

# Tectonics Implications of Bedrock Studies at the World Trade Center Site, New York City

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Hofstra University Geology Dept.



**Thanks To:**

**Cheryl Moss**

**Bob Reina**

**Pablo Lopez**

**Jim Tantalla**



Mueser-Rutledge  
Consulting Engineers



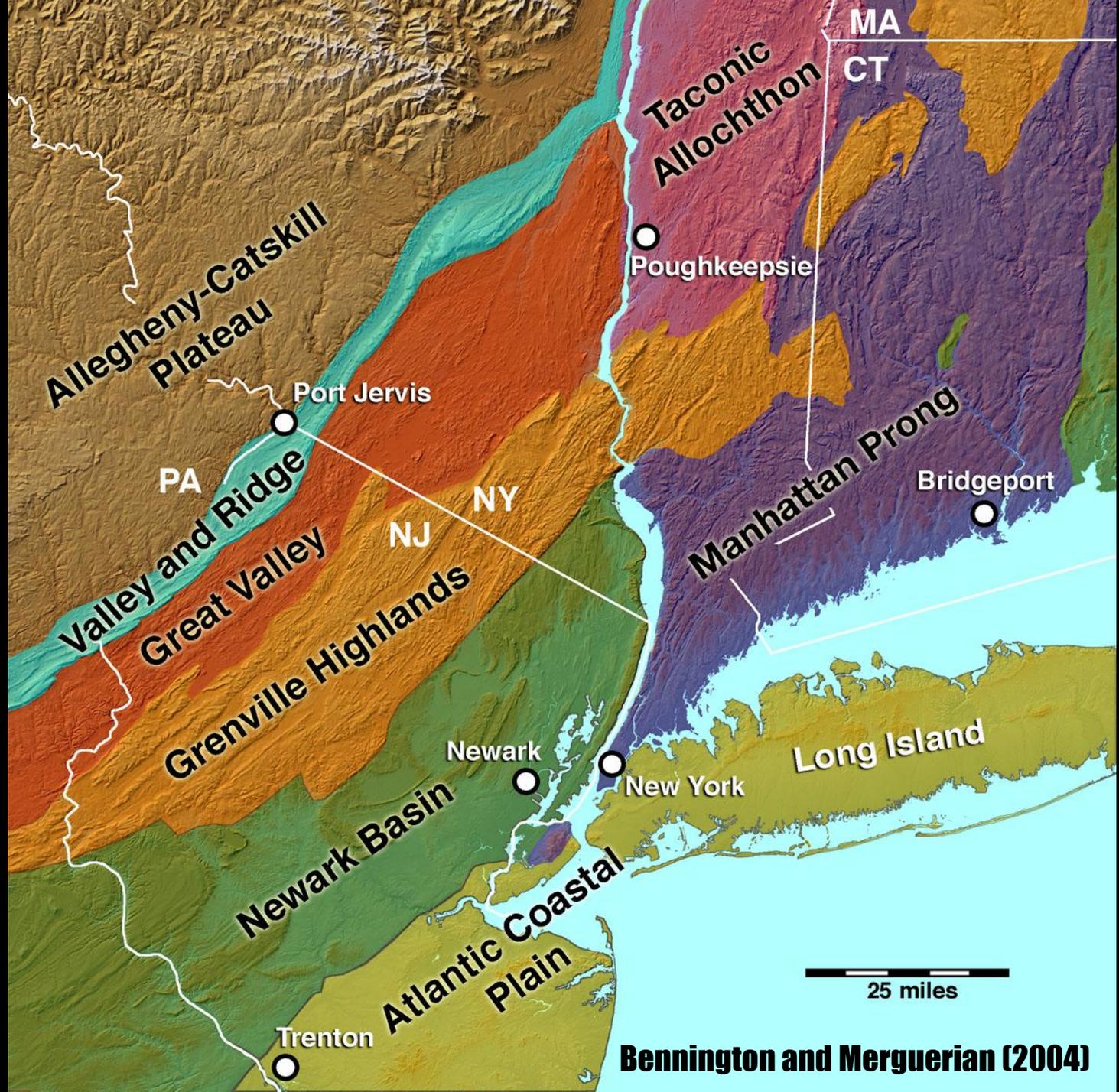
- **Elizabeth Guise and**
- **Mickey Merguerian**
- **HCLAS FRDG Grants**
- **Many Students Over 29 Years at Hofstra**
- **Some Still With Us!**



**and, the “get-it-done”  
staff at Duke  
Geological Laboratory  
in Westbury, NY**



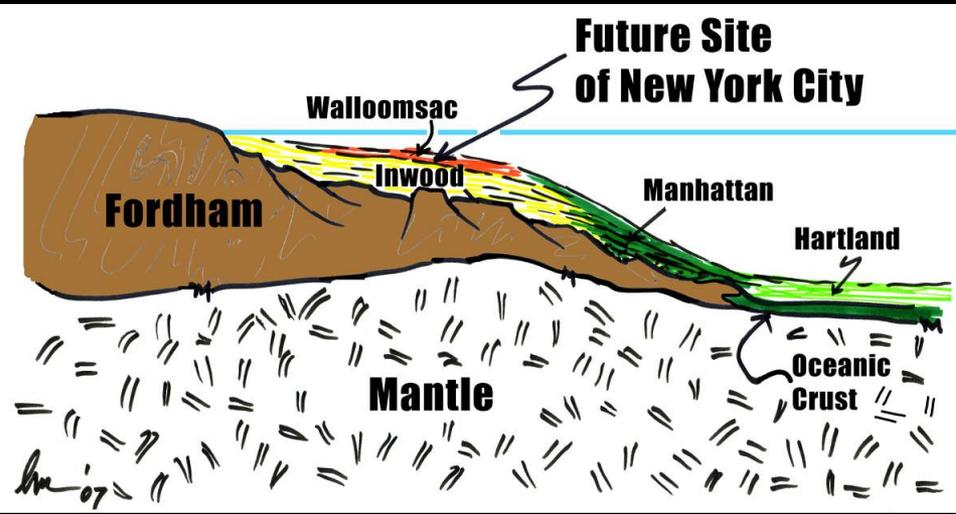
**“We’re Not Good But We’re Slow”**



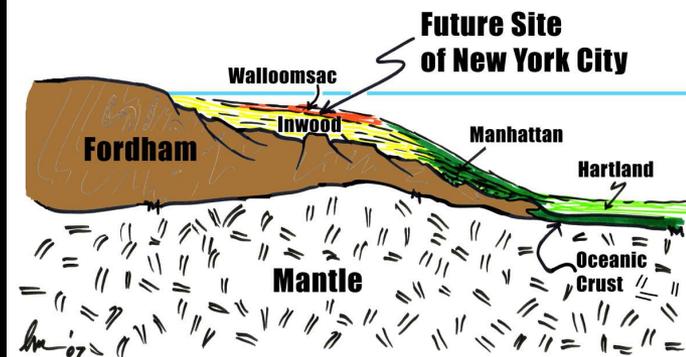
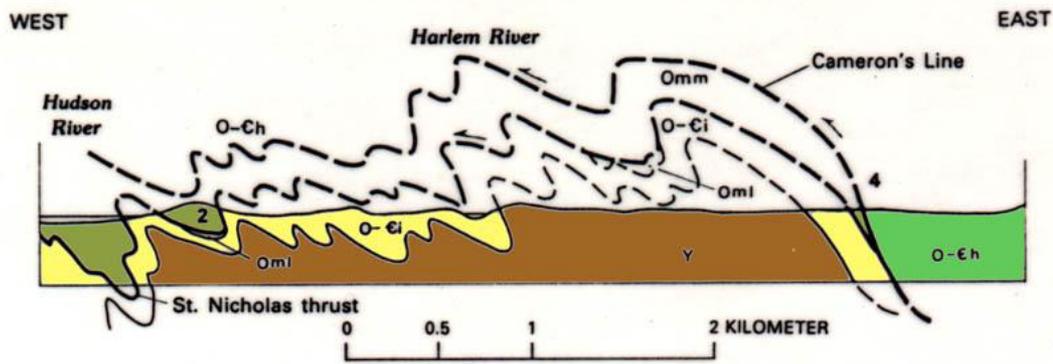
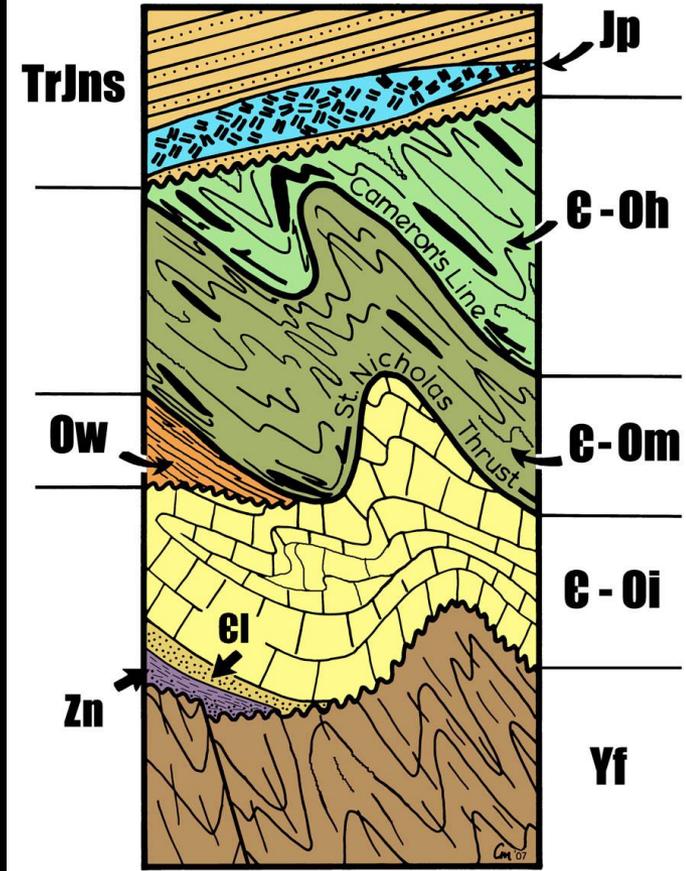
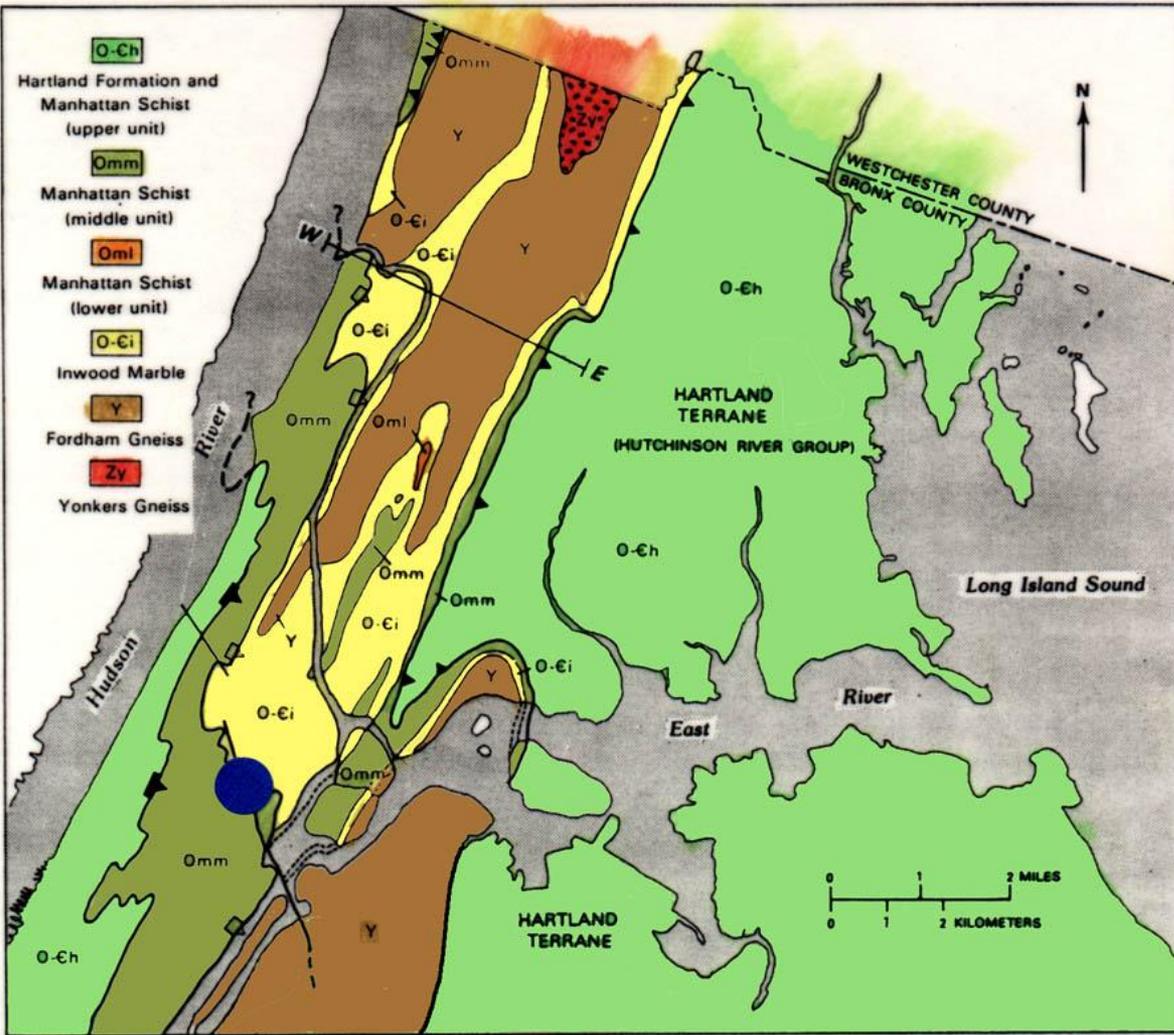
**Bennington and Merguerian (2004)**

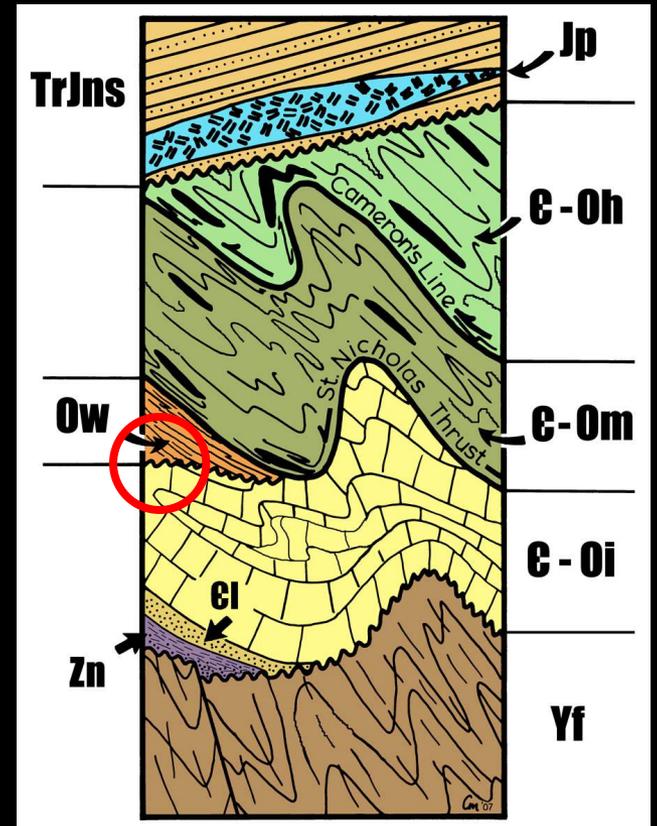


# ~ 480 Ma Taconian Arc – Passive Margin Collision

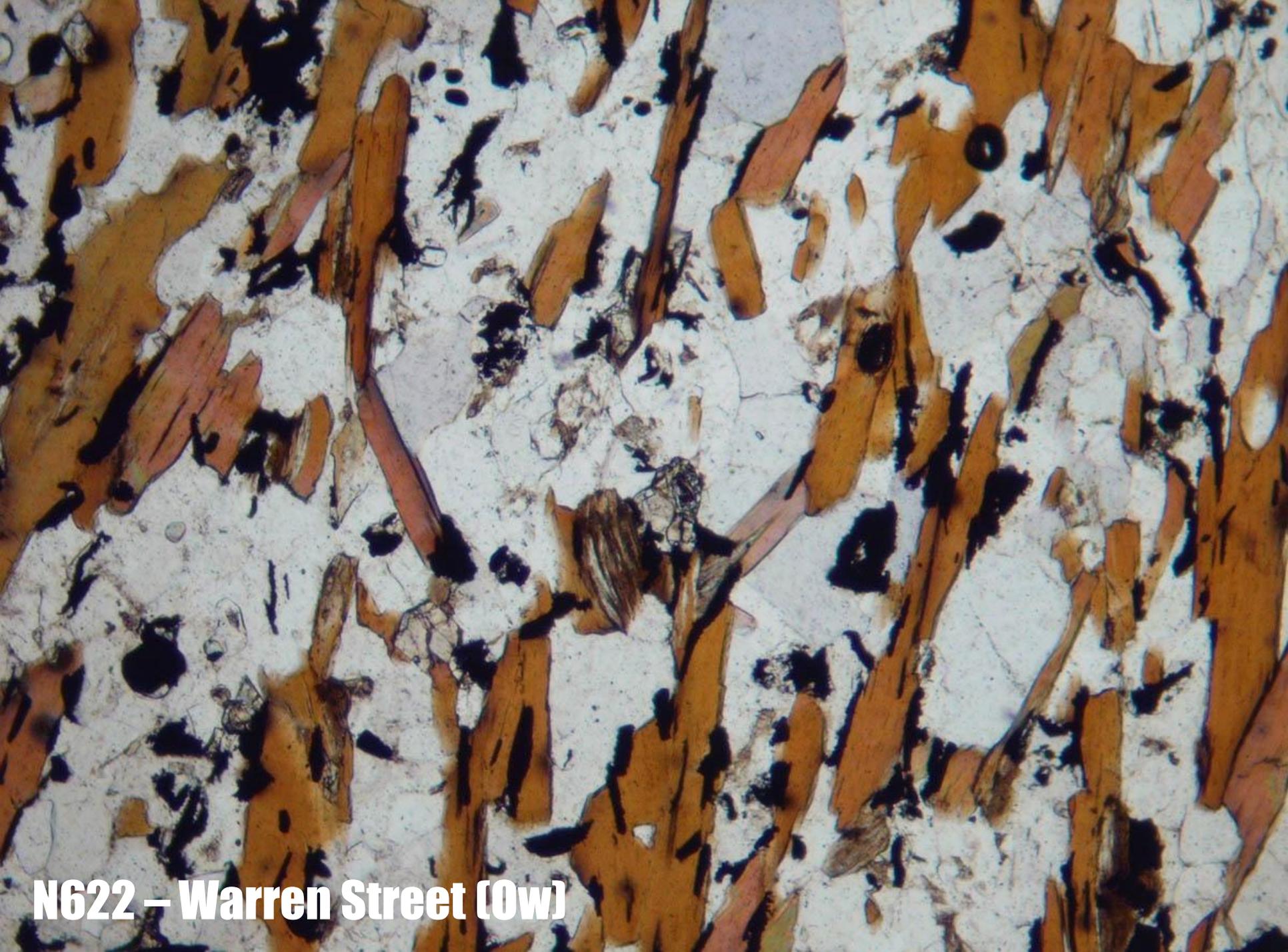


# New York City

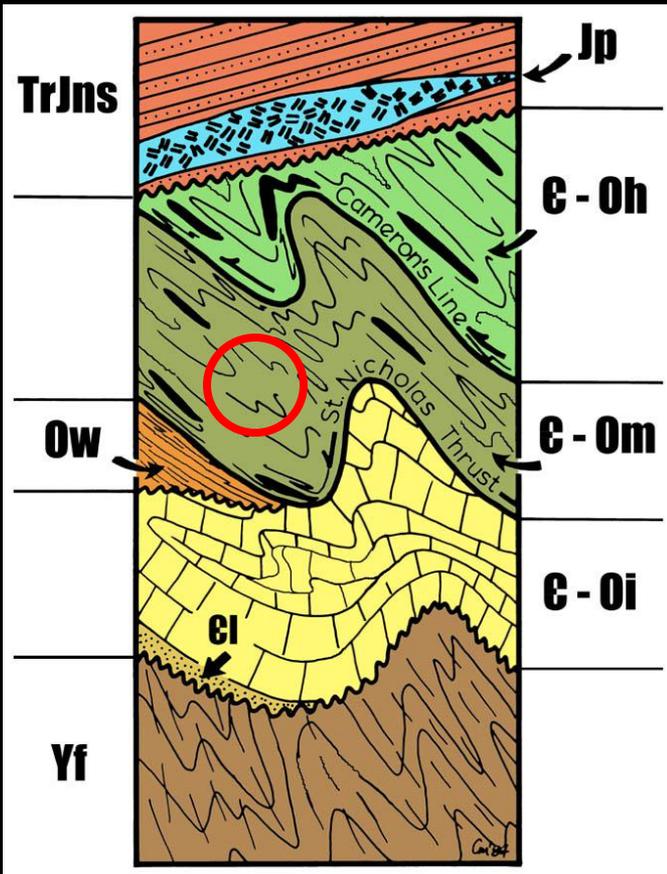




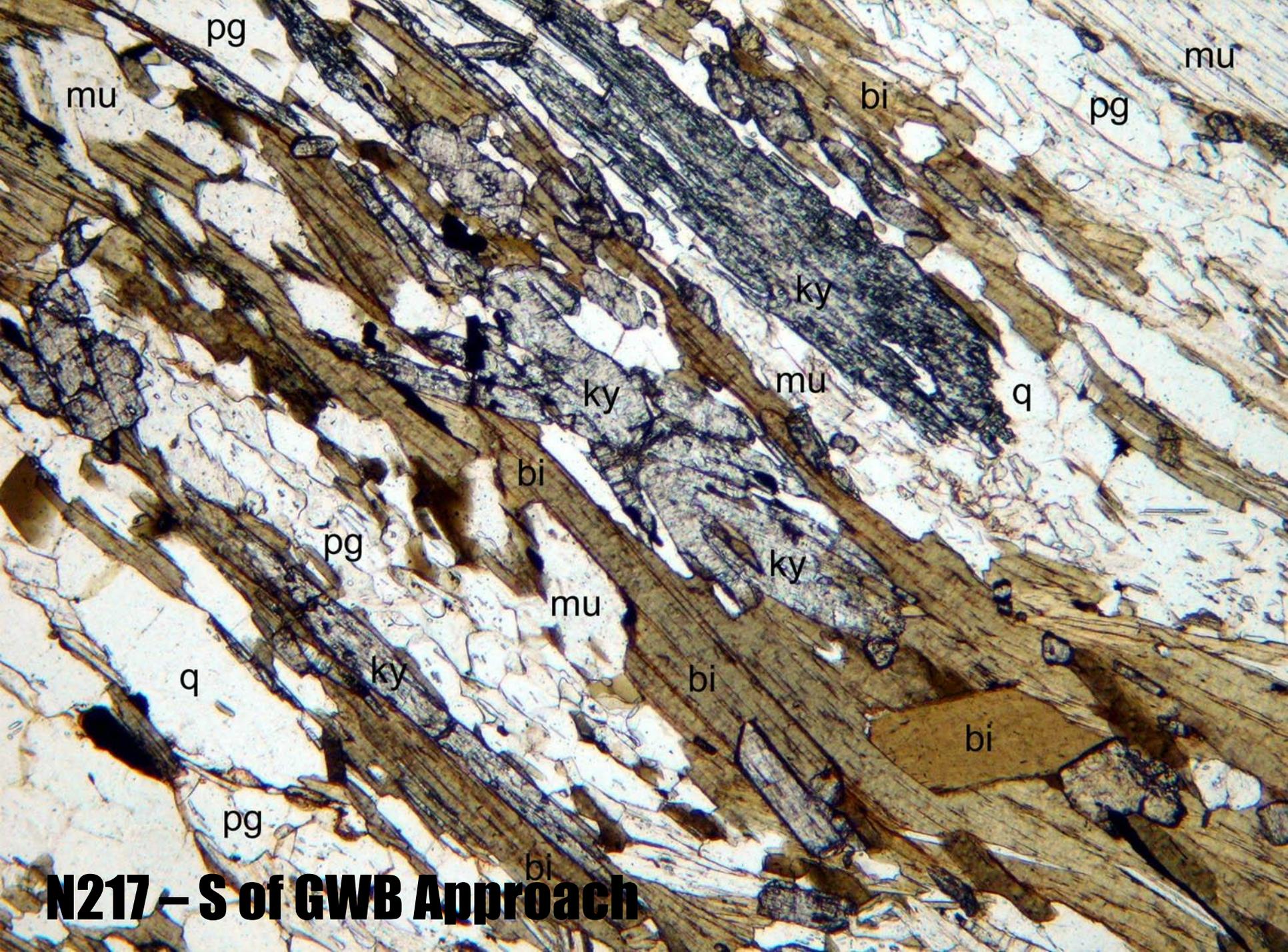
Walloomsac "Balmville" Contact, Grand Concourse, Bronx, NY



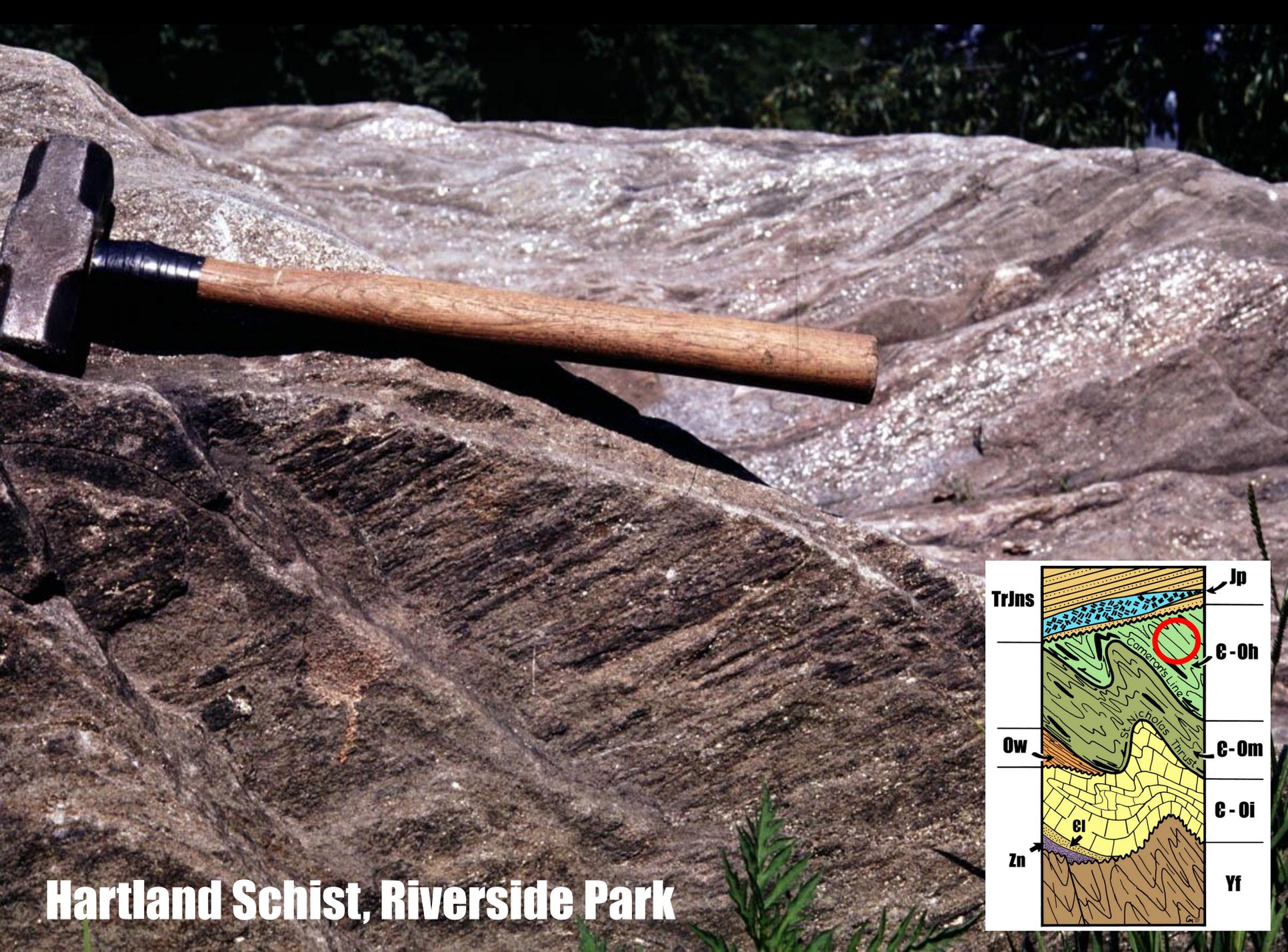
**N622 – Warren Street (Ow)**



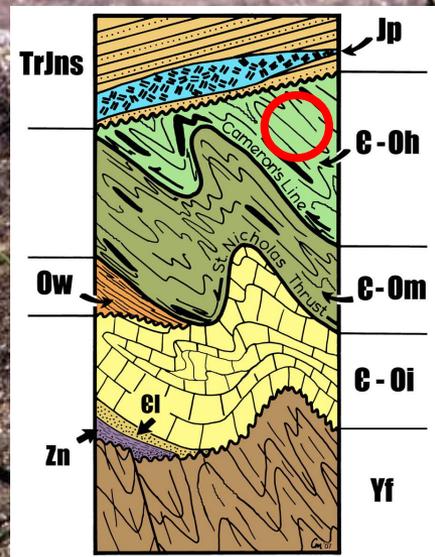
**Manhattan Schist**  
**F<sub>3</sub> Folds of S<sub>2</sub>**  
**Central Park, NYC**

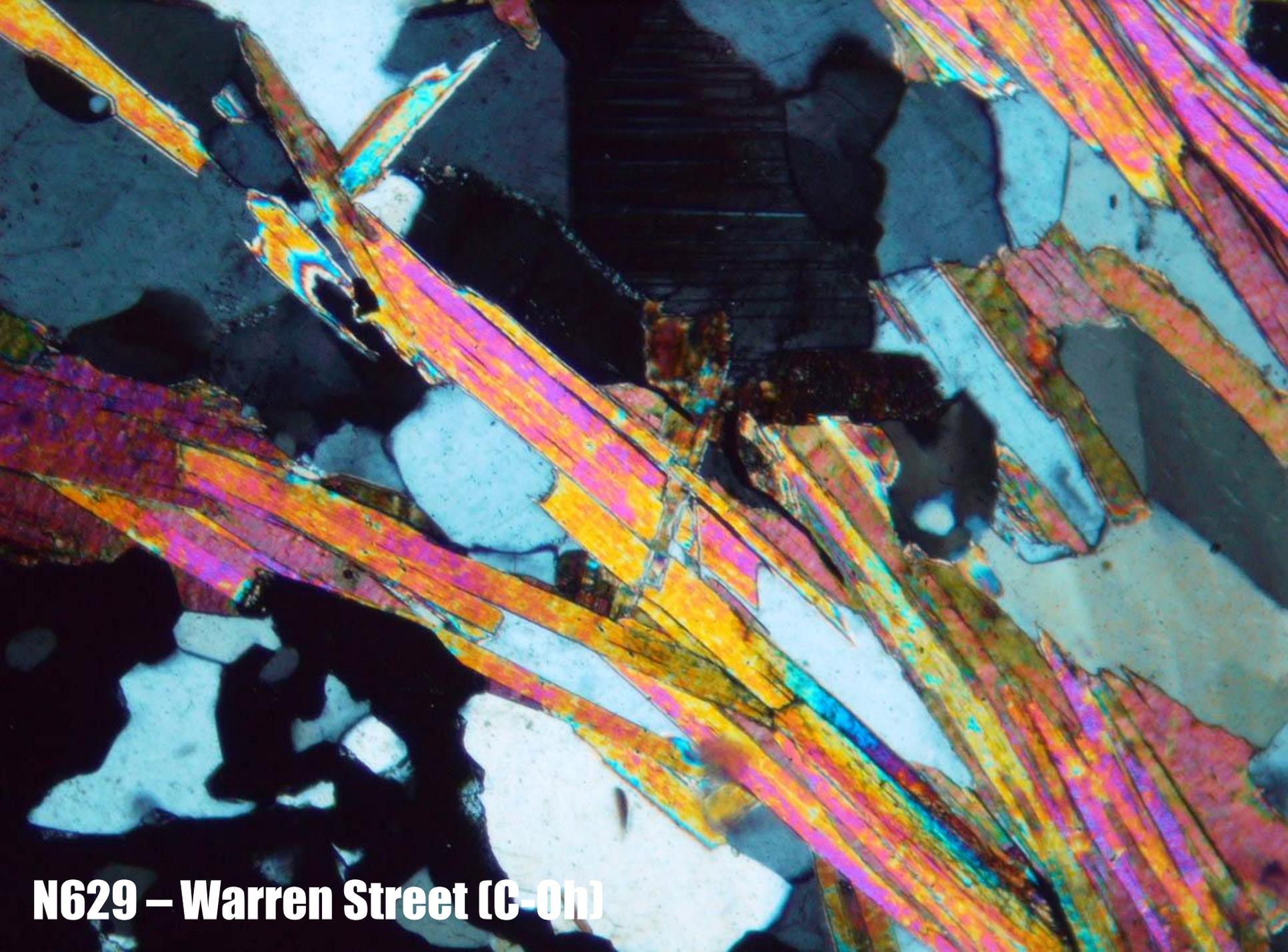


**N217 – S of GWB Approach**

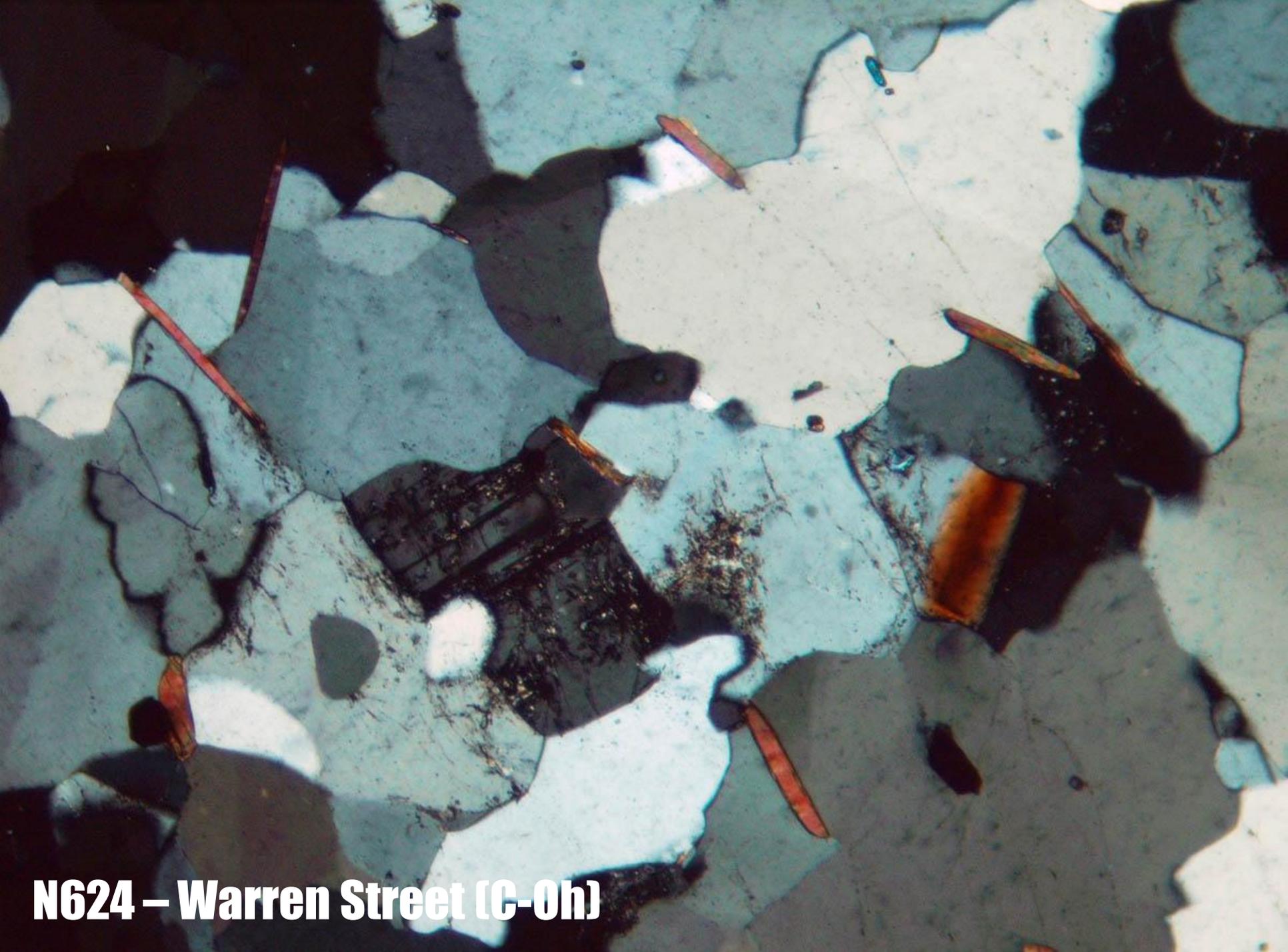


**Hartland Schist, Riverside Park**

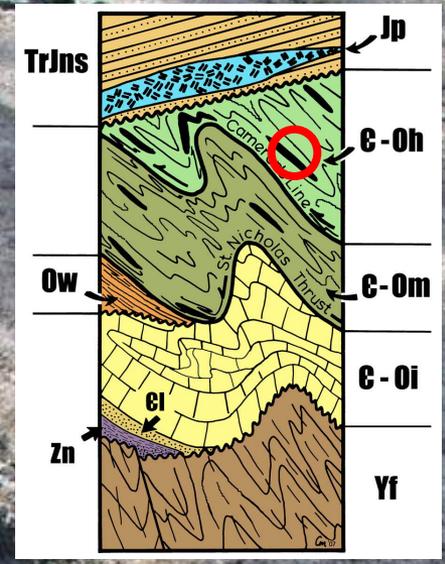
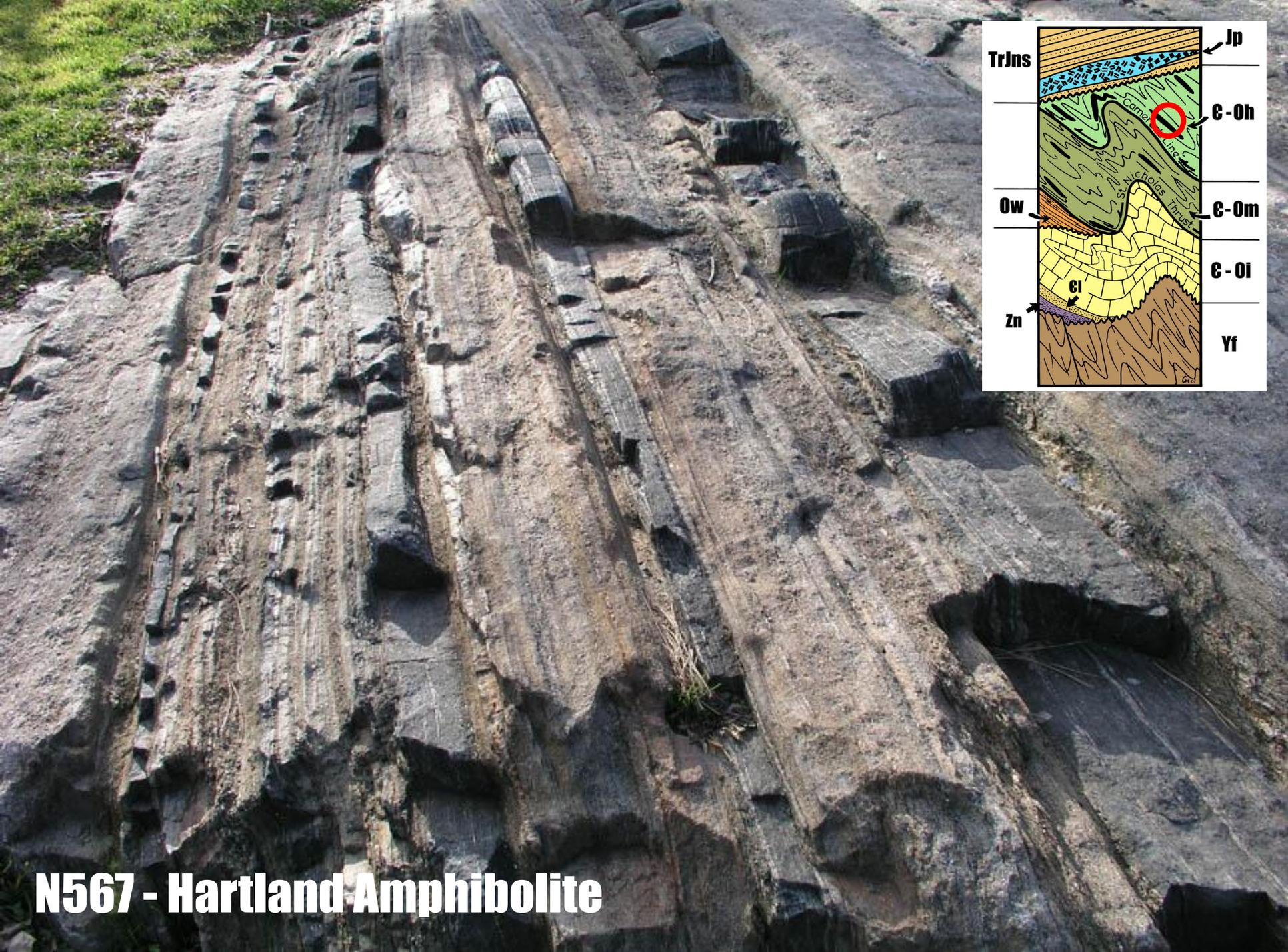




**N629 – Warren Street (C-0h)**

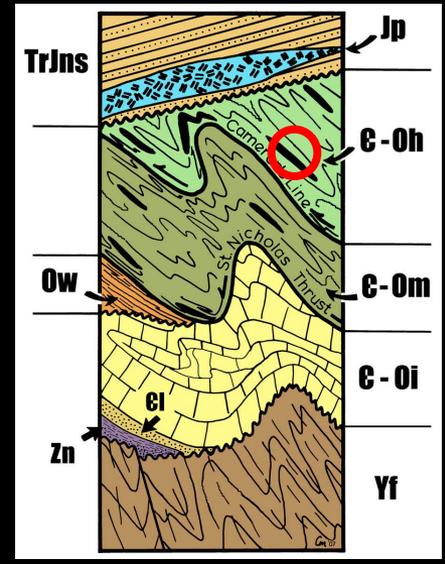


**N624 – Warren Street (C-Oh)**



**N567 - Hartland Amphibolite**

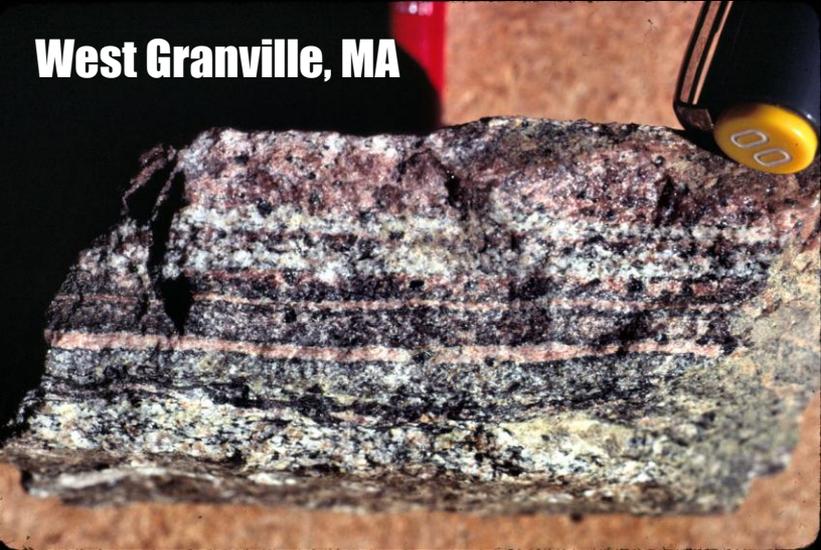
New Hartford, CT



New Hartford, CT

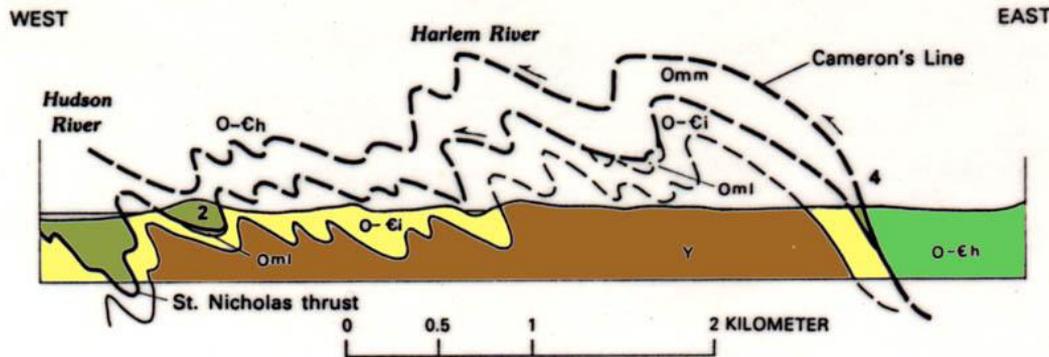
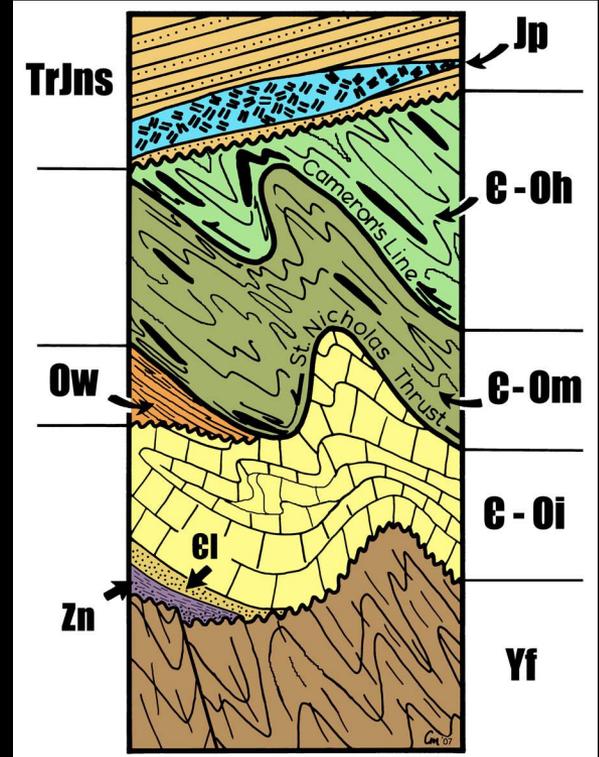
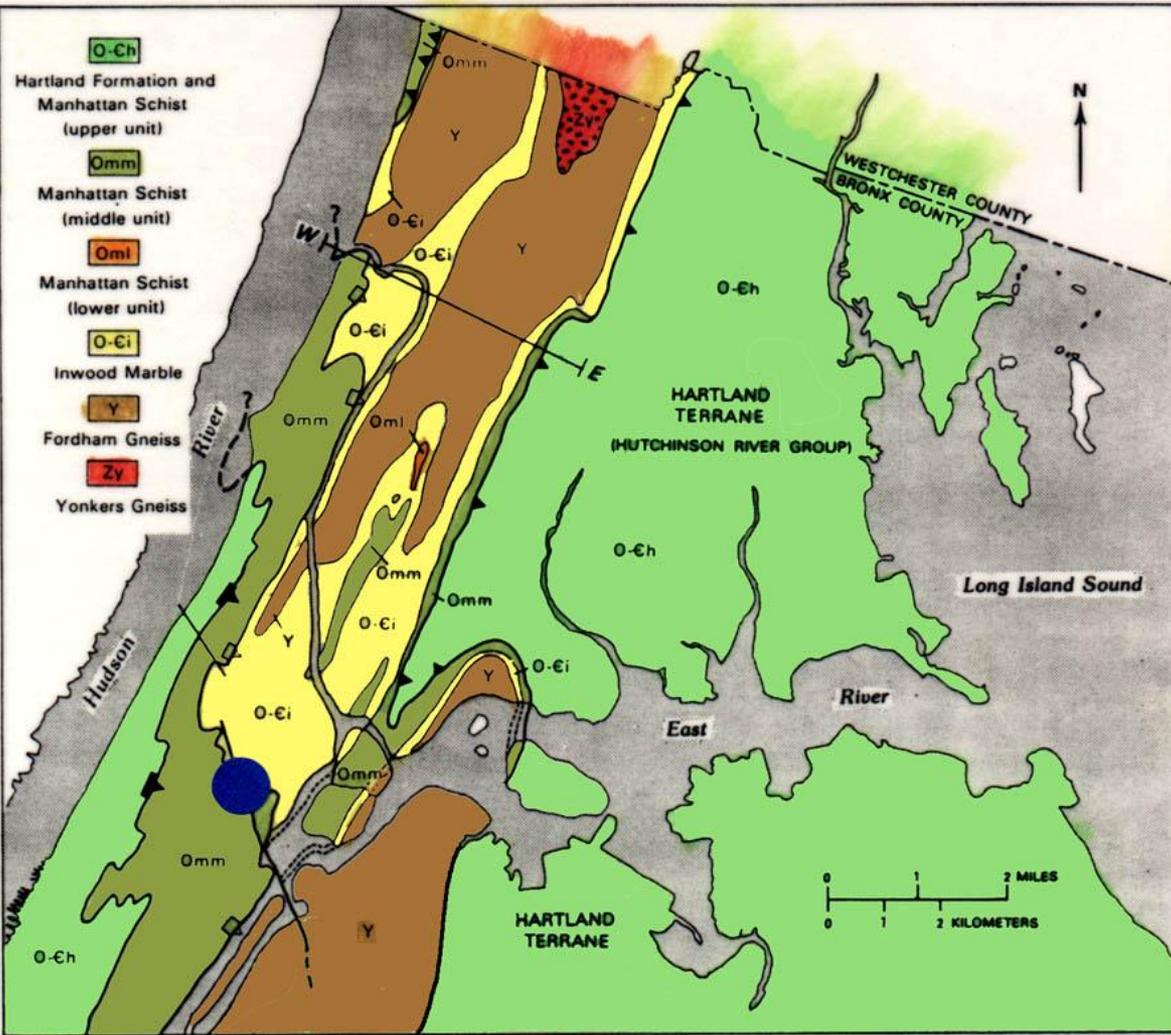


West Granville, MA



Hartland Coticule

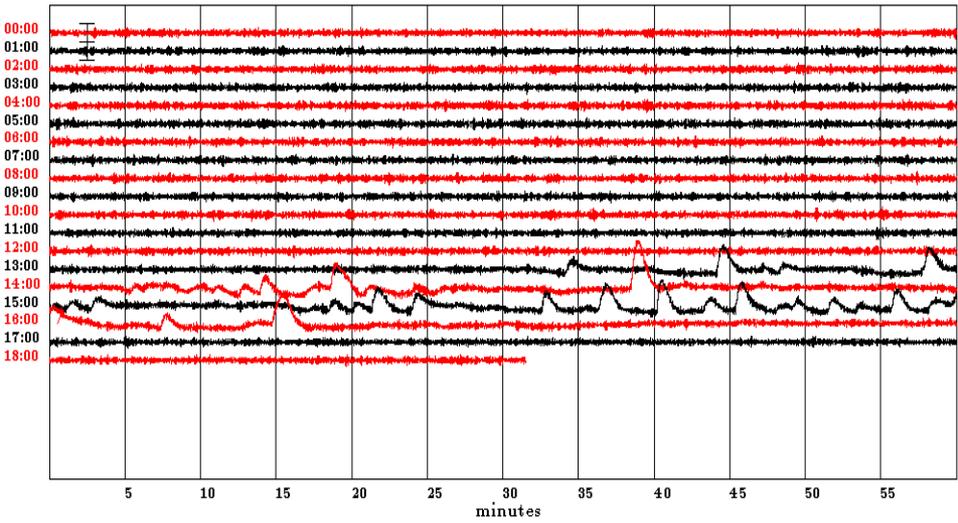
# New York City



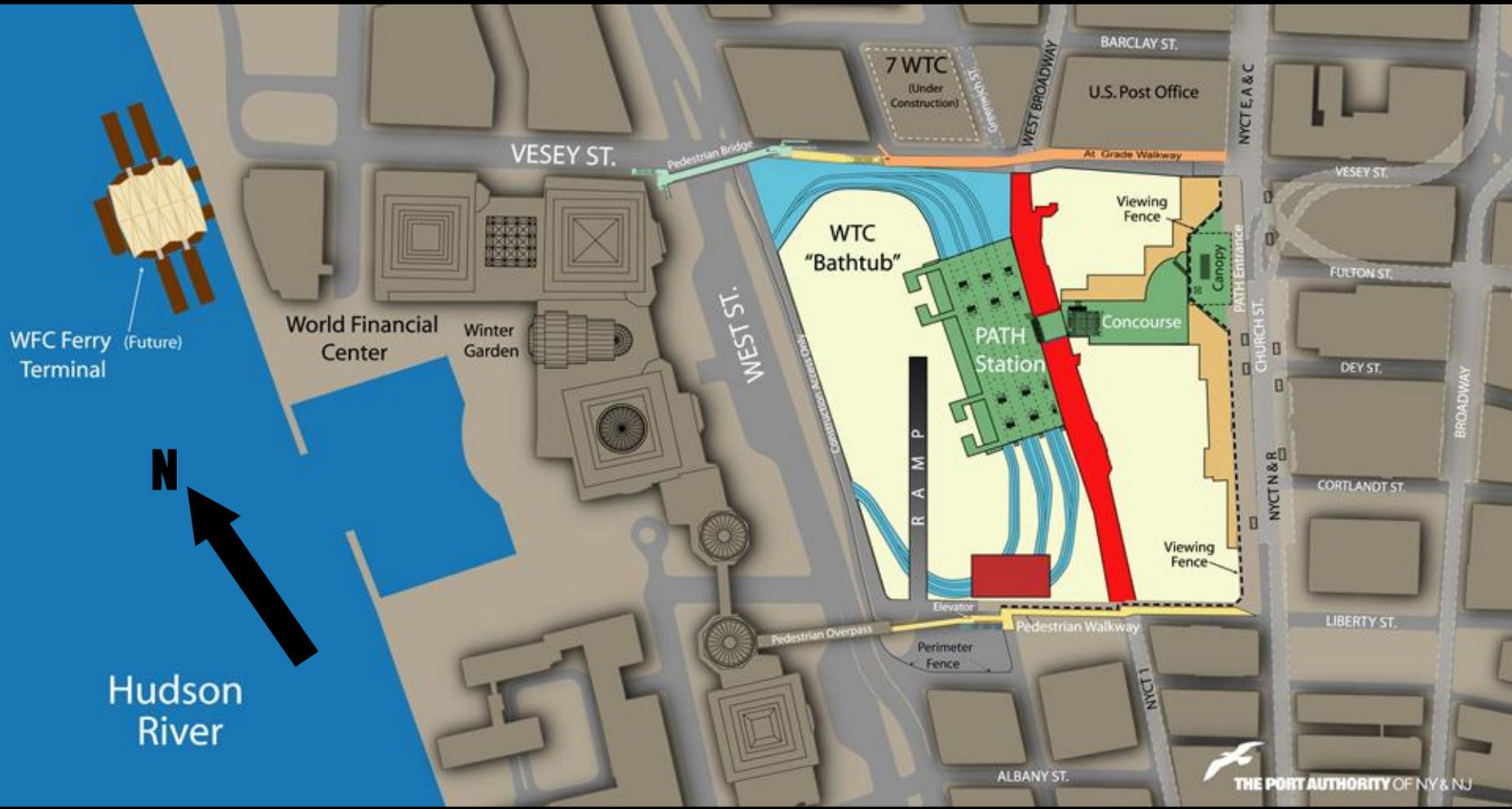
**Merguerian and Merguerian, 2004**



GMT 2 micrometer/s Station PAL, channel BHZ - Nov 1, 2001 gain 0.03 non-filtered



# The World Trade Center Site



NW WTC

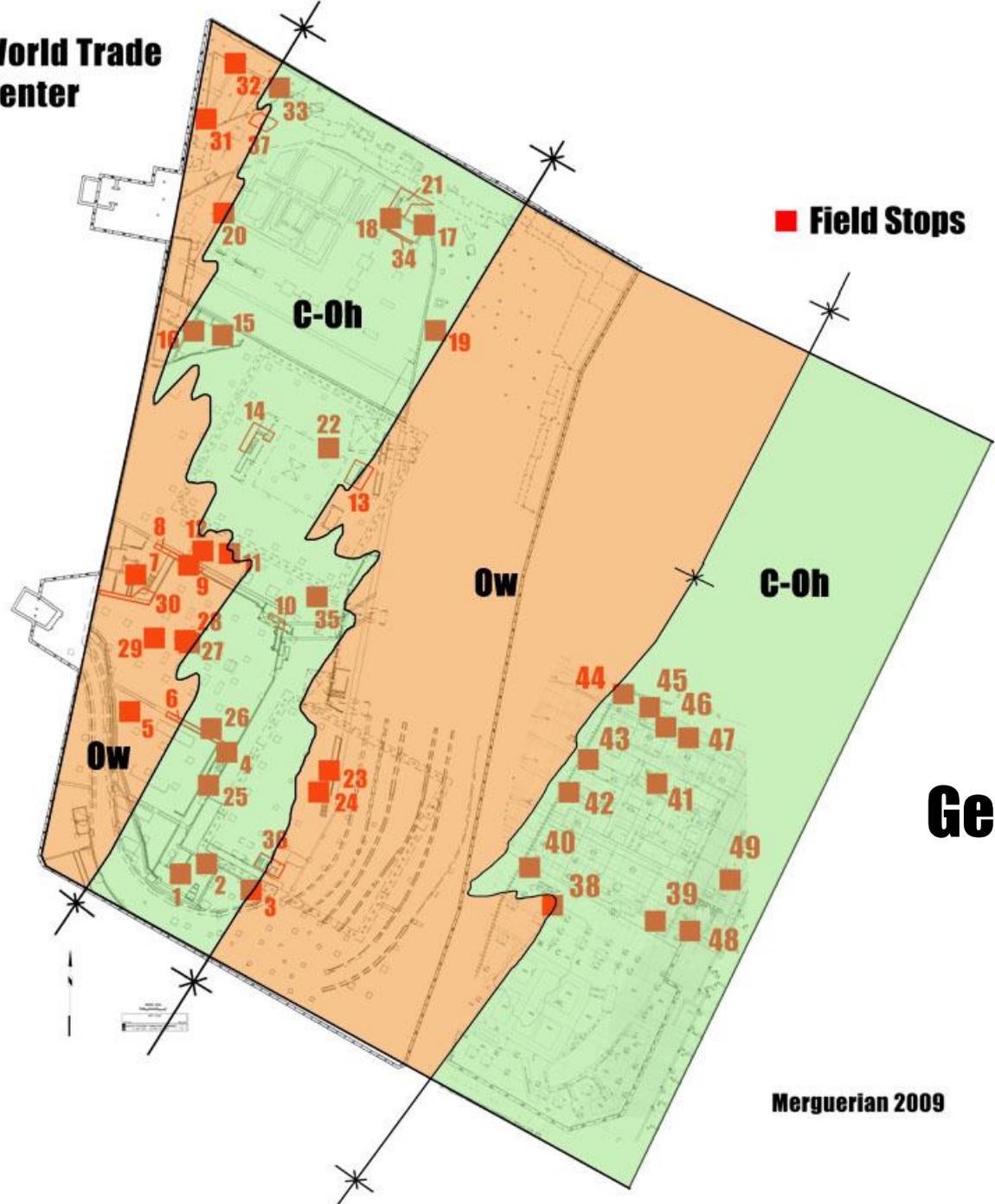


2004

# World Trade Center



**World Trade Center**



**Field Stops**

# Preliminary Geological Map WTC

Merguerian 2009

Stop 6



C-0h

Hartland Schist and Granofels

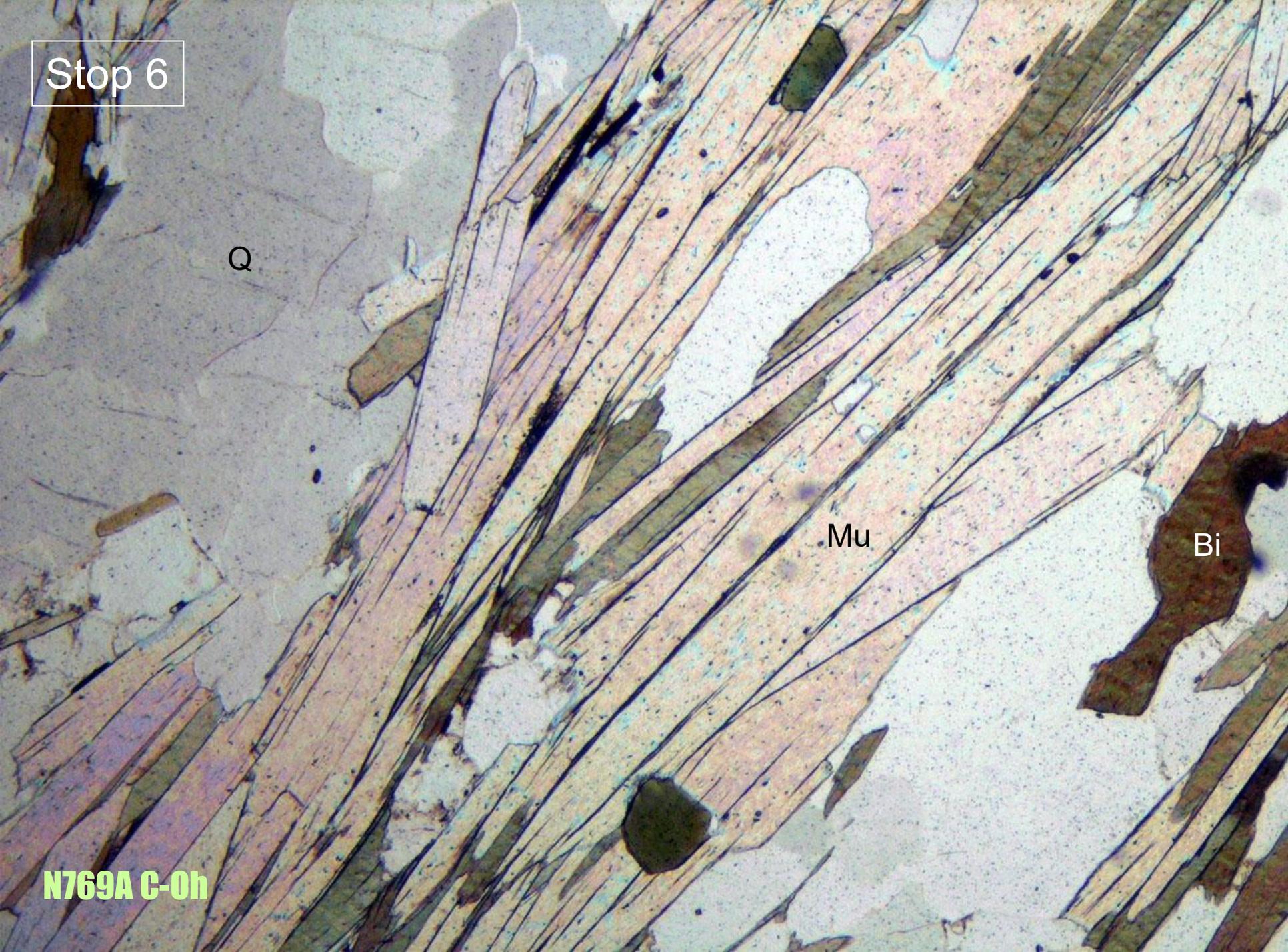
Stop 6

Q

Mu

Bi

N769A C-0h

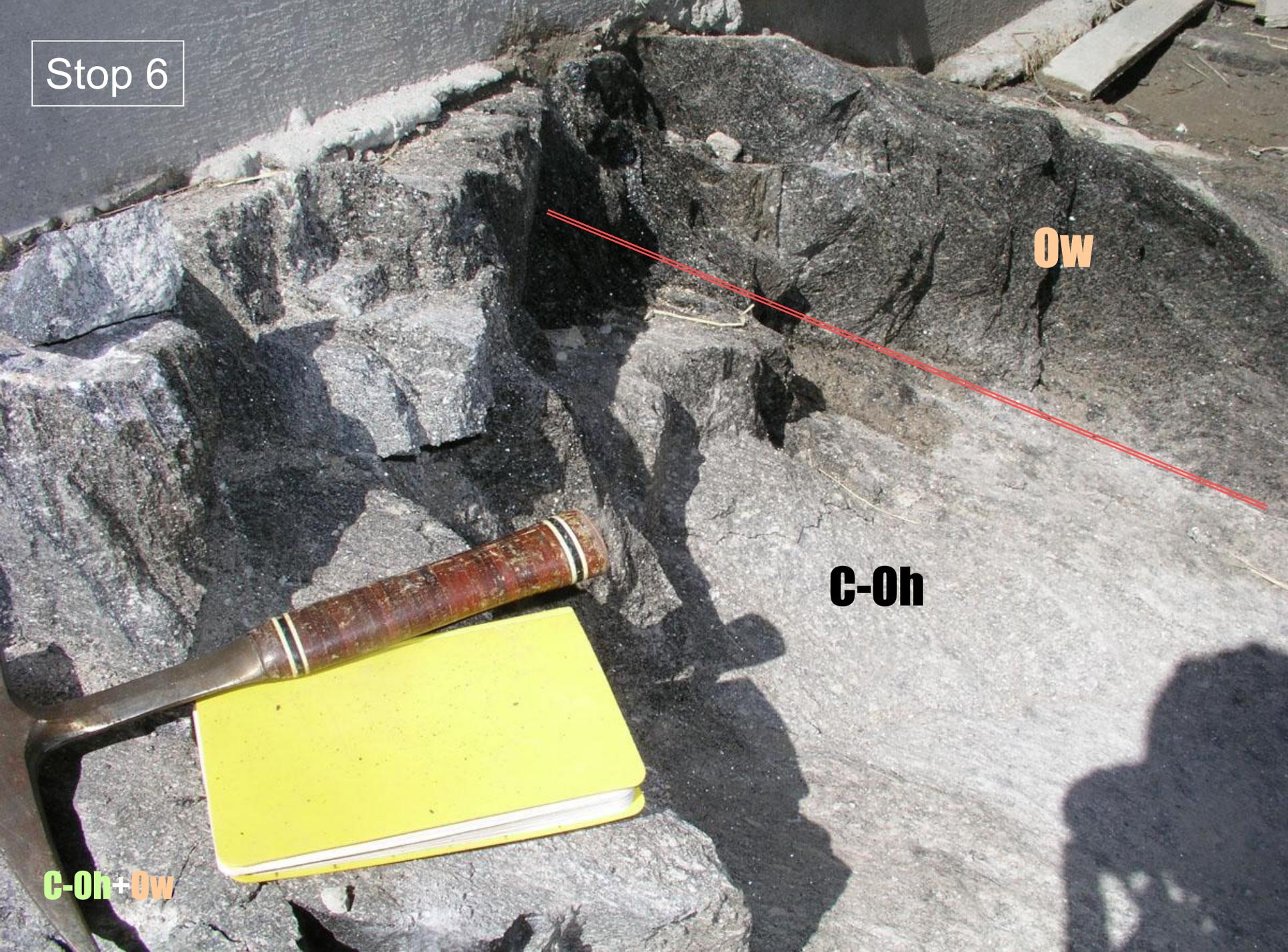


Stop 6

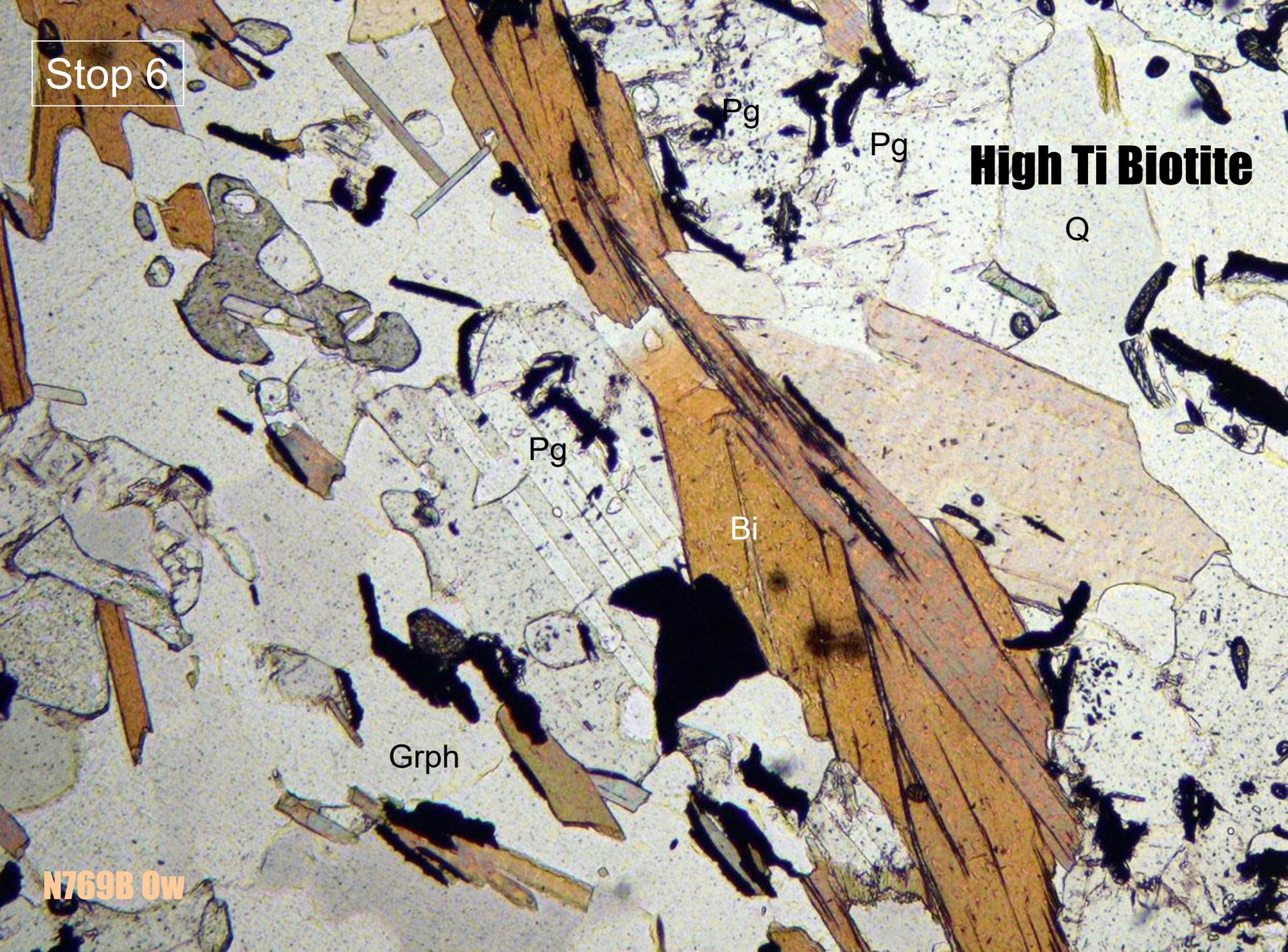
Ow

C-Oh

C-Oh+Ow



Stop 6



Pg

Pg

**High Ti Biotite**

Q

Pg

Bi

Grph

N769B 0w

Stop 13



C-0h

Schist



Scale = 22.2' Giant Hamster

Stop 13

Gt

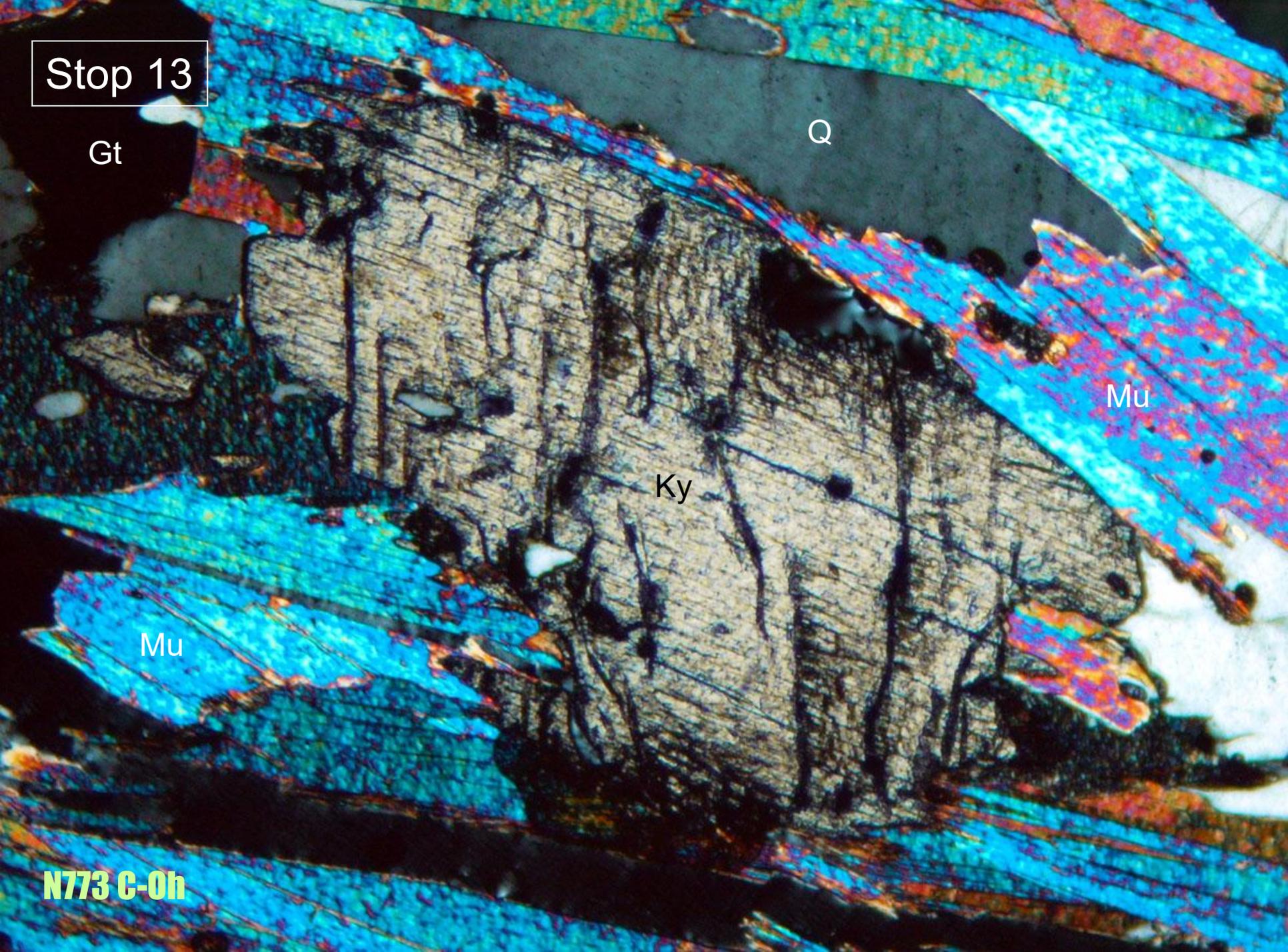
Q

Mu

Ky

Mu

N773 C-0h



MR-4014; Run 1C

Bi

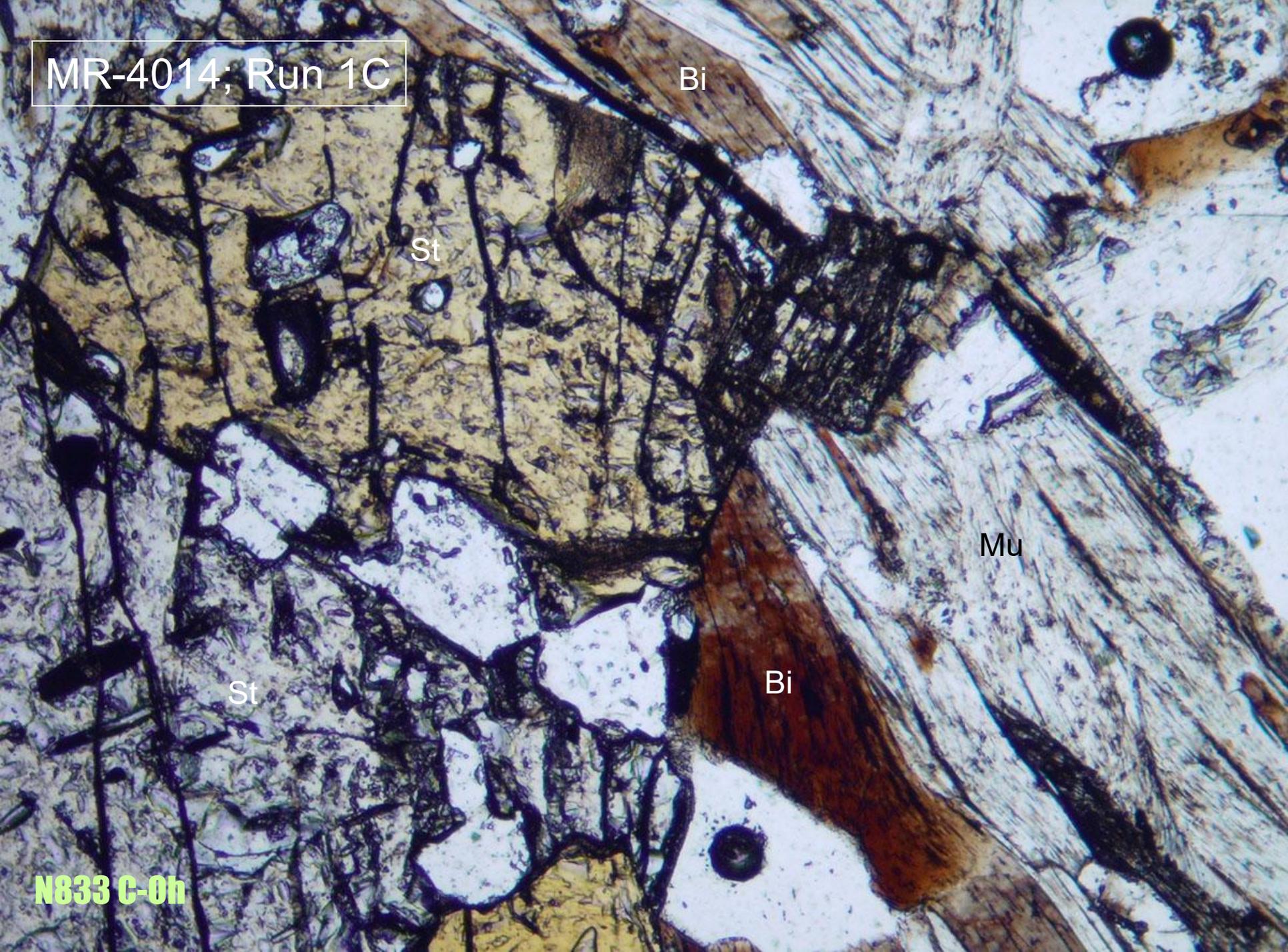
St

Mu

St

Bi

N833 C-0h

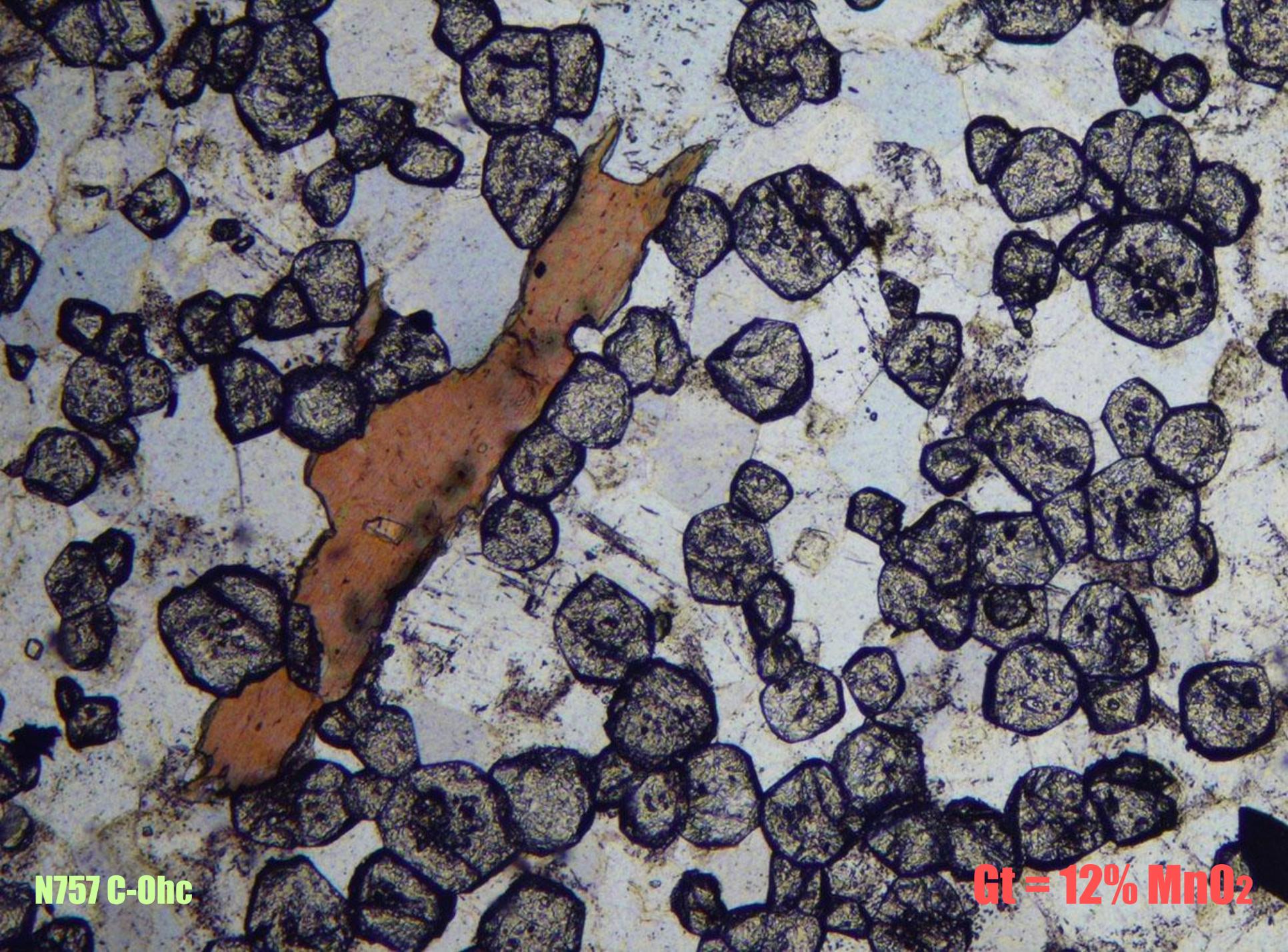


# Hartland Coticule



C-0hc





N757 C-0hc

Gt = 12% MnO<sub>2</sub>

Near Stop 13

**Sub-vertical F<sub>3</sub> Folds  
with Steep, NE-trending  
Axial Surfaces in  
Walloomsac Schist  
and Calc-Silicate Unit**



**Boring M-1009**

**0w+0wc**



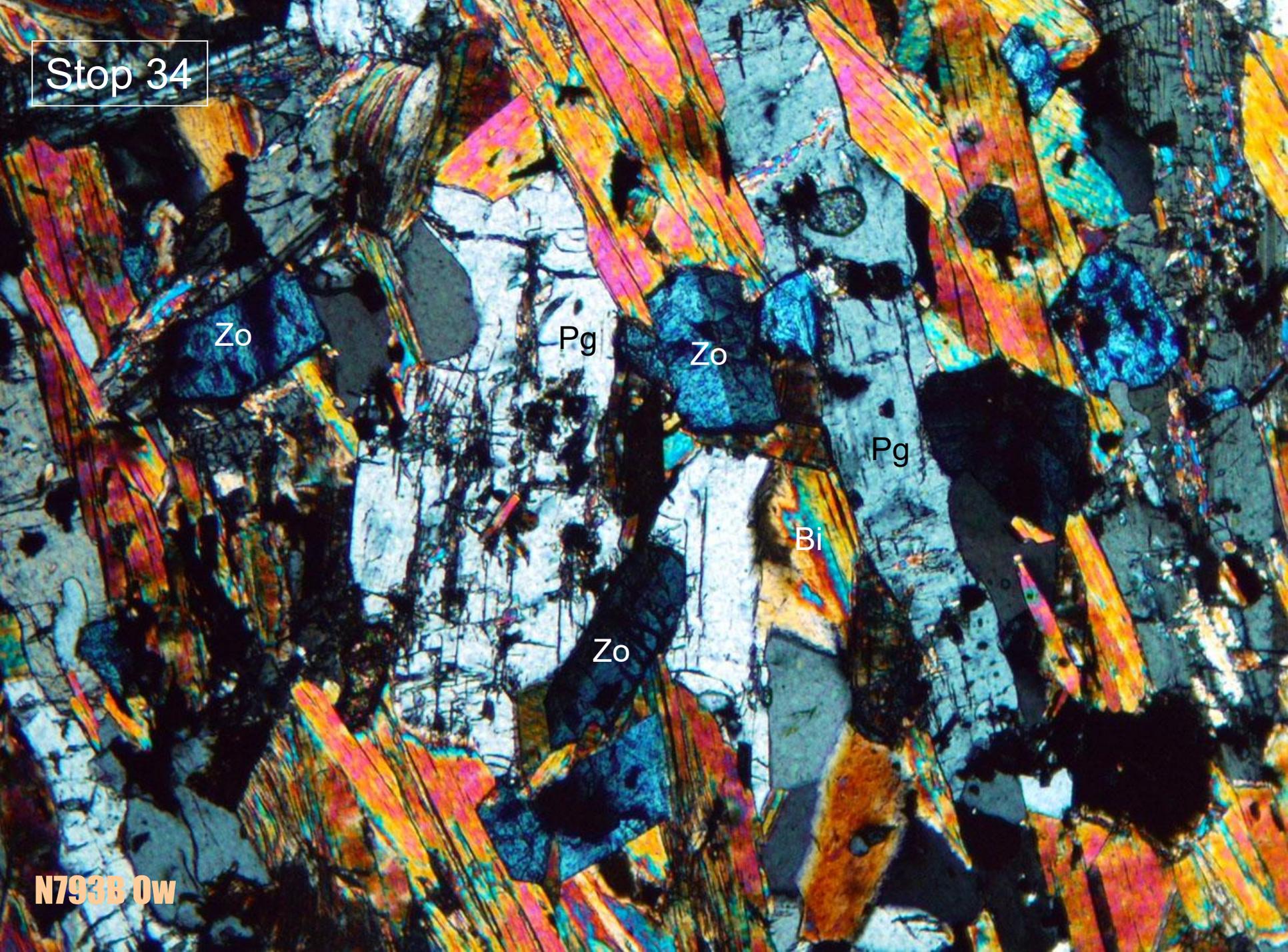
**Image by C. Moss**

Stop 34



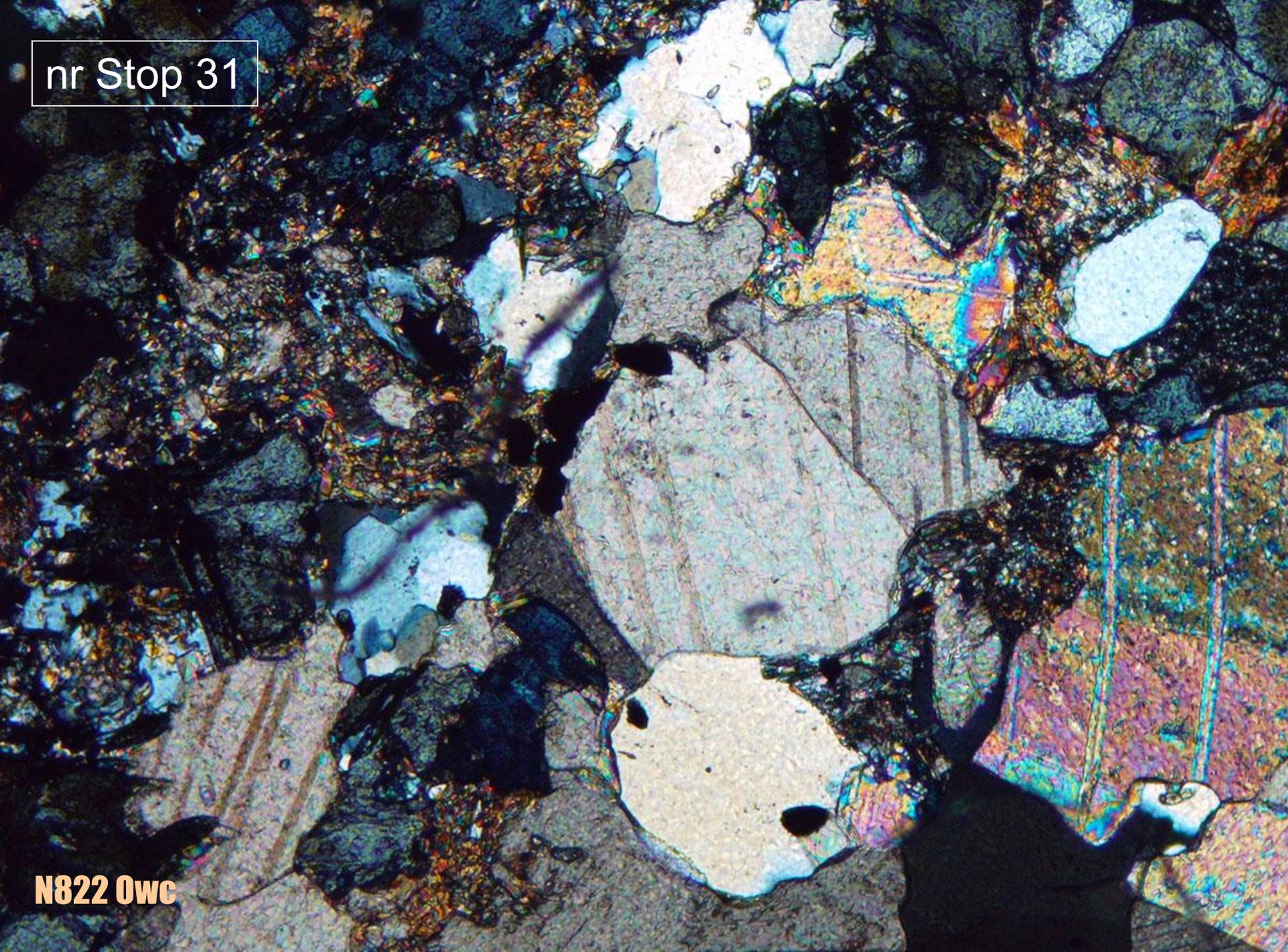
Owc

Stop 34



N793B 0w

nr Stop 31



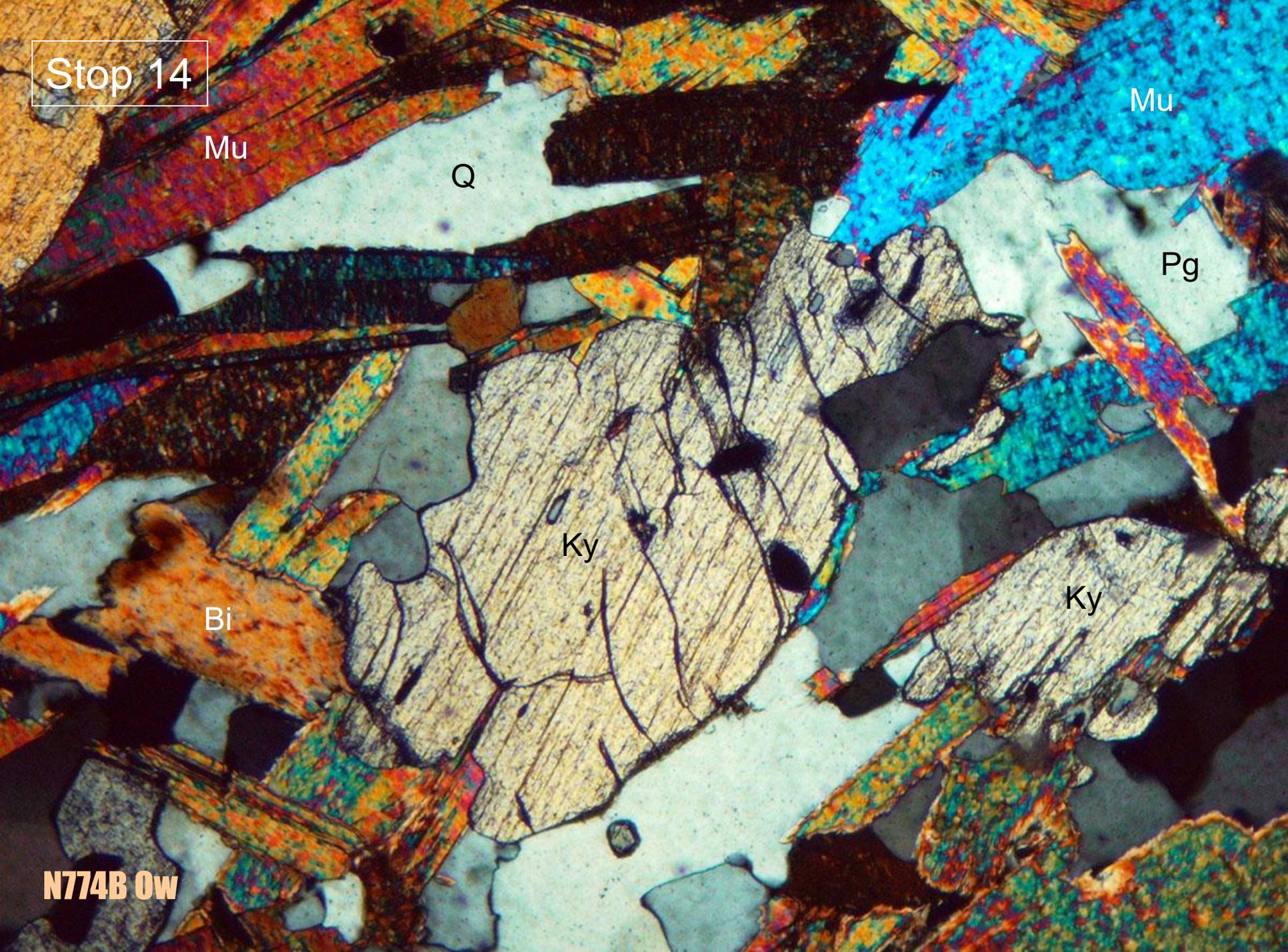
N822 0wc

Stop 14



0w

Stop 14



Mu

Q

Mu

Pg

Ky

Bi

Ky

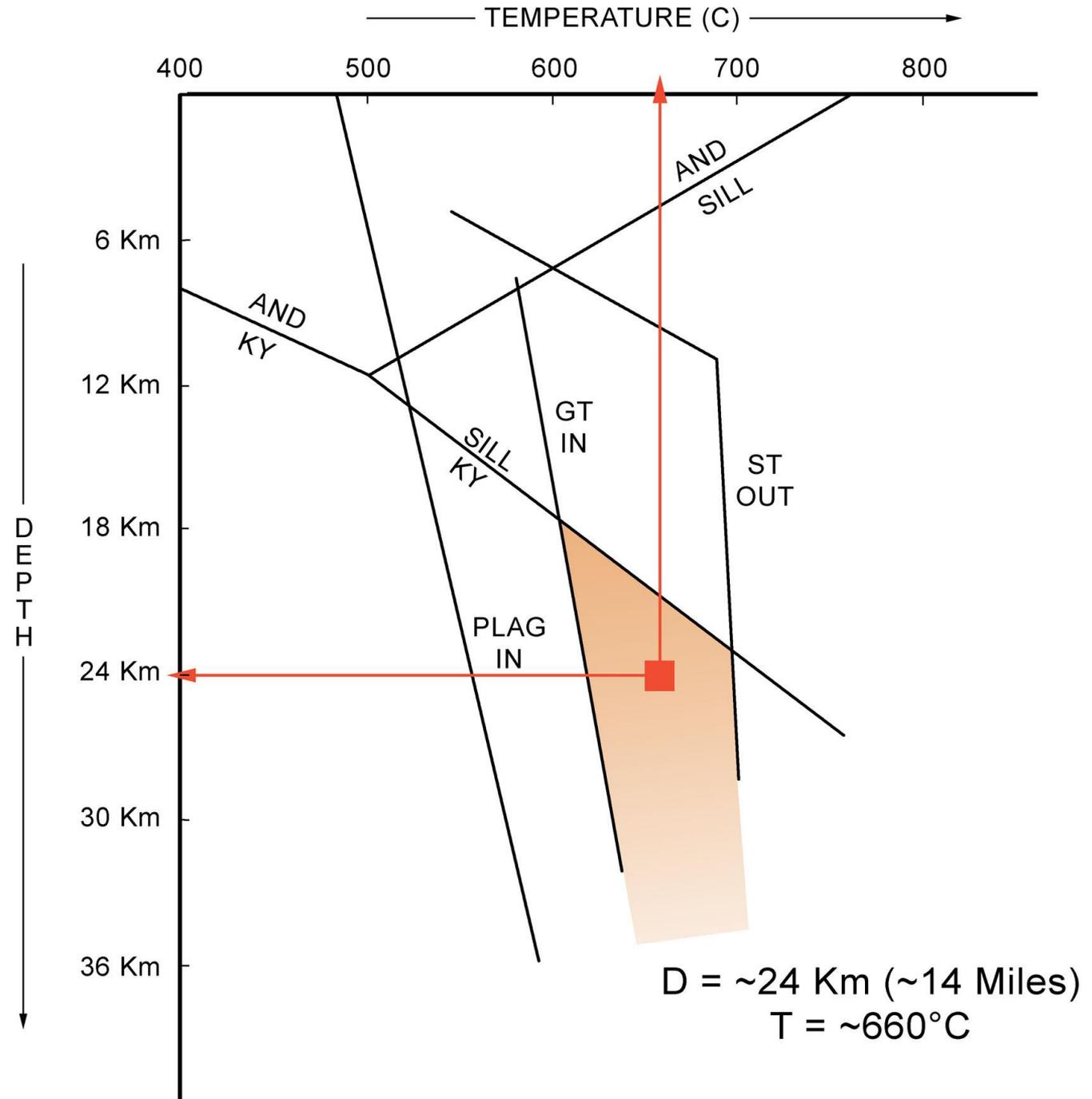
N774B 0w

Stop 44

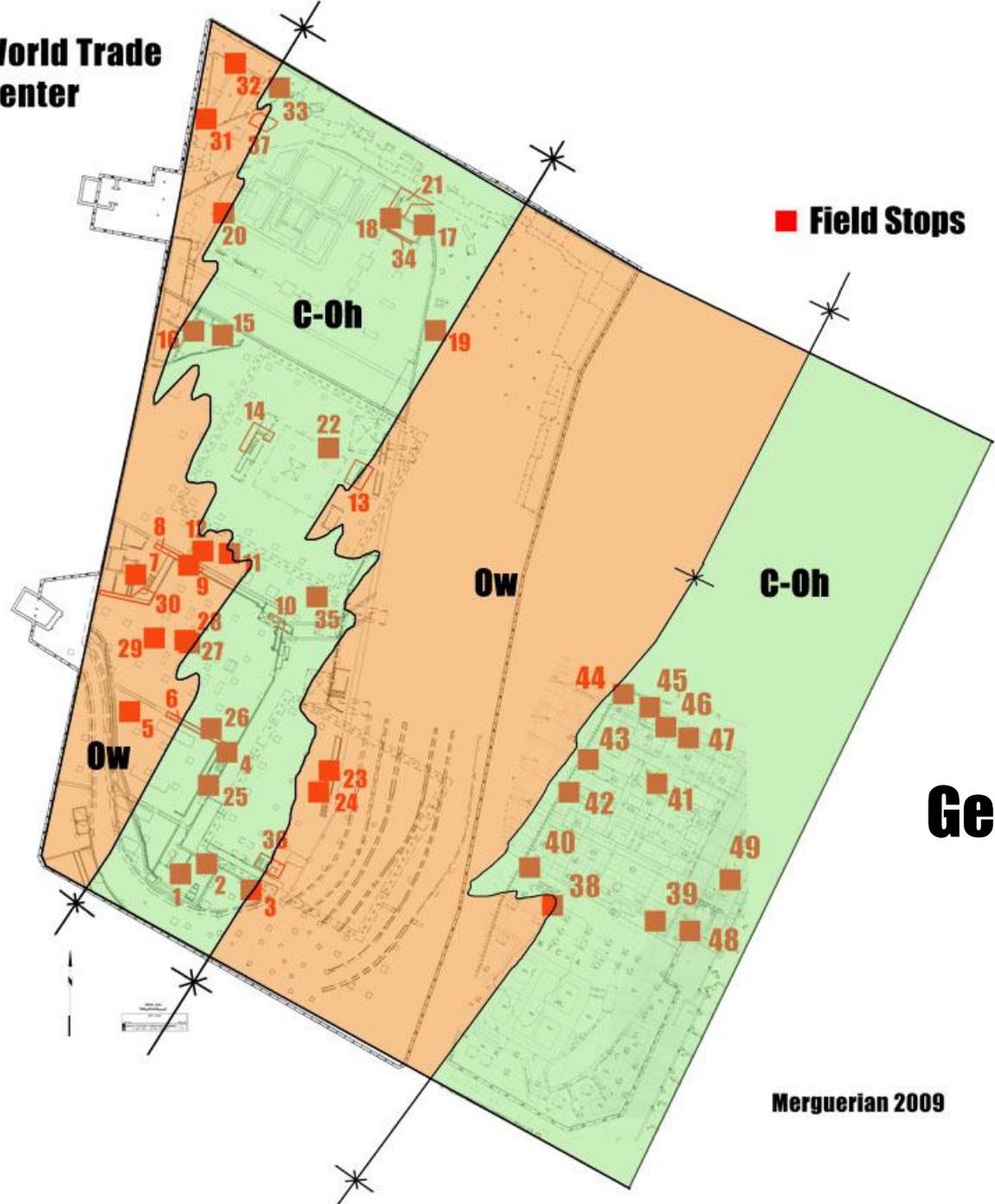


# Re-equilibrated WTC Mineral Assemblage

Plagioclase  
Garnet  
Staurolite  
Kyanite



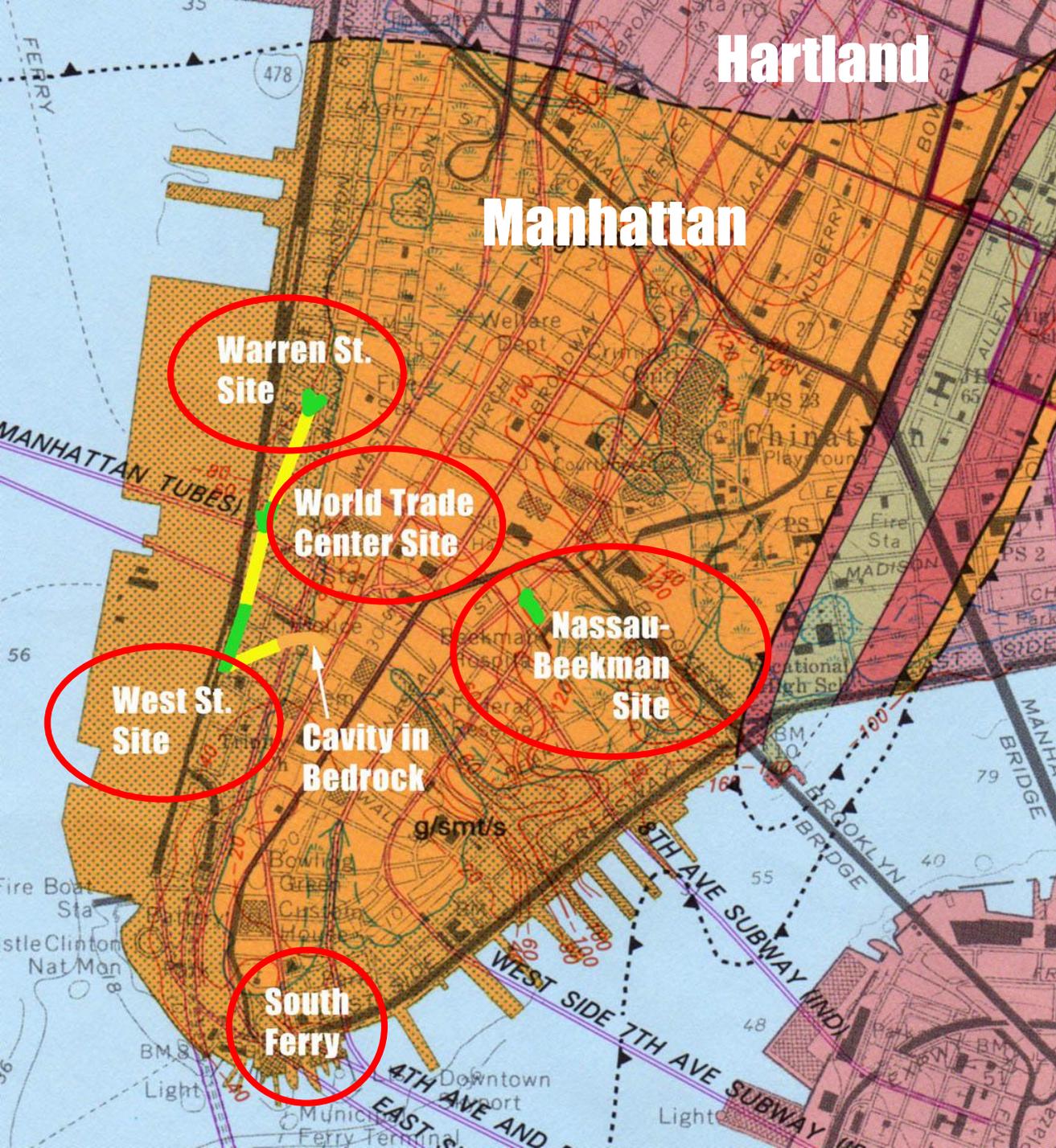
**World Trade Center**



**Field Stops**

# Preliminary Geological Map WTC

Merguerian 2009



**Hartland**

**Manhattan**

**Warren St. Site**

**World Trade Center Site**

**Nassau-Beekman Site**

**West St. Site**

**Cavity in Bedrock**

**South Ferry**

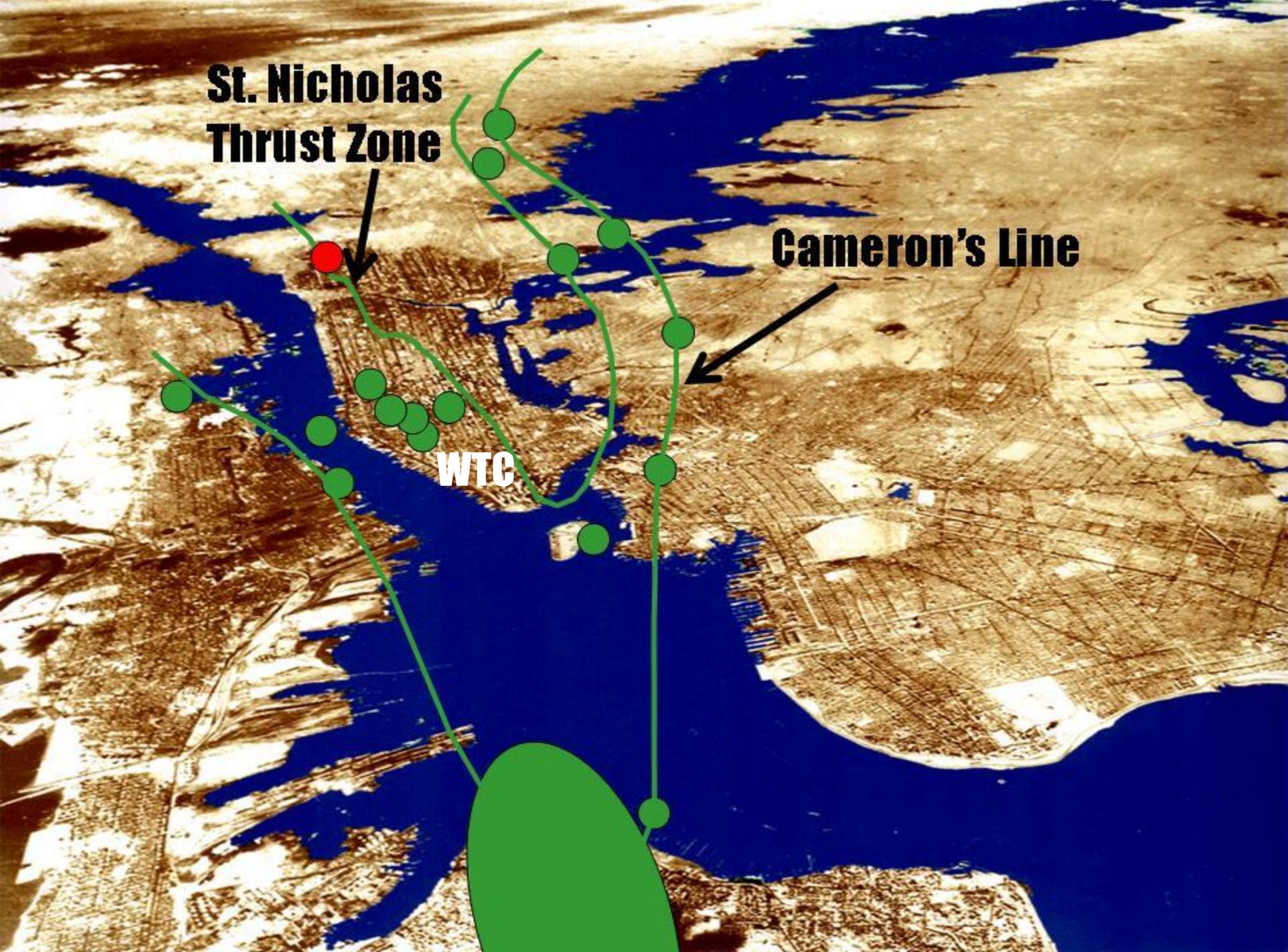
**Five Localities  
South of  
Canal Street  
Display  
Sheared  
Manhattan,  
Hartland, and  
Walloomsac  
Rocks!**

**after Baskerville 1994,  
Merguerian and Moss 2007**

**St. Nicholas Thrust Zone**

**Cameron's Line**

**WTC**



**Thanks For Attending!**

