

Abstract:

This trip to the Inwood region enables one to observe the lower sequence of Manhattan Prong, which consists mainly of Inwood Marble. It formed approximately 550 million year ago, during the Paleozoic. It formed from the metamorphosing of shallow water marine carbonate and clastic sediment. Currently, Inwood Marble consists of dolomitic and calcitic marble. It underlies the Inwood section of northern Manhattan, where Inwood Hill Park and Isham Park is located. This region also allows one to observe the variable texture of Inwood Marble, with silicates, and boudines of quartzite. The Manhattan Schist is another important outcrop present in the Inwood region. Here, it exhibits the high intensity metamorphism with garnet porphyroblasts as well as migmatic facies and thick amphibolite levels.

Keywords: Manhattan Prong, Inwood Marble, Manhattan Schist, Hudson River, Harlem River, Metamorphic Rocks, Paleozoic

Introduction:

Inwood Hill Park and the Isham Parks are located in the northern most region of Manhattan, surrounded by the Hudson and Harlem River. Both parks are within close proximity of one another. The marble contained in this region marks the lowlands and schist exhibits steep slopes and higher elevations.

Before becoming a New York City Park in 1916, Inwood Hill Park was known during the Colonial and post-Revolutionary War period as Cock or Cox Hill. The Isham Park, however was named after a successful leather merchant and banker, named William Bradley Isham, who donated this park to New York City in May 1911. This neighborhood is not only known for its outcropping of marble, schist, and amphibolite, but it is also home to the United States national bird, the bald head eagle. In addition, these parks provide a great place to go hiking.

Observation:

- Day, hour: Friday April 1st 2016, 5pm-6:30pm
- Weather: Partly Cloudy, mid-70s
- Stops in areas: Isham Park, Inwood Park (various points in eastern portion of park)

Directions:

Inwood Hill Park is easily accessed by public transportation:

By Subway: Take the 1 train to 215th street and walk north to 218th. Take a left and walk to the end of 218th street. Alternatively, you can take the A train to 207th street, walk west onto Seaman Ave, then walk north into the park.

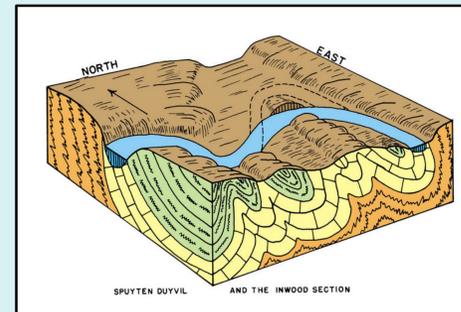
By Bus: take Bx7, Bx12, Bx20 or M100 to 207th street and follow the same walking directions as from the A train 207th Street stop.

Geology of Inwood Hill Park and Isham Park

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Objective:

To observe the geologic bedrock of the Inwood region.



Block diagram illustrating the structural geology of Inwood and Isham parks, which primarily consists of Manhattan Schist (green) underlain with Inwood Marble (yellow) and old non outcropping bedrock which is Proterozoic Fordham Gneiss (orange)

Geological History:

The two major formations found in Inwood Park are Manhattan Schist and Inwood Marble. Both formations are part of a greater formation of metamorphic rocks known as the Manhattan Prong. The Inwood Marble underlies the Manhattan Schist and so is older, however both were originally down as sedimentary rock approximately 500 mya in Paleozoic Era. Both layers were then heavily metamorphosed and folded during the Taconic Orogeny as a volcanic arc collided with the North American Craton. The effects of subsequent Acadian and Alleghanian Orogenies can be seen by the presence of jointing, fracturing and retro morphism. The effects of even more recent geological events can be seen from erosion and weathering of outcrops. The area is generally characterized by higher regions of Manhattan Schist and lower regions of Inwood Marble, owing to the much faster erosion rates of the softer Inwood Marble. Glacial erosion and striation can also be seen in the hard Manhattan Schist, whereas these effects cannot be seen in the Inwood Marble as weathering and erosion has already erased these marks.

14 Large garnet porphyroblasts in Manhattan Schist

15 Micaceous migmatite

16 Foliated Marble

1 Weak areas in Marble more susceptible to chemical weathering forming micro-caves

2 Outcropping of Marble with large crystals

3 Large crystals of tremolite in Inwood Marble

4 Outcropping of Inwood Marble in Isham Park

5 Inwood Marble with boudine of quartzite and schist

6 Boudines probably consist of pyrite indicated by the presence of rust

7 Quartz is harder and therefore more resistant to weathering

9 Amphibolite

8 Amphibolite

7 Manhattan Schist with Quartz Vein

13 Micaceous migmatite

12 Joints in marble circulated by calcite

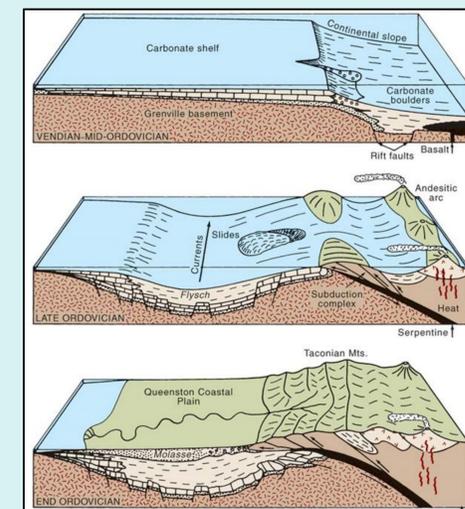
11 Foliated Marble layered with Schist

10 Altered hydrothermal rock (Schist or Amphibolite)

- Contains Pyrite
- Weathering of Pyrite creates sulfuric acid

Conclusion:

- Inwood Park offers a very good outcrop sequence of Inwood marble, Manhattan schist and amphibolite.
- Rocks in this region are from the Early Paleozoic sequence of the Manhattan Prong
- The intensity of metamorphism is medium to high, based on Ca and Mg Silicates in marble, garnets, feldspars, and migmatite in the Manhattan Sequence
- Inwood Park offers great outcrops to observe, for example:
 - Facies, textural and mineralogical aspect of the lower part of Manhattan Formation which appear here in a tilted anticline
 - Retro morphism which appears along joints, faults and fractures of post Taconic orogeny
 - Resistance of the metamorphic rocks against glaciation and weathering shows differences in geomorphology and structural deformations of the rocks
 - Marble metamorphism, texture and composition variation and relation to glacial and recent weathering protection
 - Amphibolite and clean marble do not show folding or major deformation
 - Marble which marks the lowland and Manhattan schist which exhibits steep slopes and higher elevation
 - Glacial Striation which is preserved in the hard rocks only in Manhattan Schist Formations
 - Differential weathering and erosion based on chemical and mineralogical composition of the rocks



A cross sectional view of the sequence of events that formed the Taconic orogeny which formed much of the bedrock on the North American Eastern margin, including the formations found in Inwood Park.

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