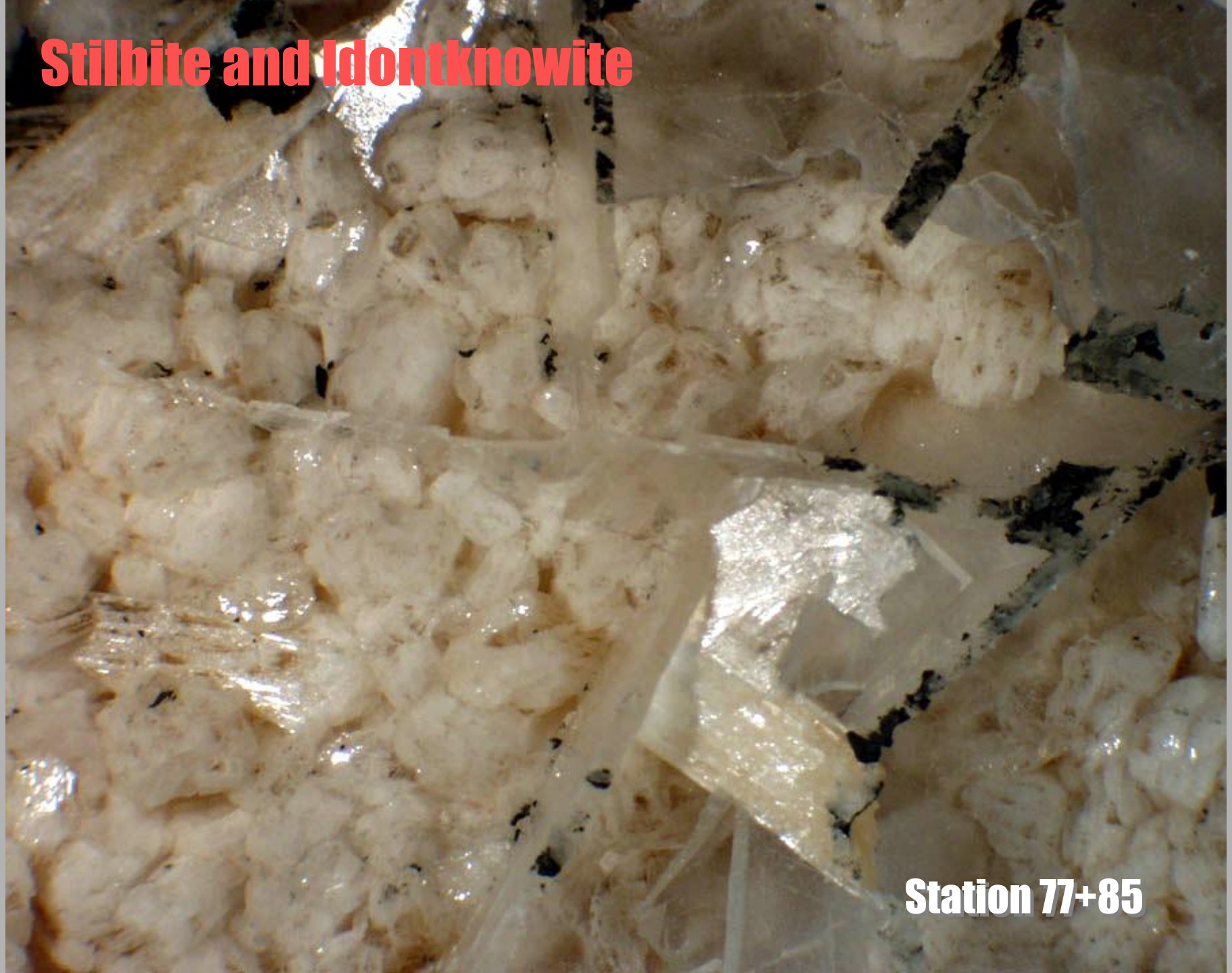
Let's Take a Peek at Some Minerals


Apophyllite Stilbite
Station 190+15


Analcime Apophyllite Stilbite
Station 190+15

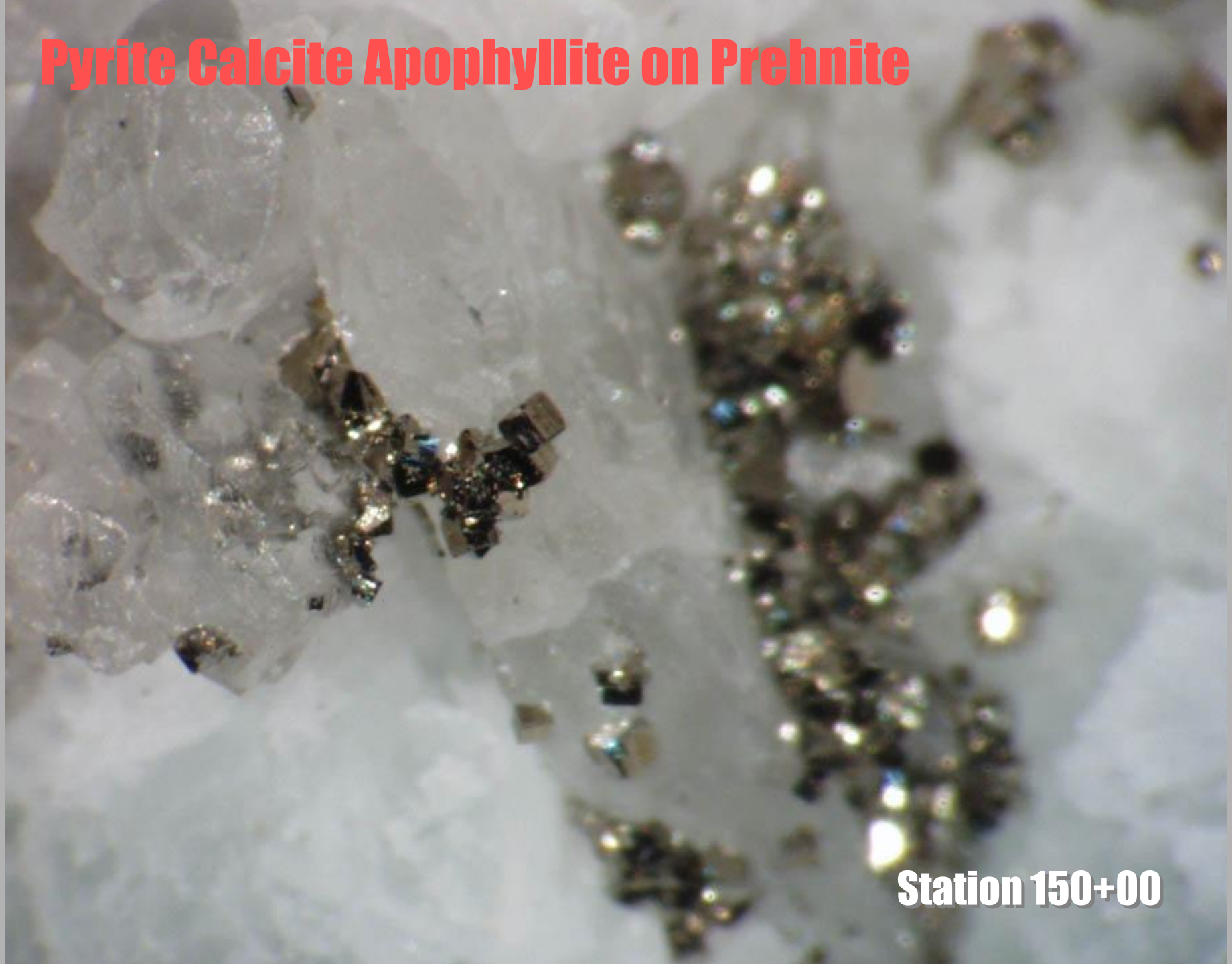

Stilbite on Heulandite
Station 77+85


Stilbite on Heulandite
Station 77+85


Stilbite and Idontknowite
Station 77+85


Stilbite var. Epidesmine
Station 77+85


Calcite and Pyrite on Stilbite var. Epidesmine
Station 77+85


Pyrite Calcite Apophyllite on Prehnite
Station 150+00

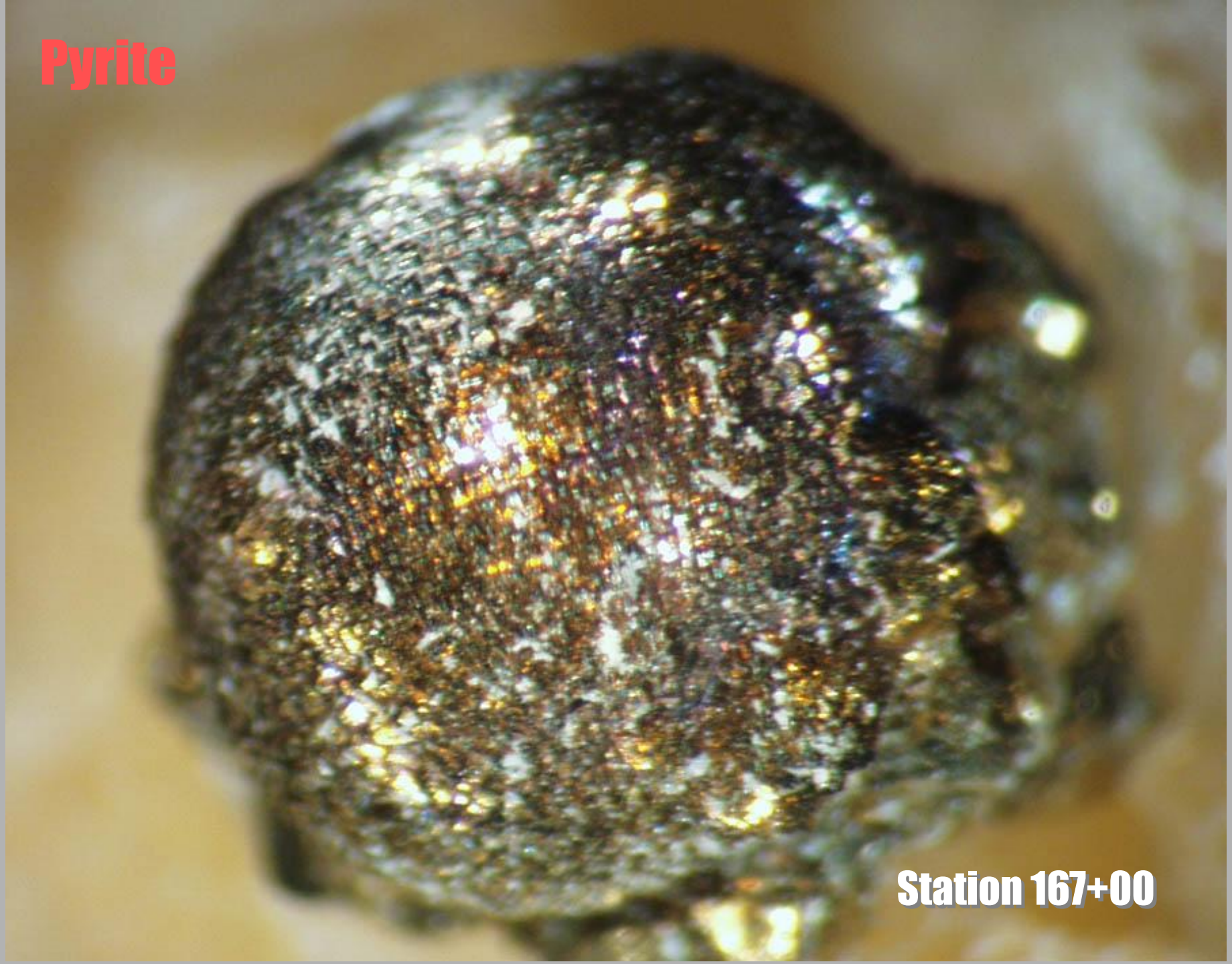

Chabazite on Calcite on Stilbite
Station 162+30


Chabazite on Calcite on Stilbite
Station 162+30


Chabazite on Calcite on Stilbite
Station 162+30


Chabazite on Calcite
Station 162+30


Pyrite on Stilbite
Station 167+00

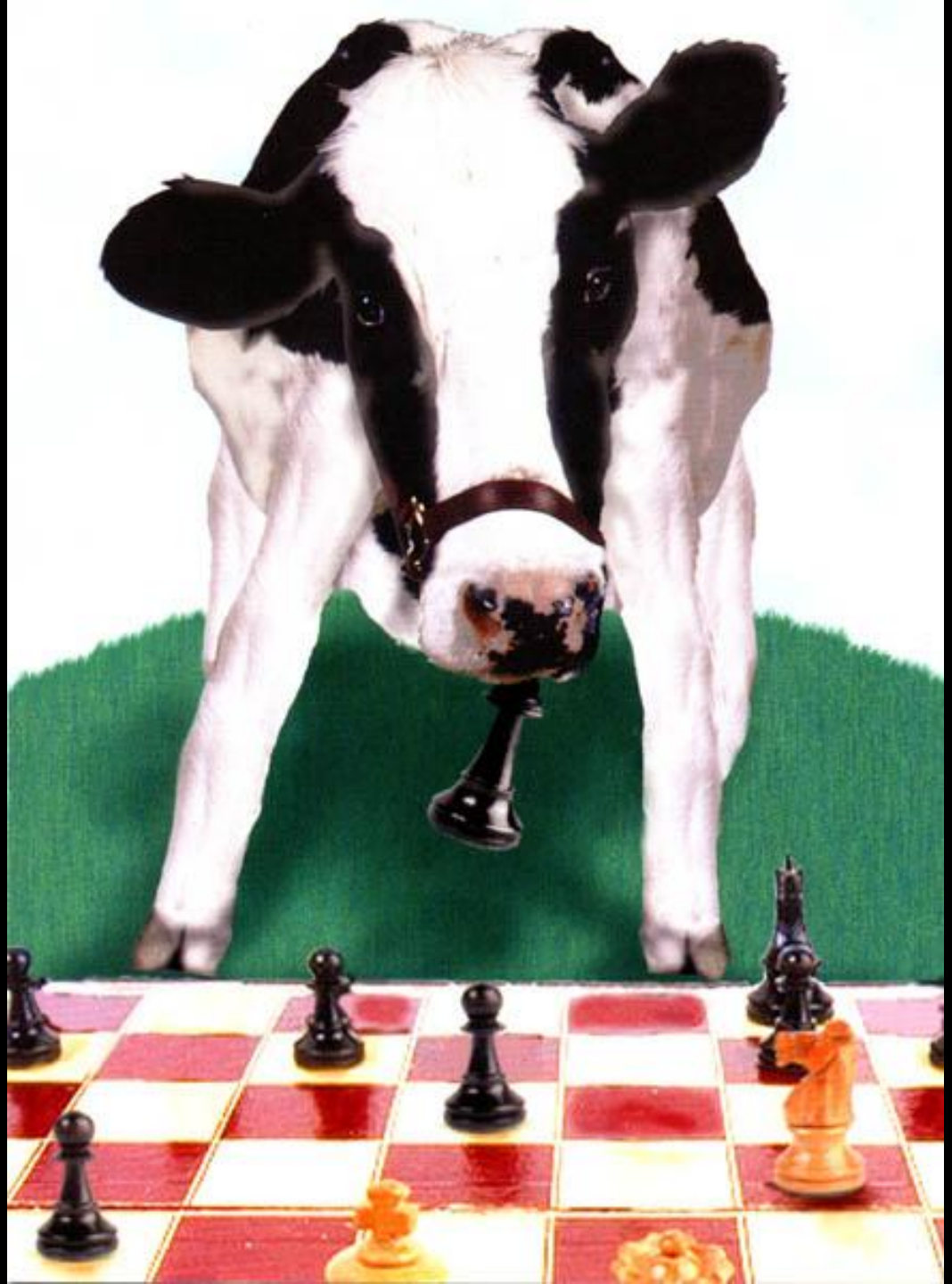

Pyrite
Station 167+00


Calcite on Pyrite
Station 167+00


Pyrite on Stilbite
Station 169+37

Hammieite

www.dukelabs.com



Moo
Chess
Gracias!

www.dukelabs.com

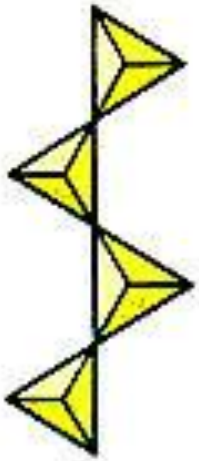
Well, Time to Clean Up
And Get to Work
On Those Rocks
In the Lab Upstairs


Extra Clips

Silicate Architectural Groups

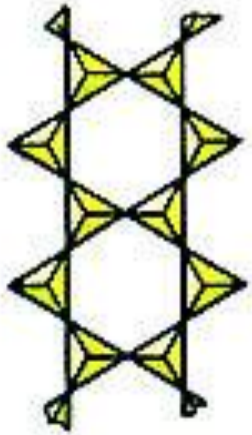
Isolated silicate structure

Olivine



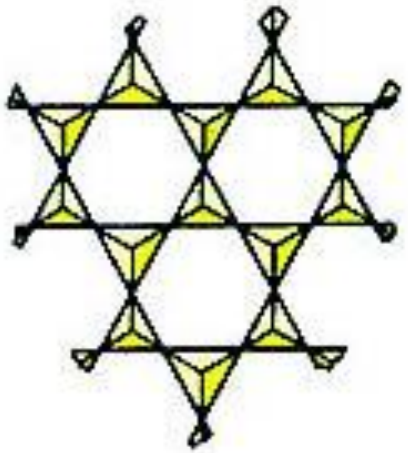
Single chain structure

Pyroxene group



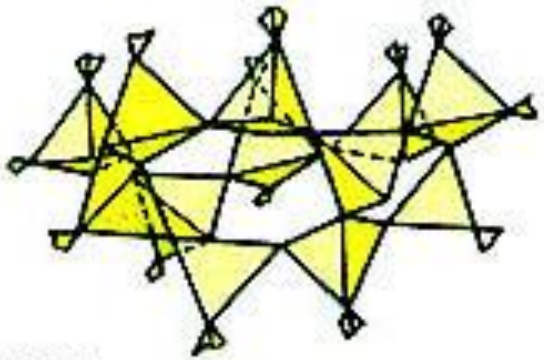
Double chain structure

Amphibole group



Sheet silicate structure

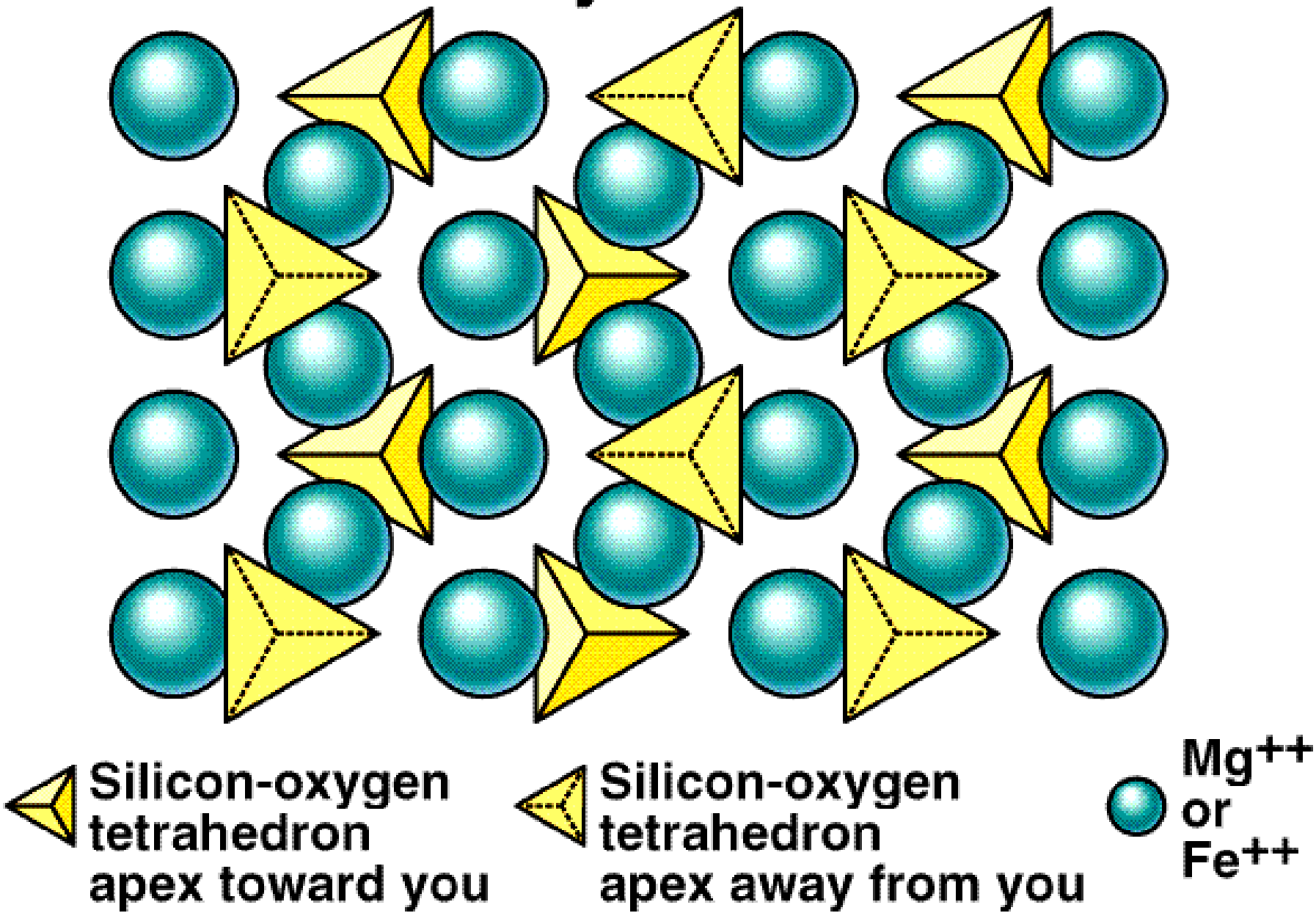
Mica group
Clay group



Framework silicate structure

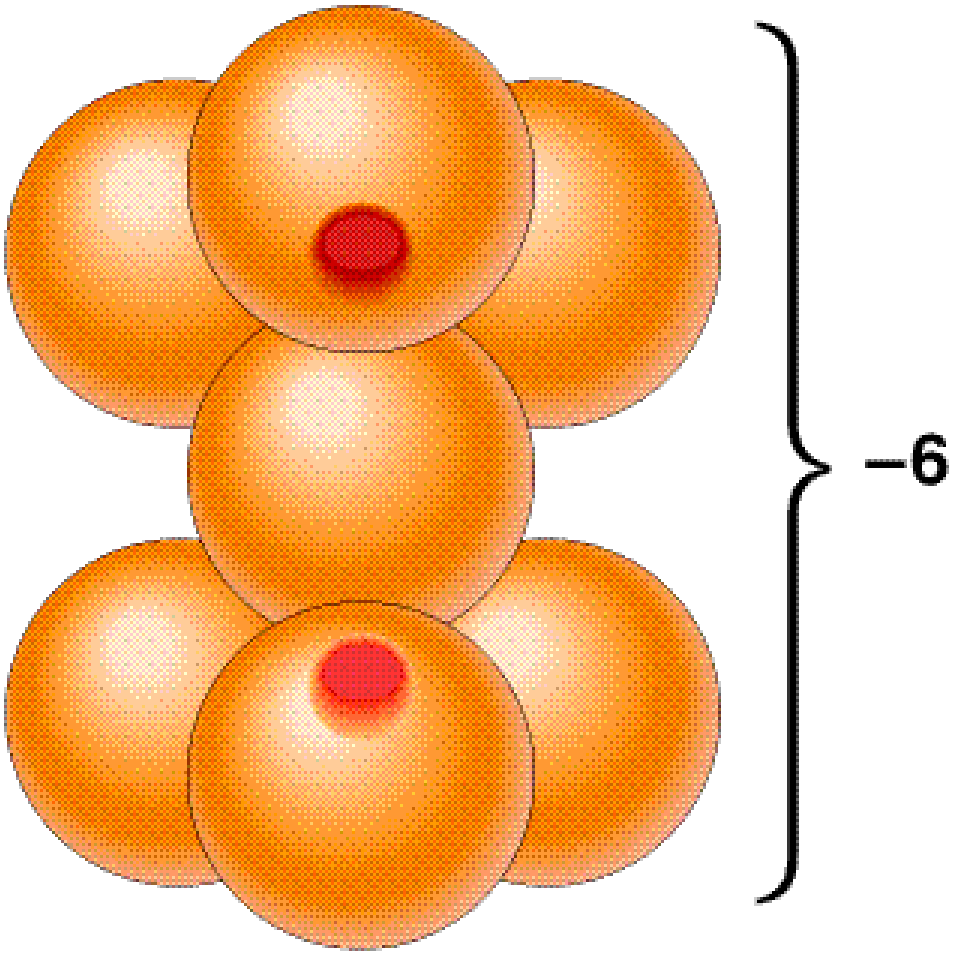
Quartz
Feldspar group

Olivine Crystal Structure



Two Tetrahedron Sharing an Oxygen Atom

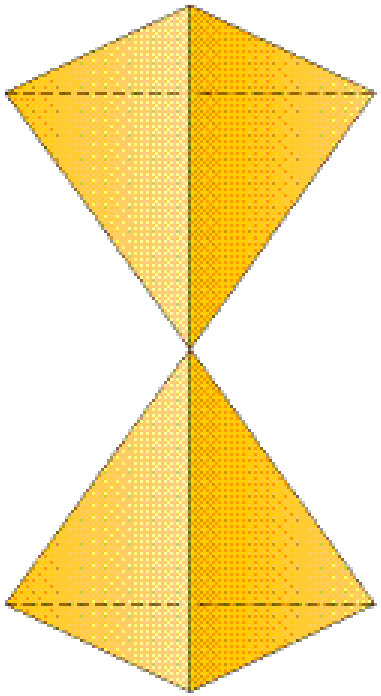
$Si_2O_7^{-6}$



−6

C

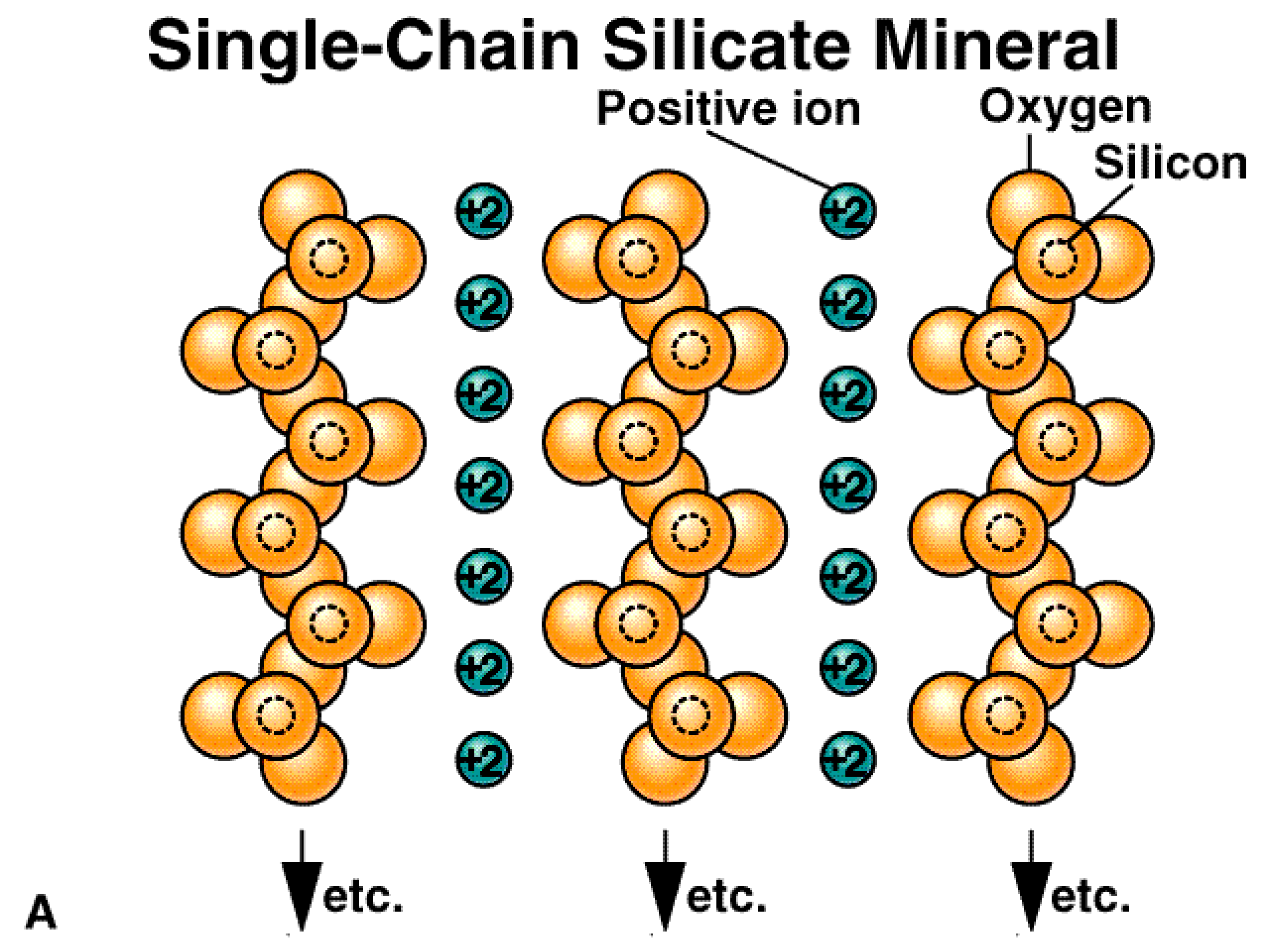
$Si_2O_7^{-6}$



−6

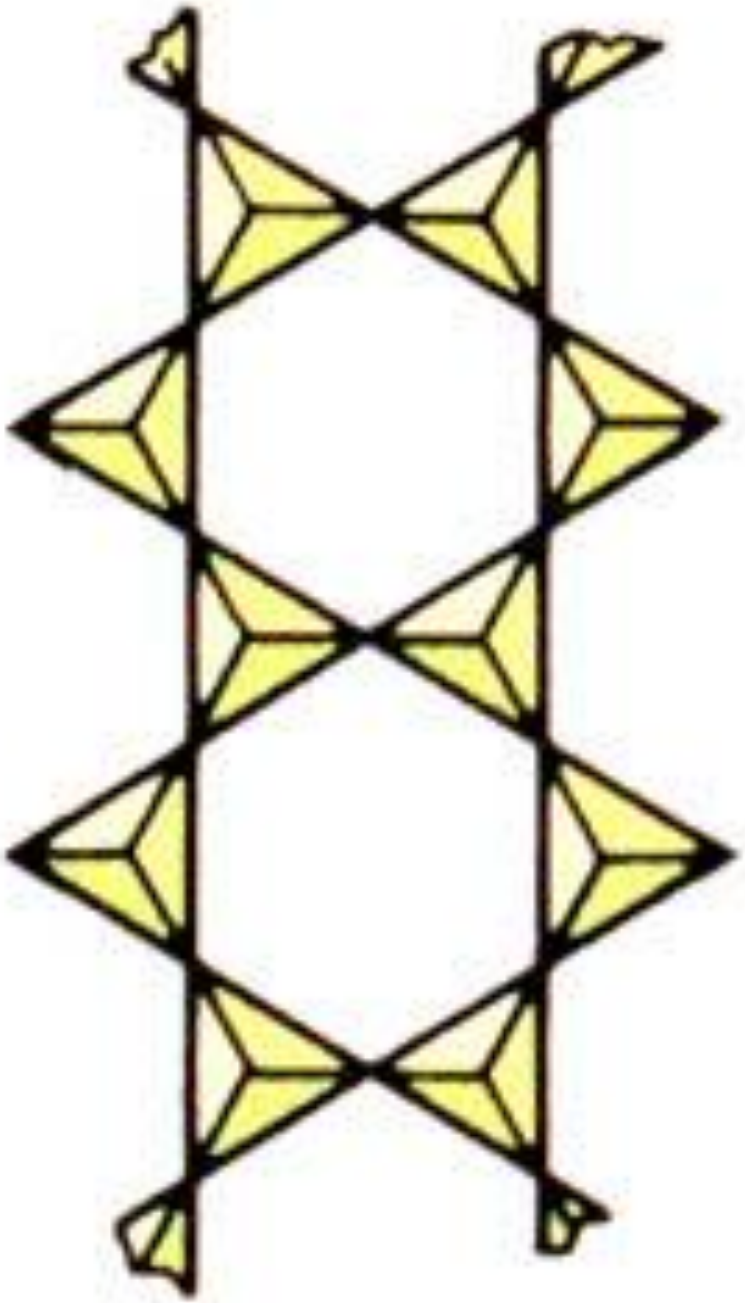
D

Single-Chain Silicate Mineral

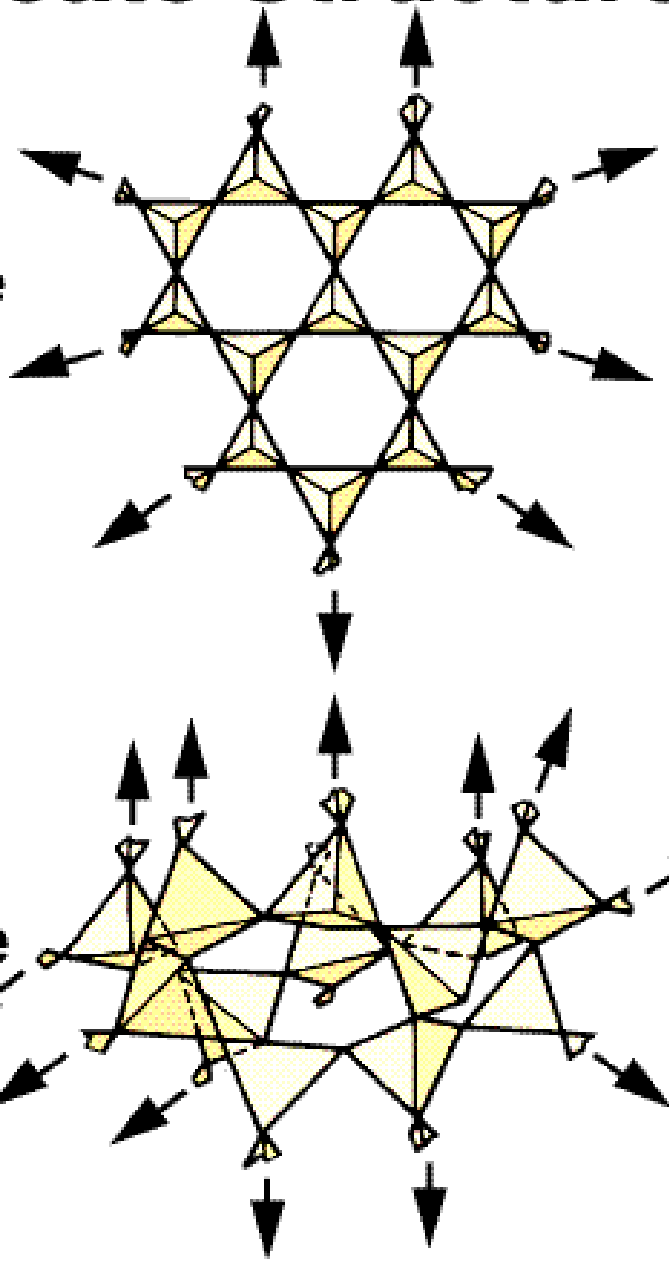


Amphibole group

Double chain structure



Silicate Structures



Sheet silicate structure

Mica group
Clay group

Framework silicate structure

Quartz
Feldspar group

Olivine

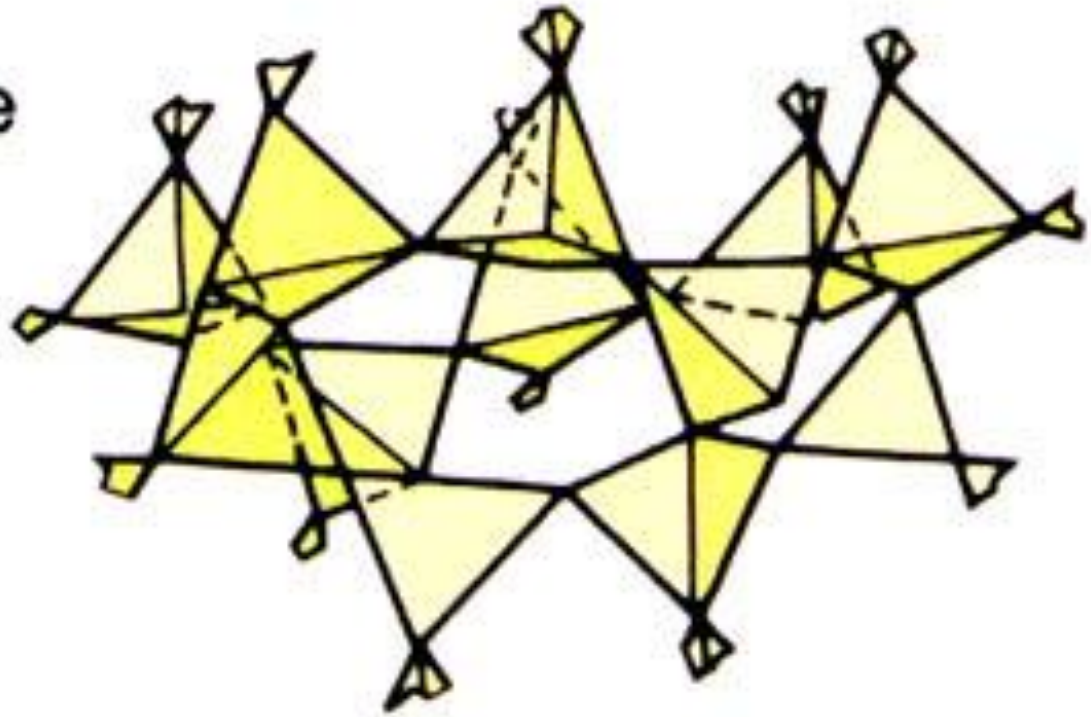
Pyroxene Group

Amphibole Group

Framework silicate structure

Quartz

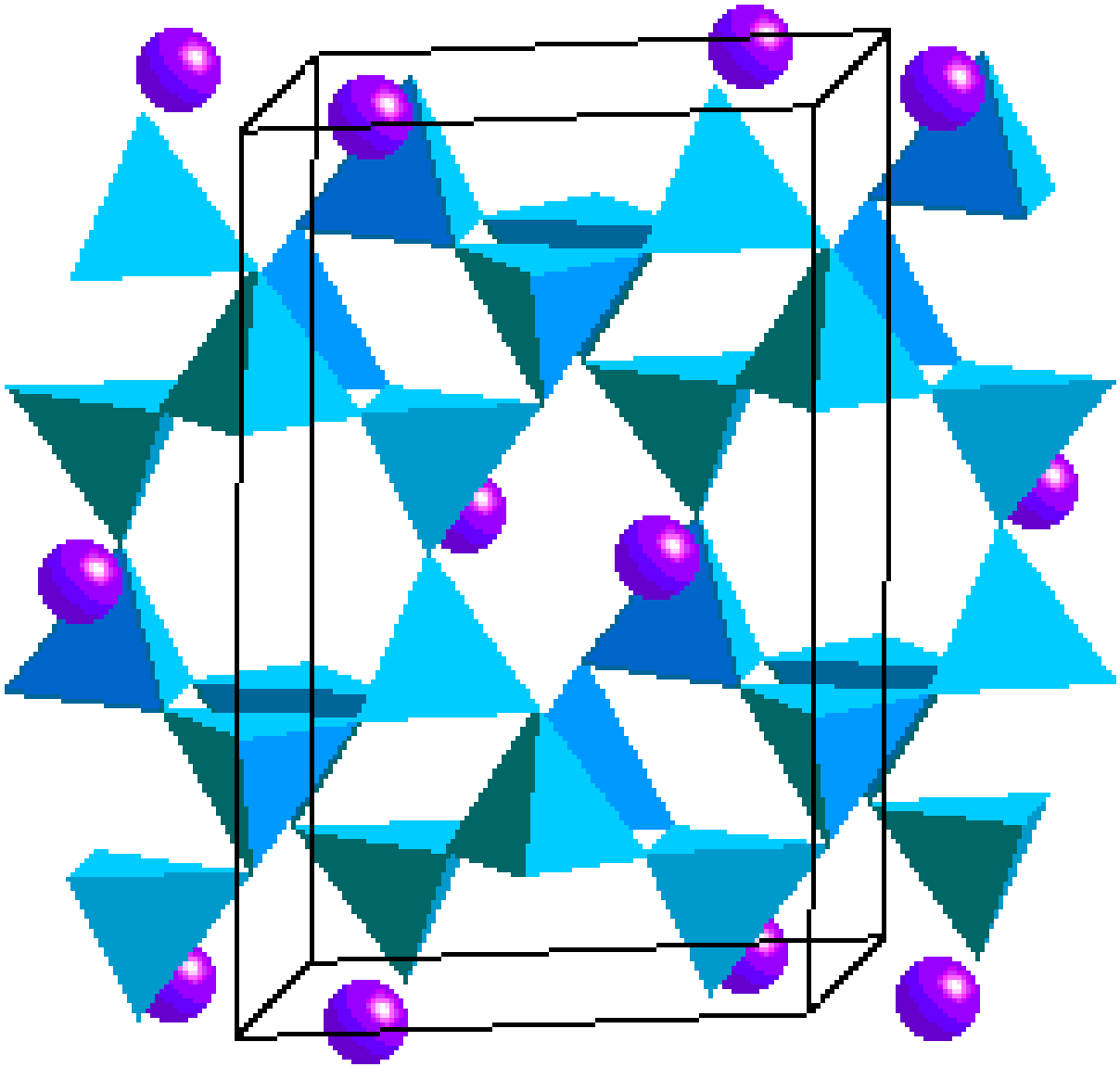
Feldspar group

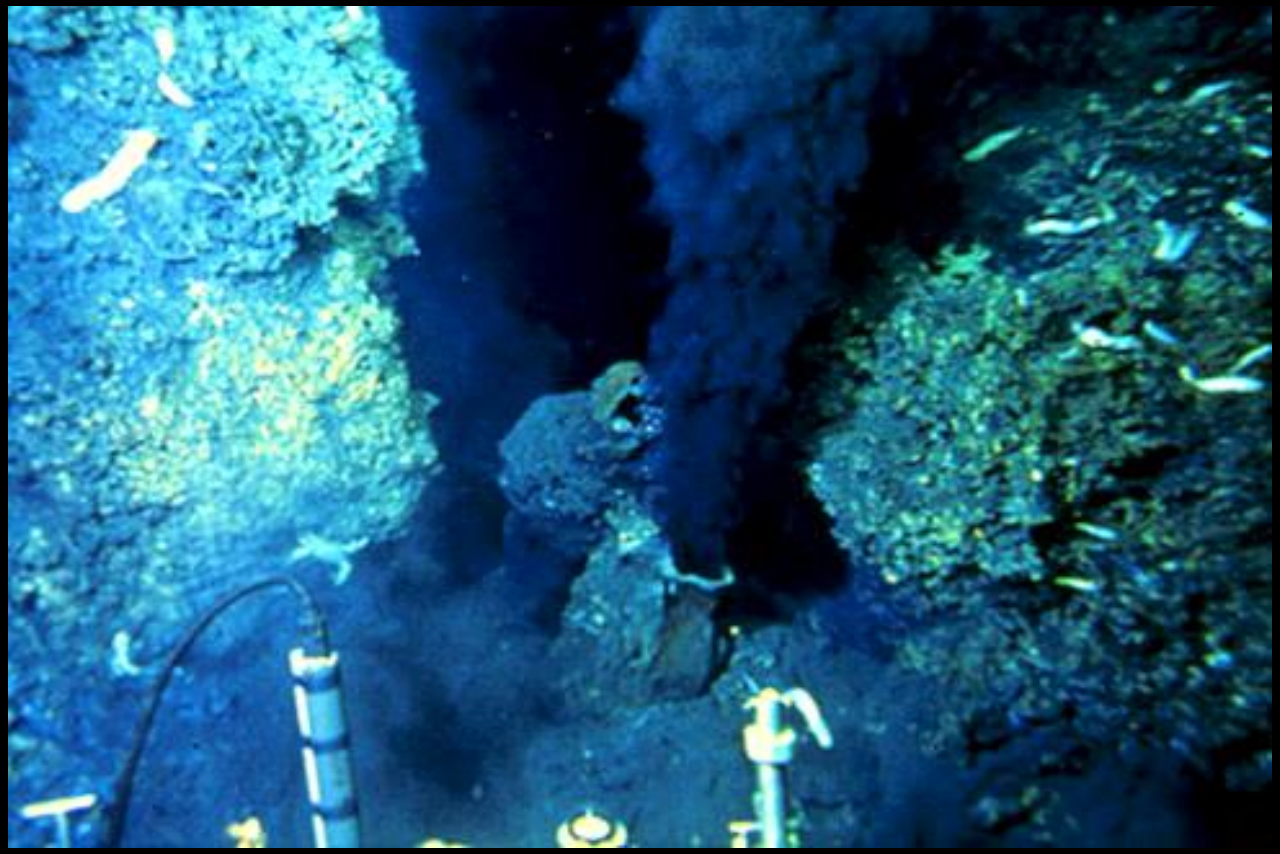


Quartz Group

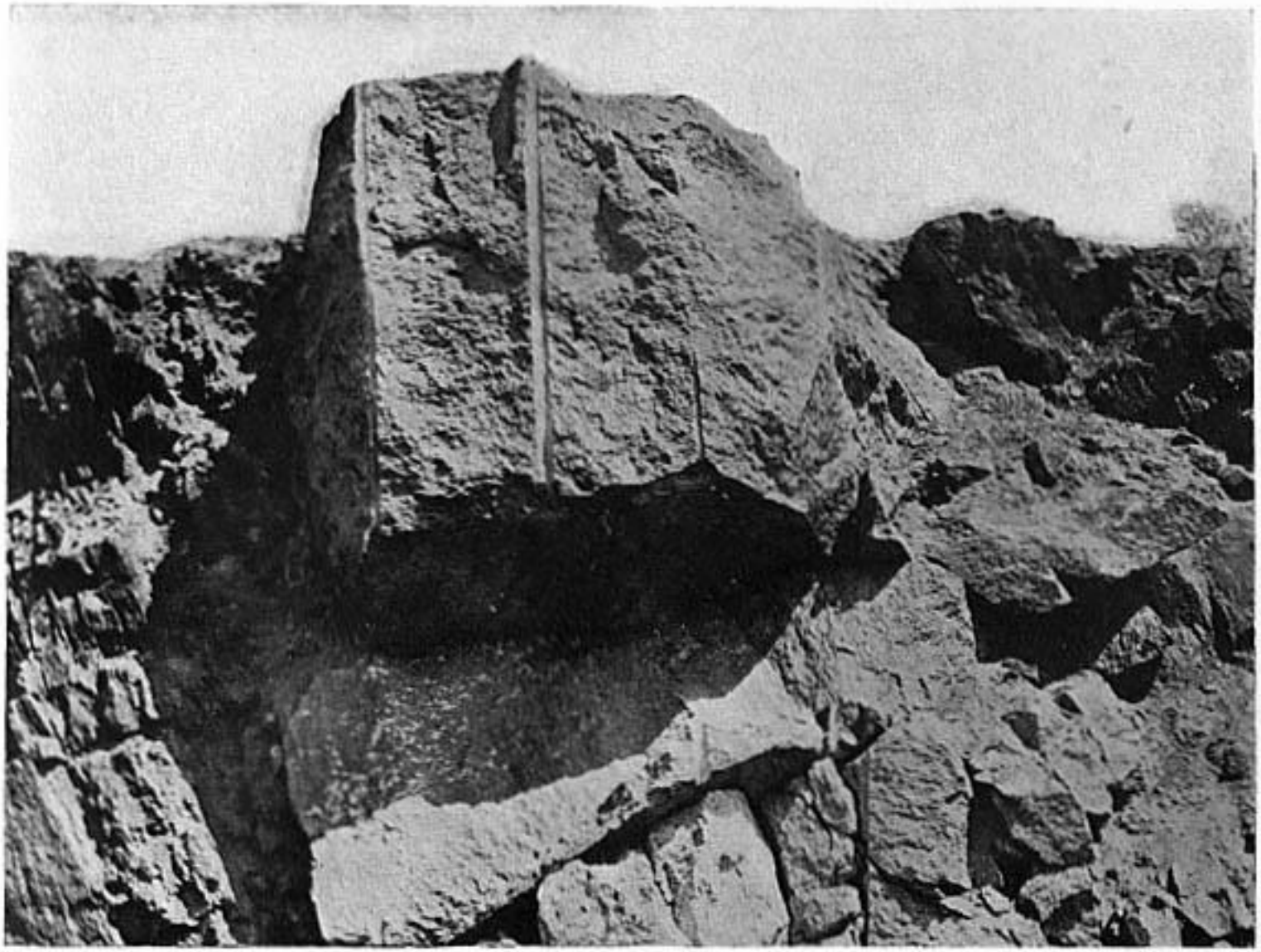
K-Feldspar Group

Sanidine (K-Feldpar)





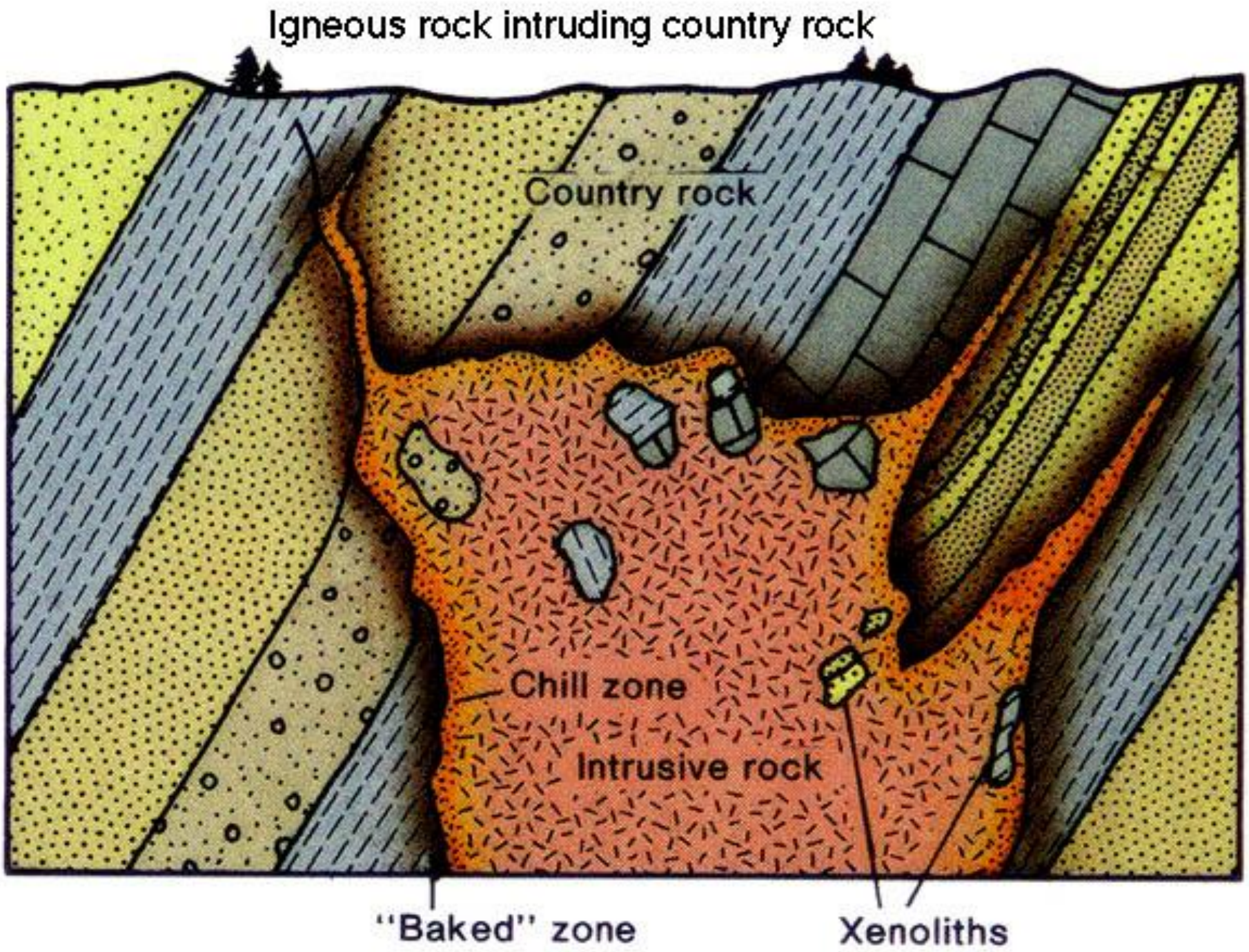
Black Smokers



W. G. LEVISON, PHOTO. PLATE No. 91 (1908)

ACTINOLITE DIKE

130th St., near Convent Avenue, Manhattan Island, New York City


Igneous rock intruding country rock
Country rock
Chill zone
Intrusive rock
"Baked" zone
Xenoliths


Stilbite on Calcite
Station 190+15


Stilbite on Heulandite
Station 77+85


Calcite and Pyrite on Stilbite var. Epidesmine
Station 77+85


Pyrite on Stilbite
Station 169+37


Analcime Apophyllite Stilbite
Station 190+15

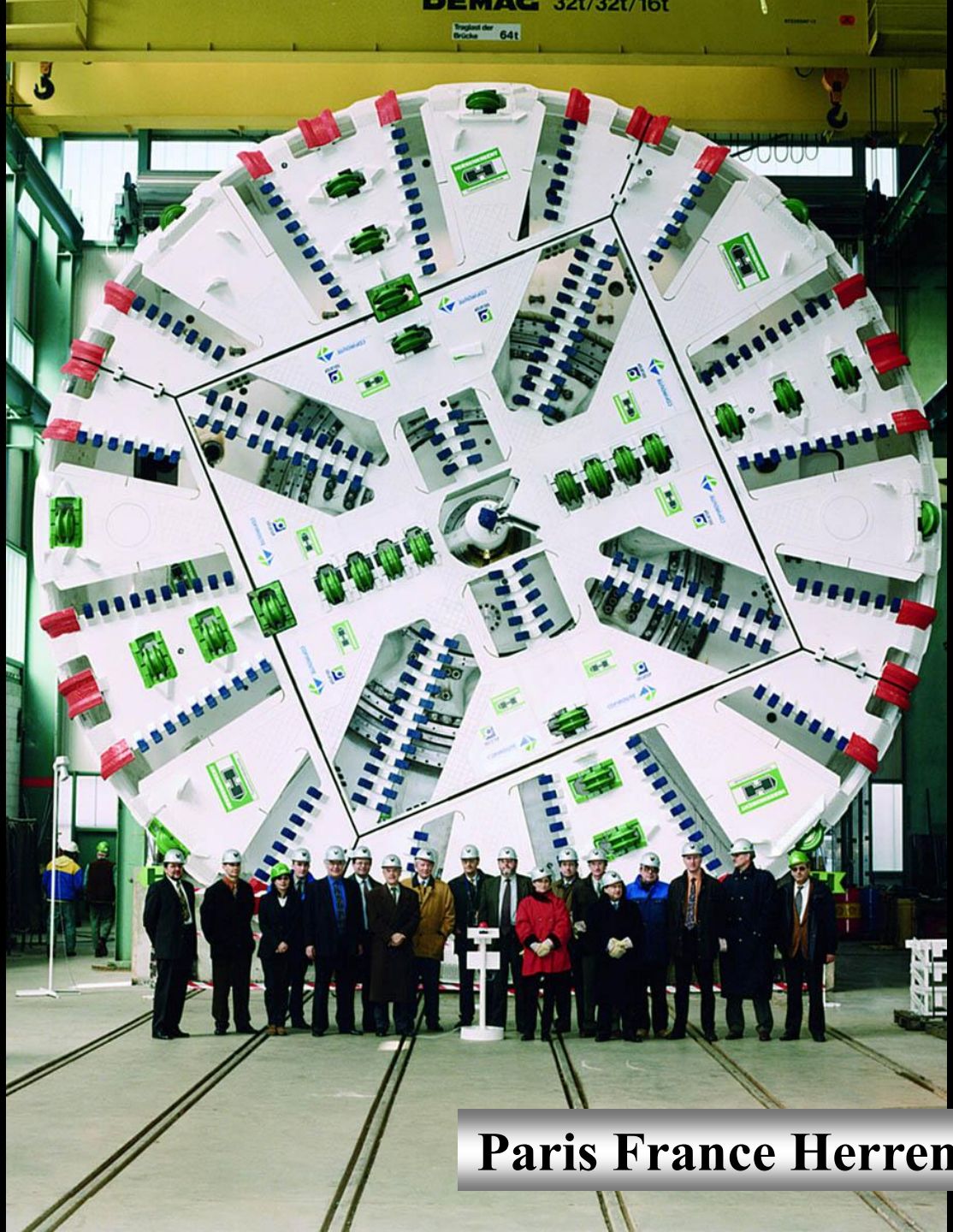

Lower TBM Platform

Before

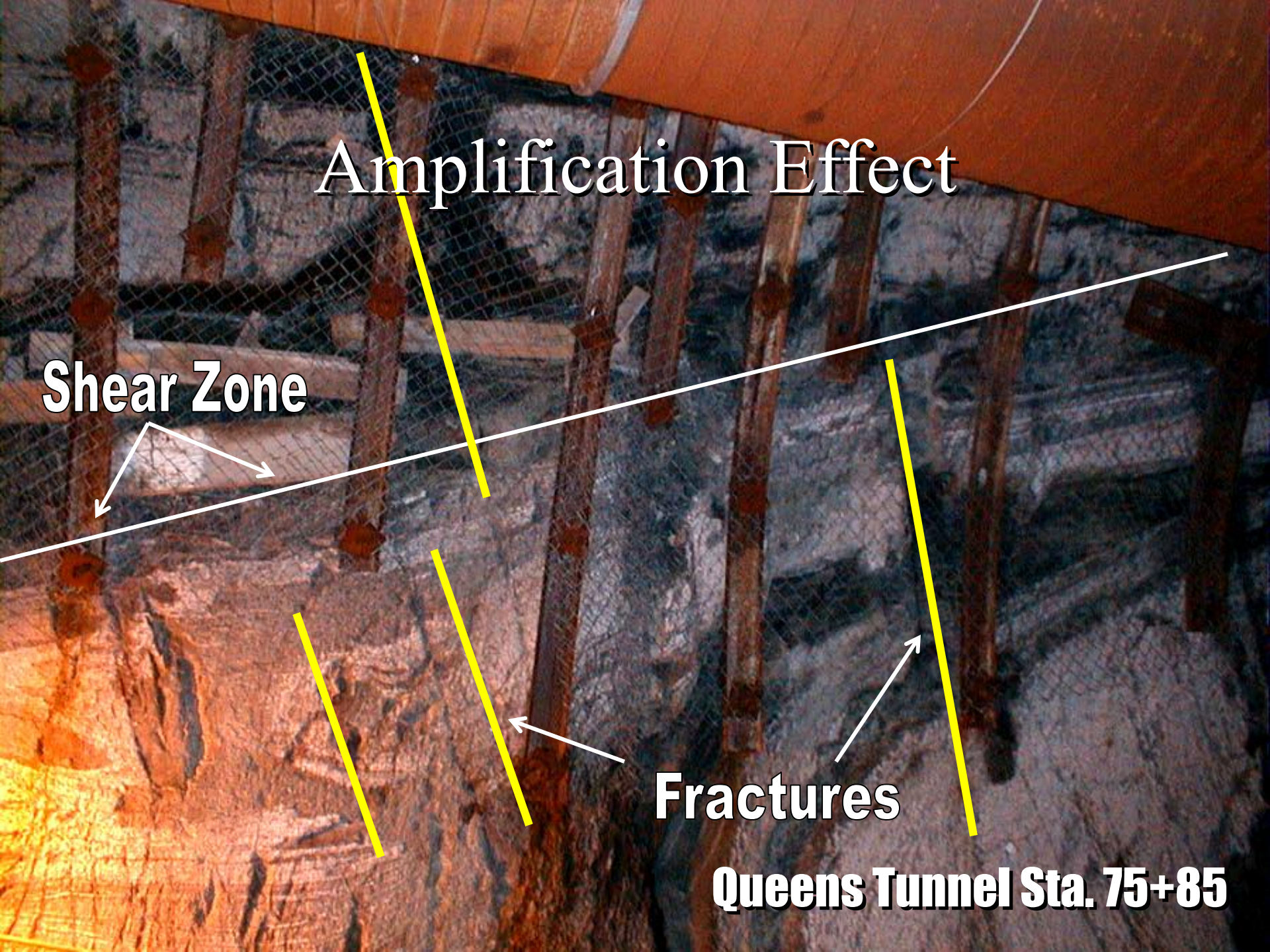
After


Worn and Damaged Cutters

Hamburg Germany Herrenknecht TBMs



Paris France Herrenknecht TBM


Amplification Effect
Shear Zone
Fractures
Queens Tunnel Sta. 75+85