

**W. T. Clarke High School**

# **Geology and Megaconstruction Projects, New York City, NY**

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**Charles Merguerian**



**02 June 2009**



**Paleo-shoreline**

EARLY MEDIAL ORDOVICIAN

(Early Chazyan)

PALEOGEOGRAPHY

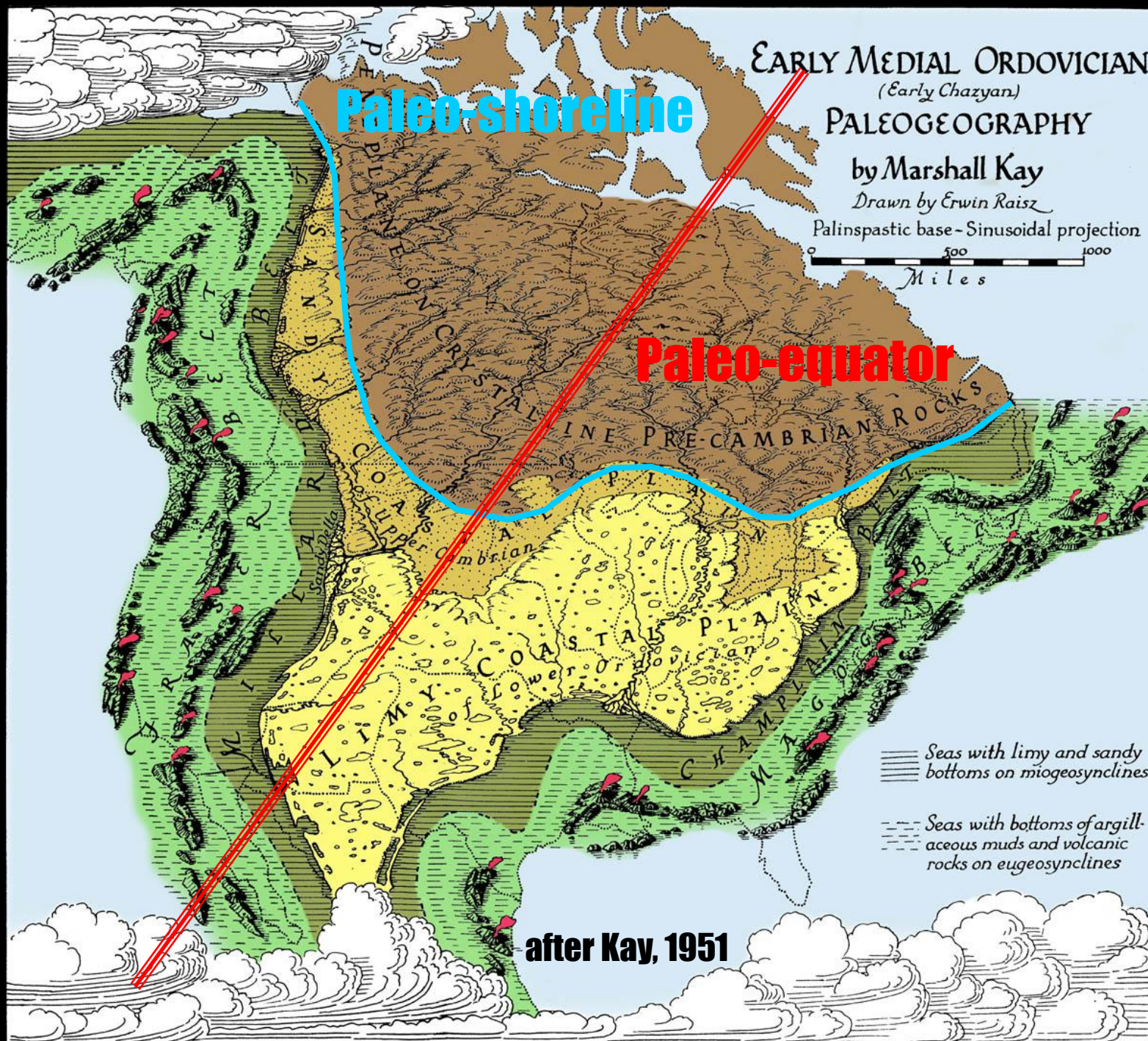
by Marshall Kay

Drawn by Erwin Raisz

Palinspastic base - Sinusoidal projection

0 500 1000  
Miles

**Paleo-equator**



after Kay, 1951



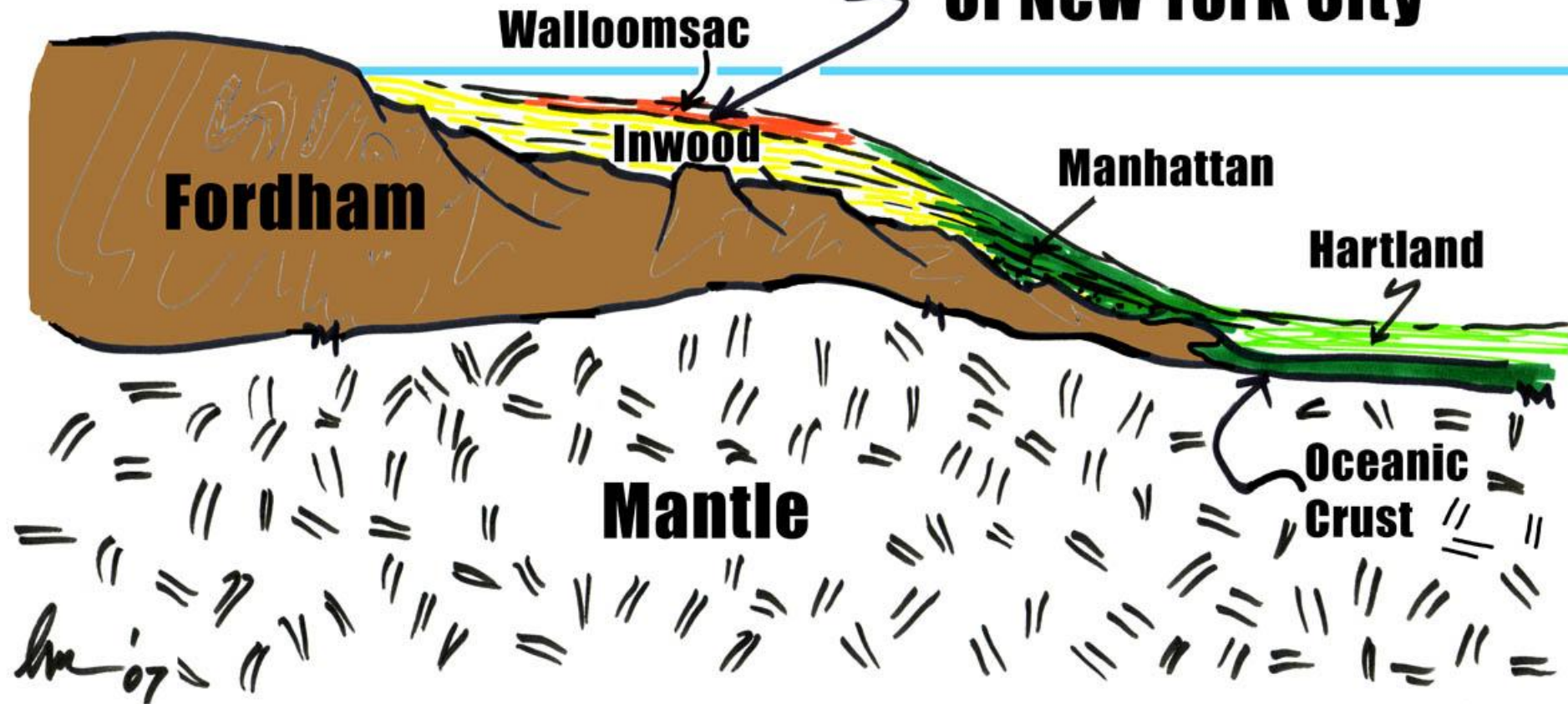


**Let's Go Back  
In Time From  
Today to the  
Cambrian!**

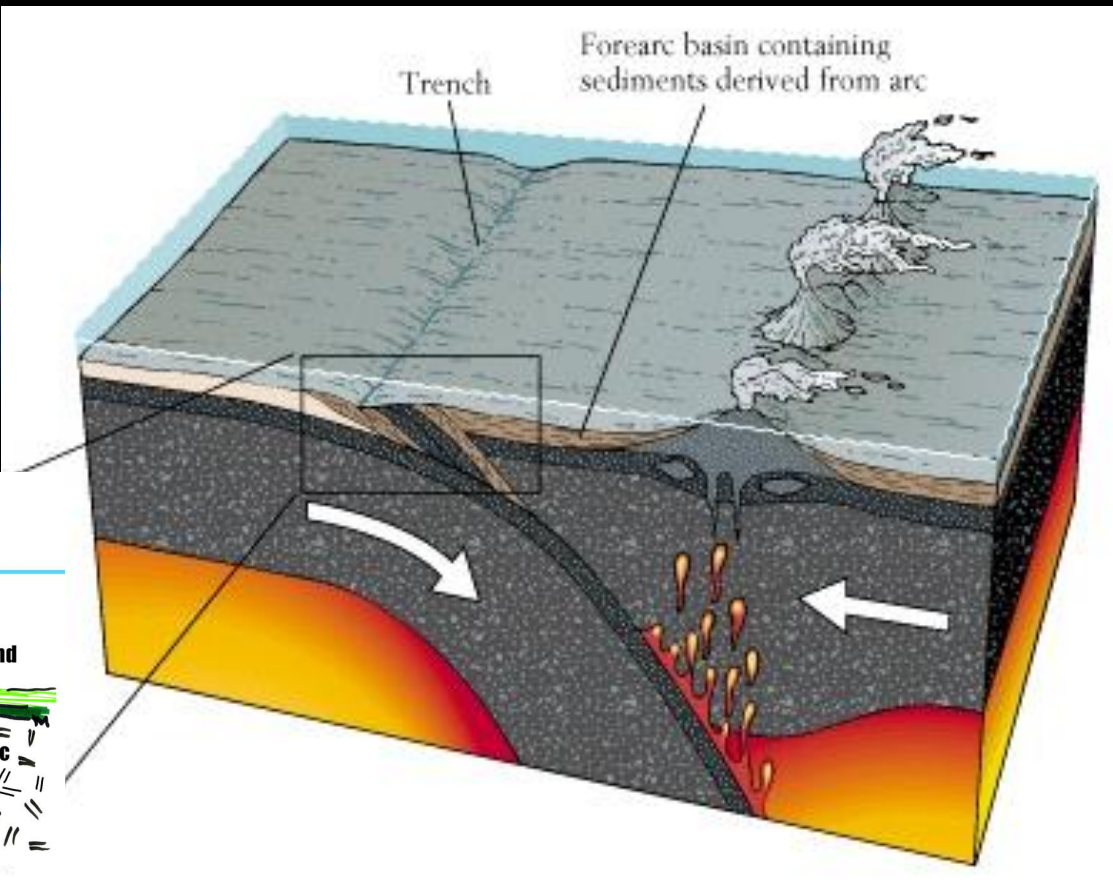
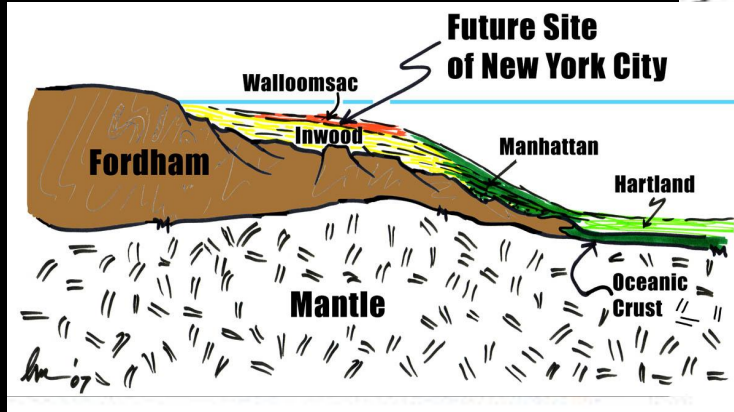


**Club Med  
Conditions**

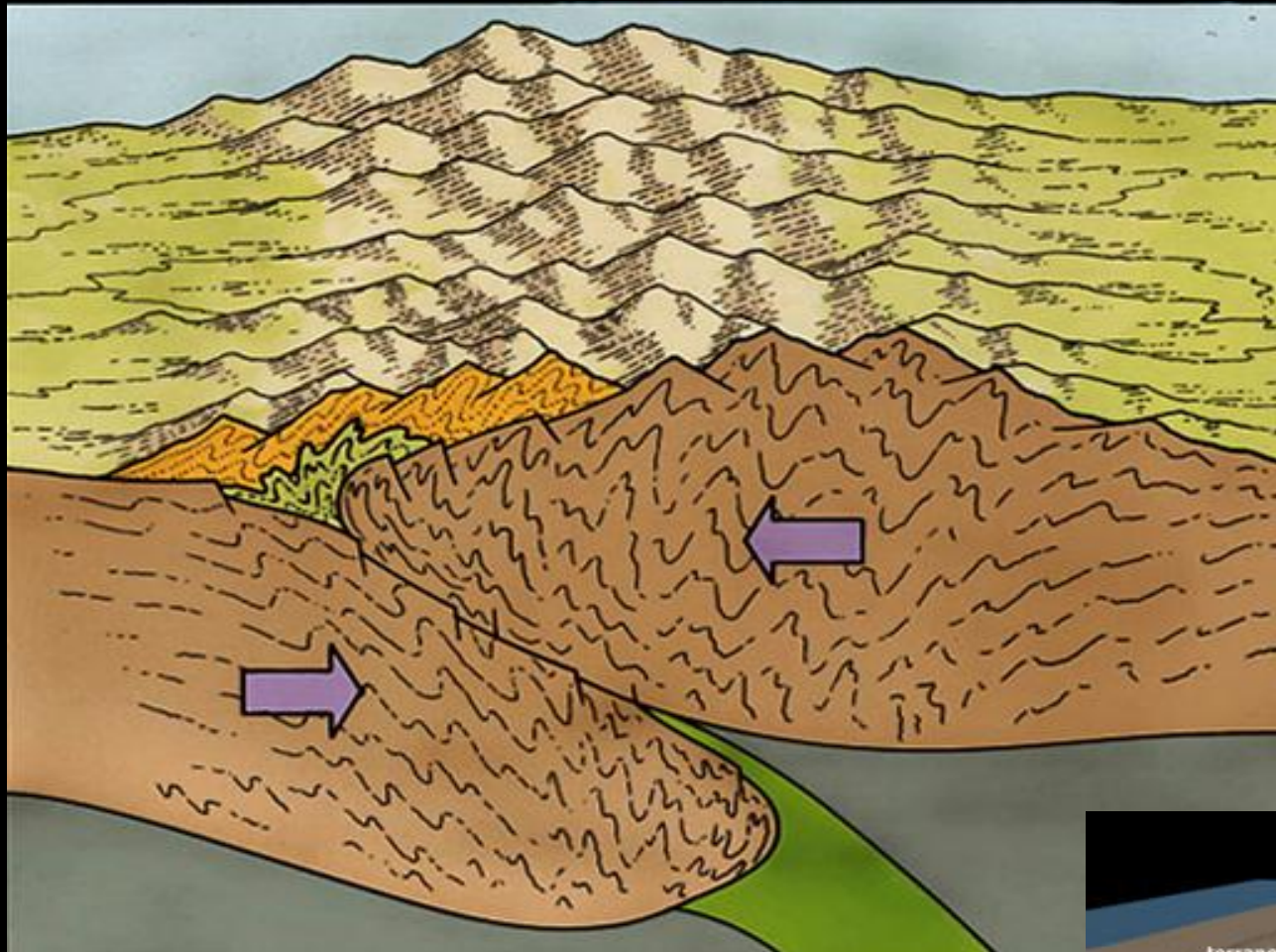
# Future Site of New York City



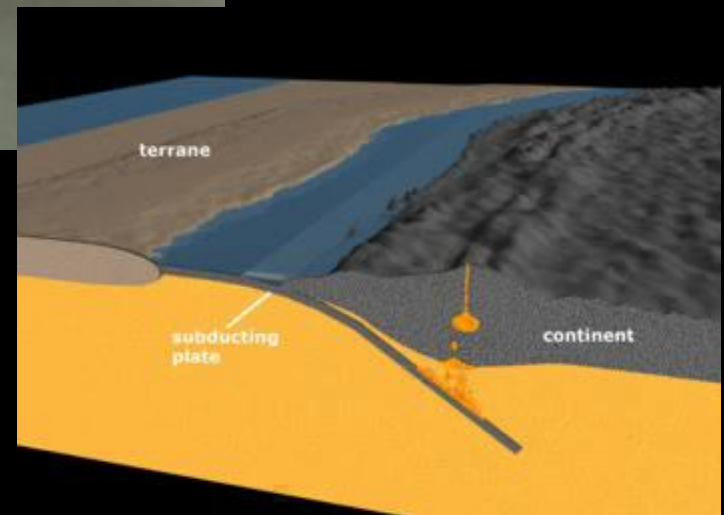
# ~ 450 Ma Taconic Arc – Passive Margin Collision

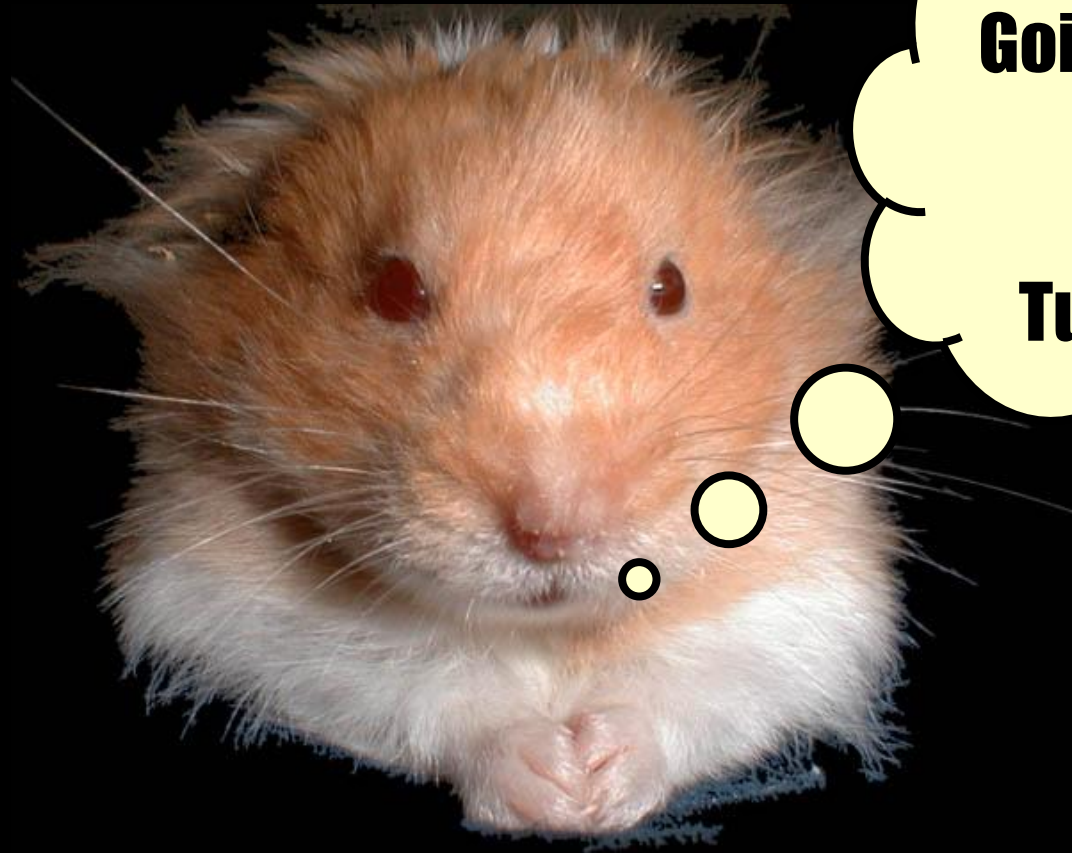






**450 Ma to 250 Ma  
Protracted Plate Collisions  
Form the Appalachians**





**Finally, He's  
Going to Talk  
About  
TBM  
Tunneling**



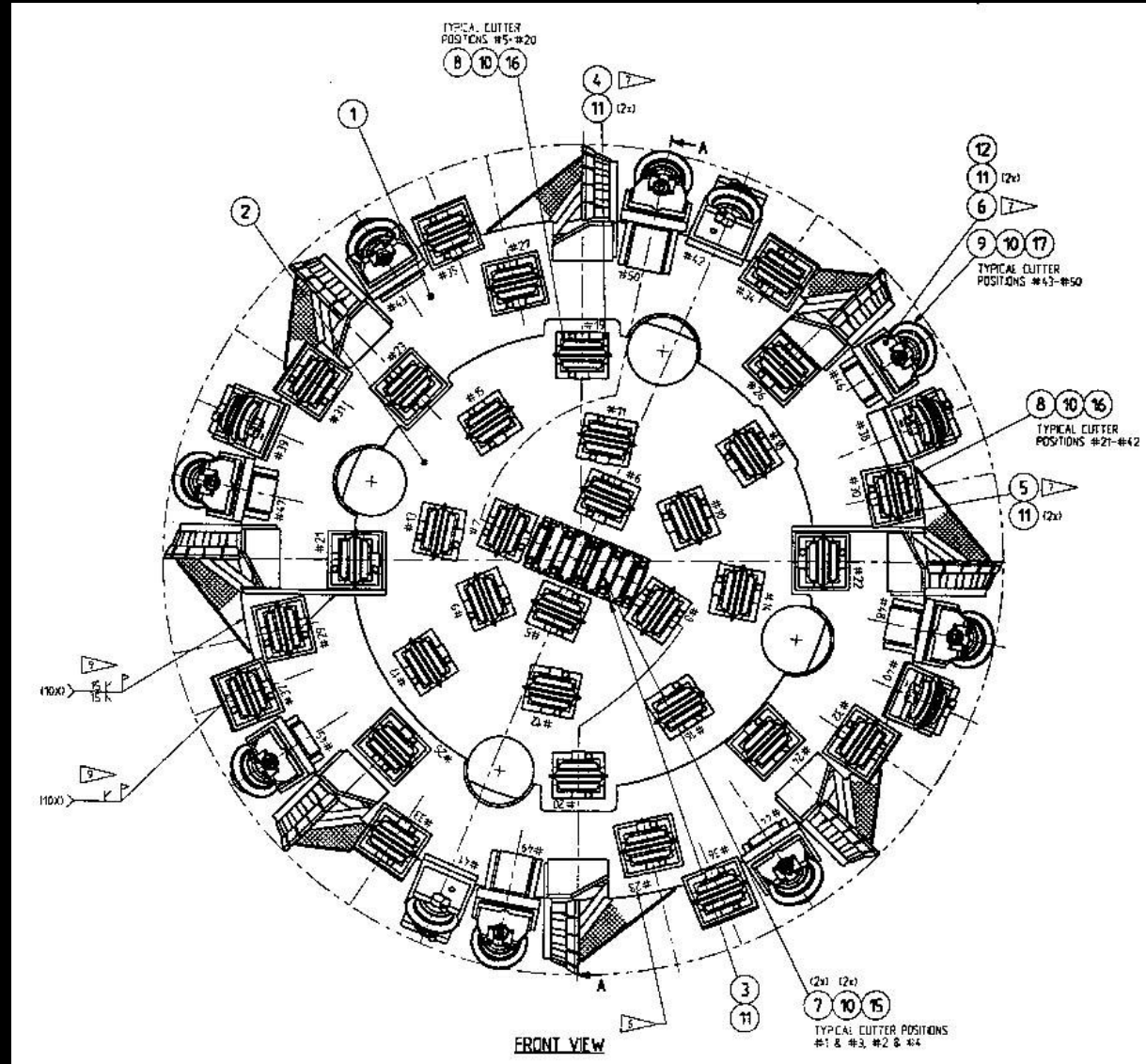
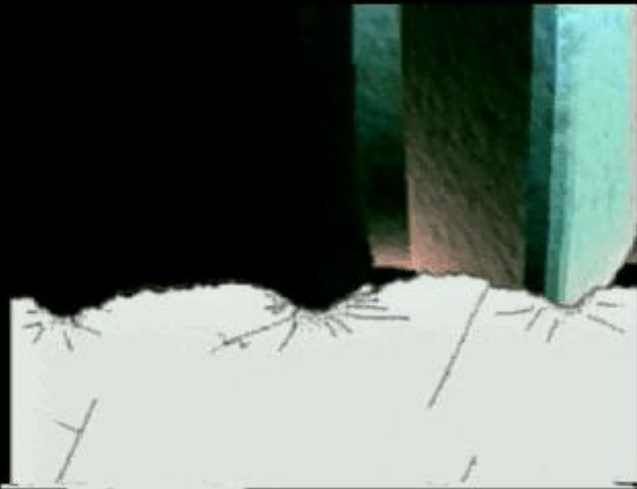
# **Robbins 235-282 HP Hard Rock Main Beam TBM**



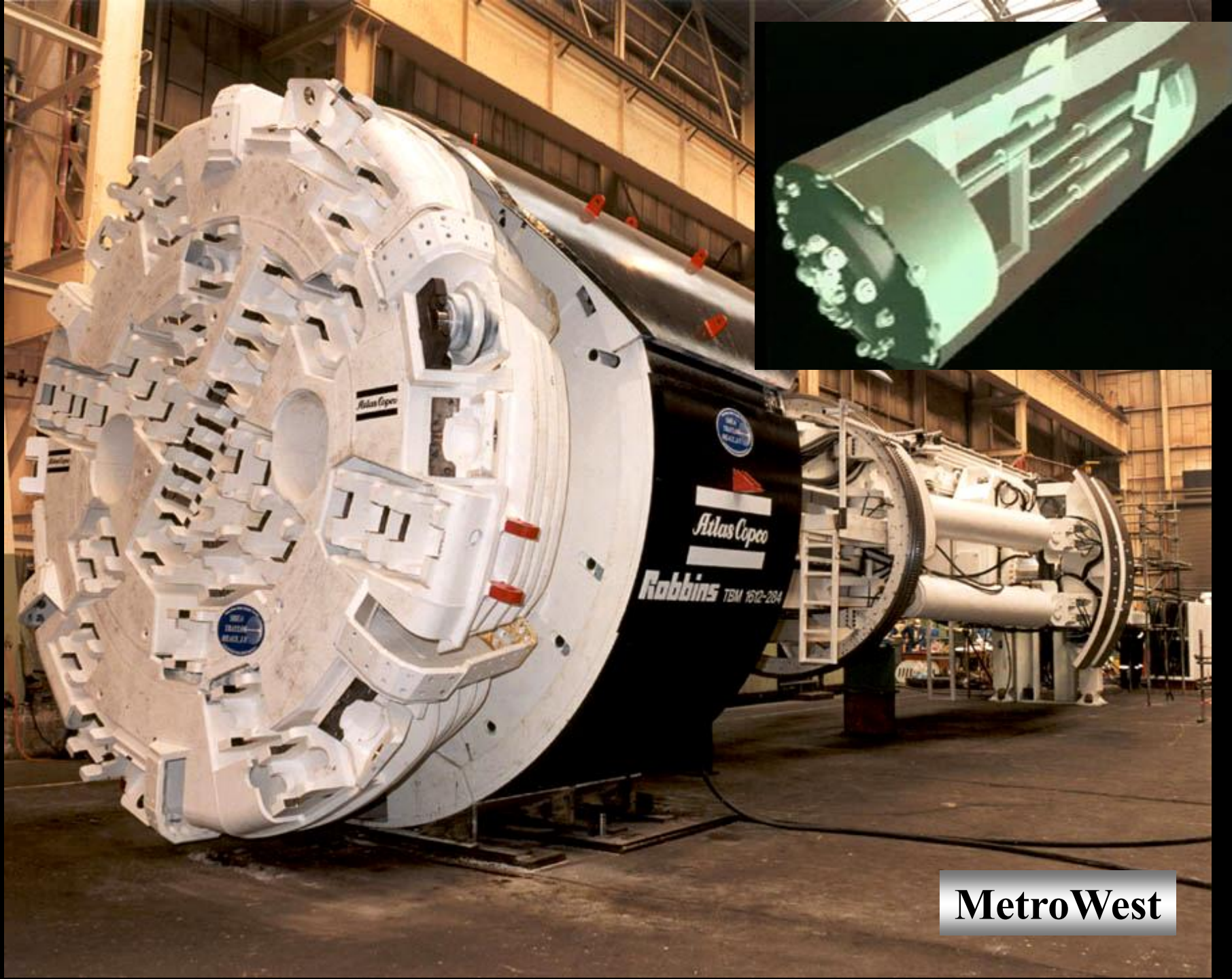
**Chesterfield, England - 1996**



# TBM Chip Production

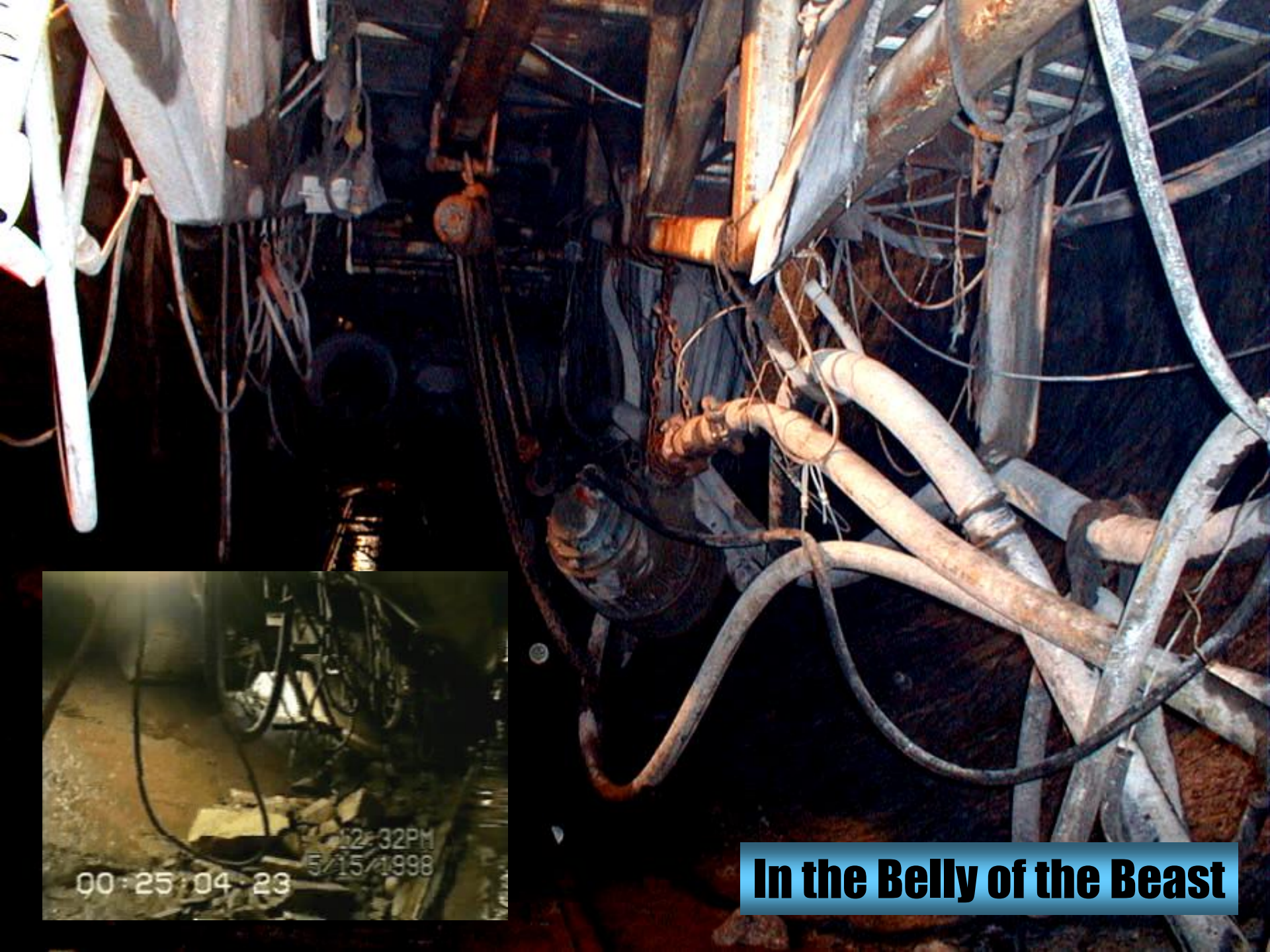






**MetroWest**






**In the Belly of the Beast**





**TBM-Bored Tunnel**



The background of the slide is a close-up, slightly blurred photograph of a Tunnel Boring Machine (TBM) cutterhead. It shows various cutting tools, including scrapers and scrapers, mounted on a complex metal structure. The lighting is somewhat dim, highlighting the metallic surfaces and the intricate design of the machine.

# **What Are the Geological Controls on Effective Hard Rock TBM Tunneling in Crystalline Terrains?**

**Excessive Fines  
Blocky Ground**

**Unstable Headings and Sidewalls  
Low Penetration Rates**



# Excessive Fines





# Blocky Ground





# Desirable Kerf Pattern in Hard Rocks





# **Collapsed Crown and Sidewalls**

The image shows the interior of a tunnel where the crown and sidewalls have collapsed. The structure is supported by a complex network of wooden beams and metal struts. The ground is dark and uneven, and the overall scene is one of structural failure.

**Short Stand-up Times**

**Station 153+30**



**Rainy Conditions**



**Station 140+60**



# Short Stand-up Times





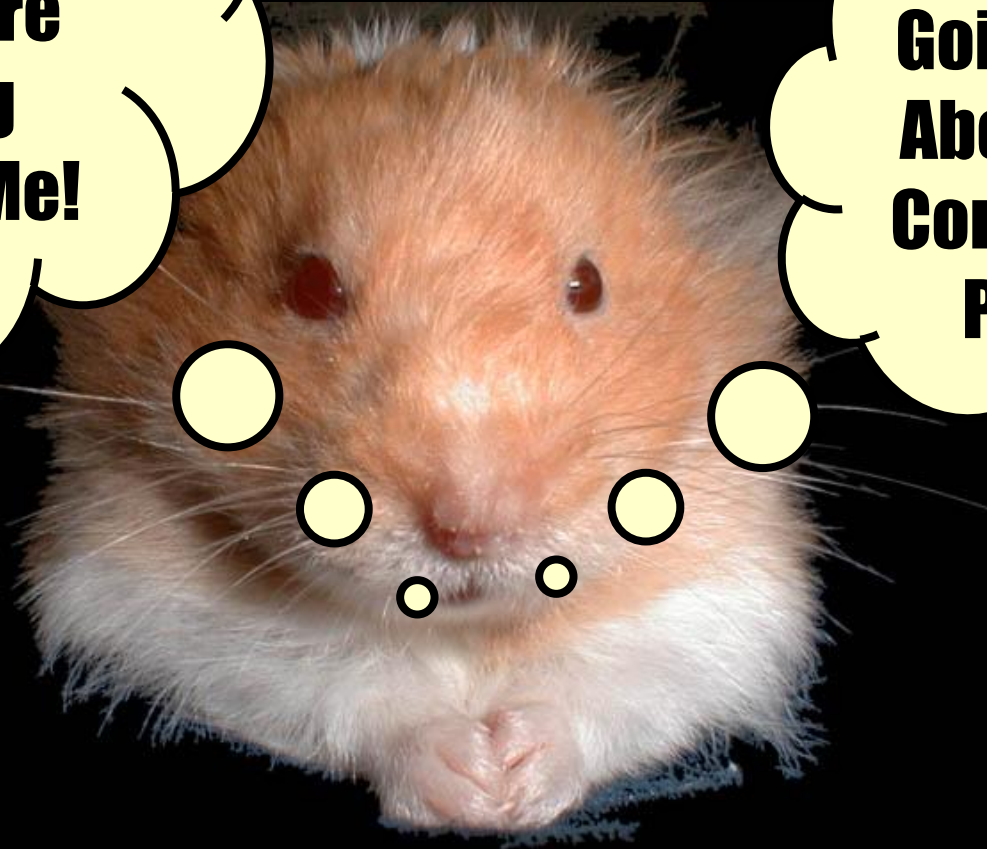
# Unforeseen Tunneling Problems





**Remember  
Doc, You're  
Nothing  
Without Me!**

**Finally, He's  
Going to Talk  
About Mega-  
Construction  
Projects**



# Mega-Construction Projects

- Queens Water Tunnel
- Con Edison Steam Tunnel
- Manhattan Water Tunnel
- East Side Access Project
- Second Avenue Subway
- IRT #7 Line Extension
- LI Cross Sound Link Tunnel

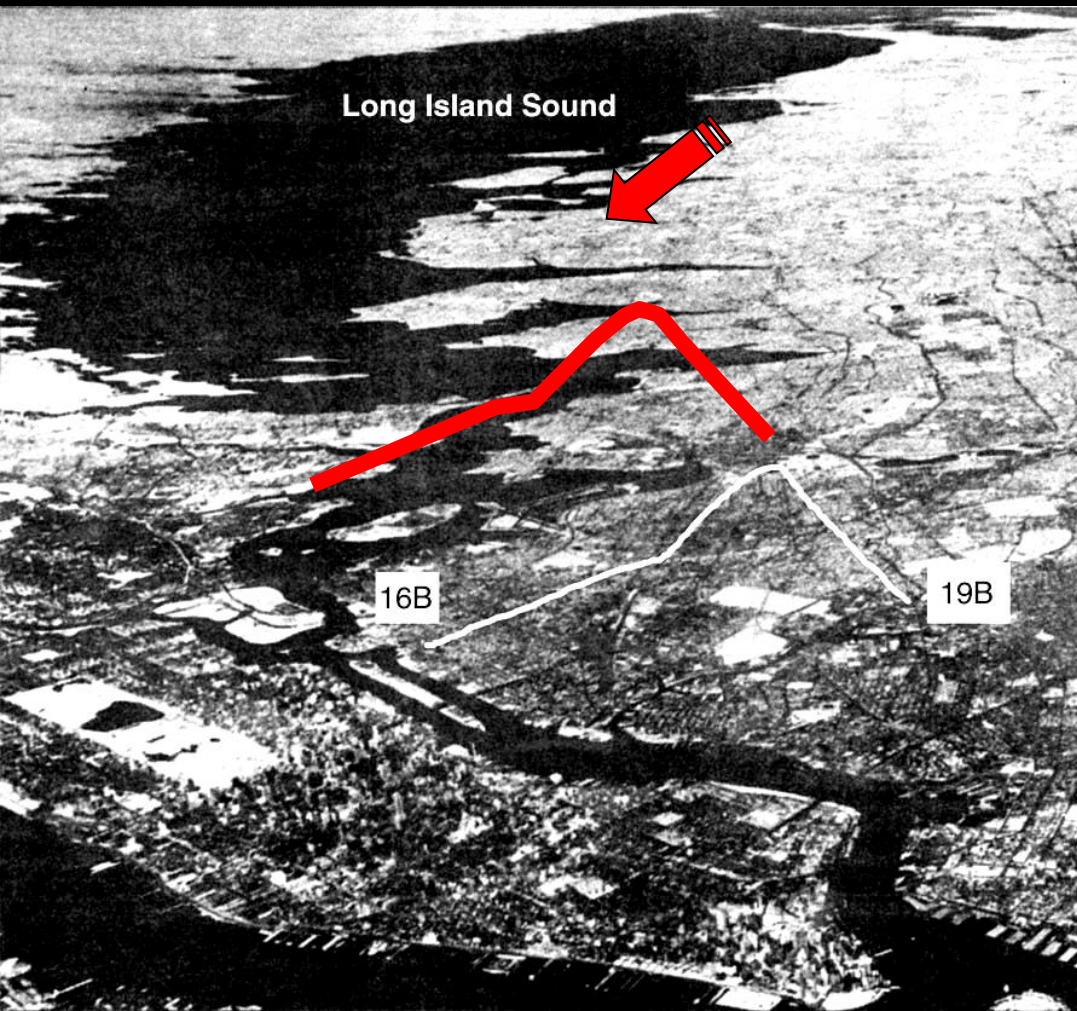




# Construction of the Queens Tunnel

## NYC Water Tunnel #3

Oct 1996 – Oct 1999









# Con Edison Utility Tunnel





# Con Edison Steam Tunnel TBM

**Robbins HP 215-257 Hard Rock Machine  
Capable of 5' stroke**



**10 Oct 2002**



# TBM Starter Tunnel







# East Side Access LIRR/MTA









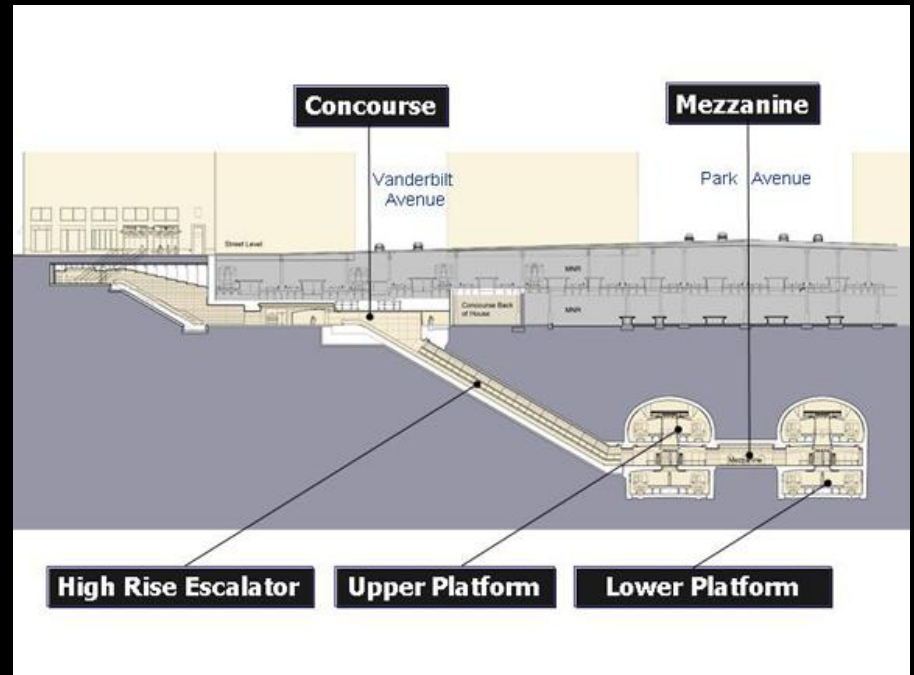
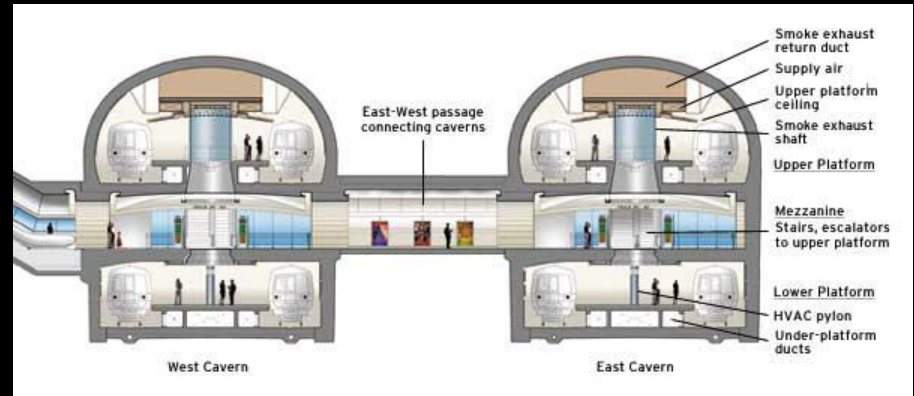
13 Aug 2007







# Construction Will Take Place **Under** Existing GCT





# IRT #7 Line Extension





# Second Avenue El



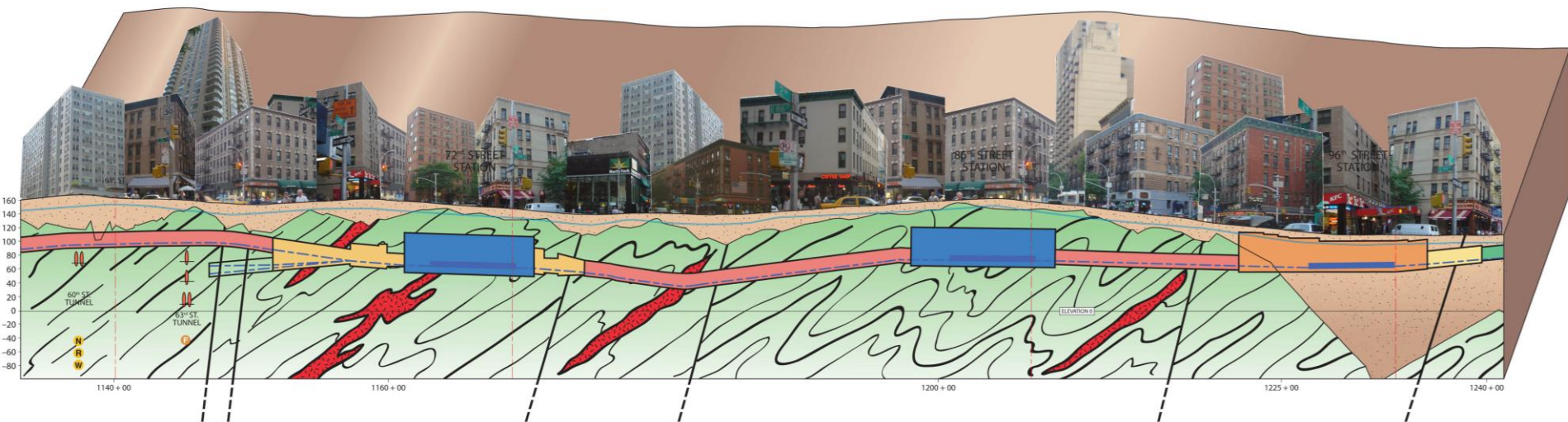
**1929** – NYC BOT Proposes  
Second Avenue Subway

**1931** – Plans Postponed  
Depression Era

**\$86M → \$249M → \$500M**

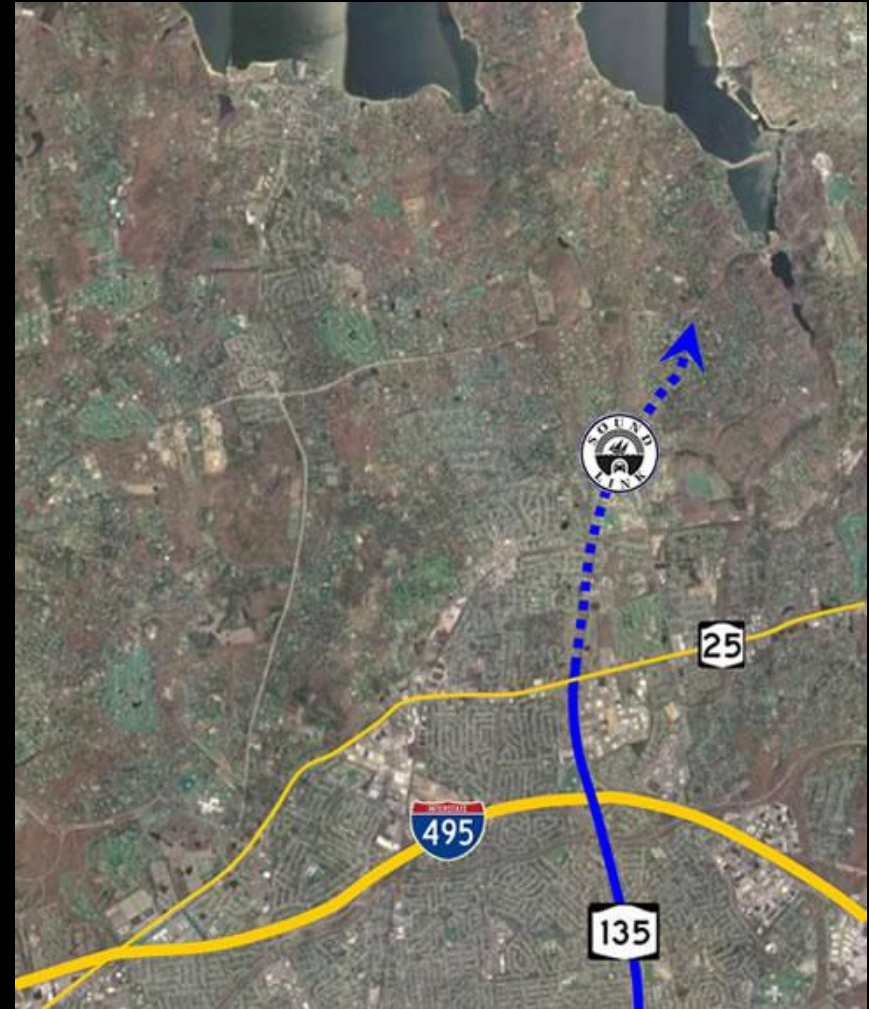
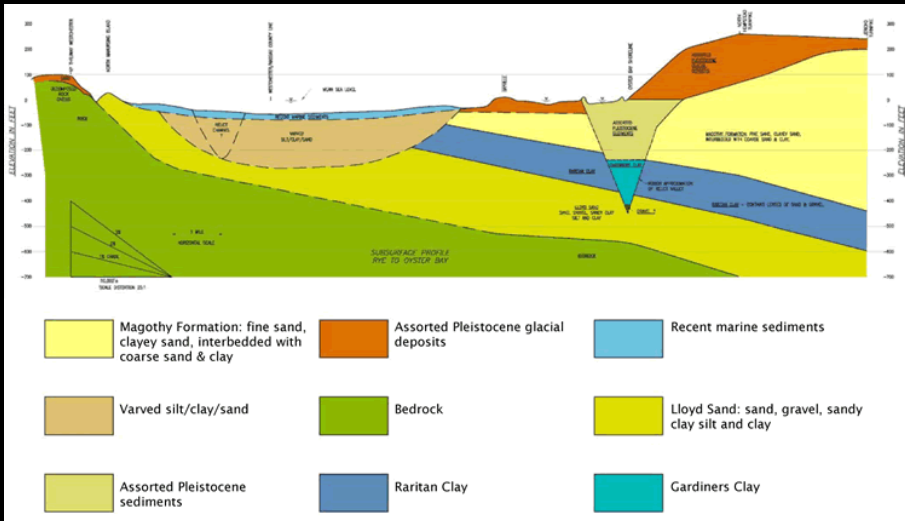
**By 1948** – (Abandonment)





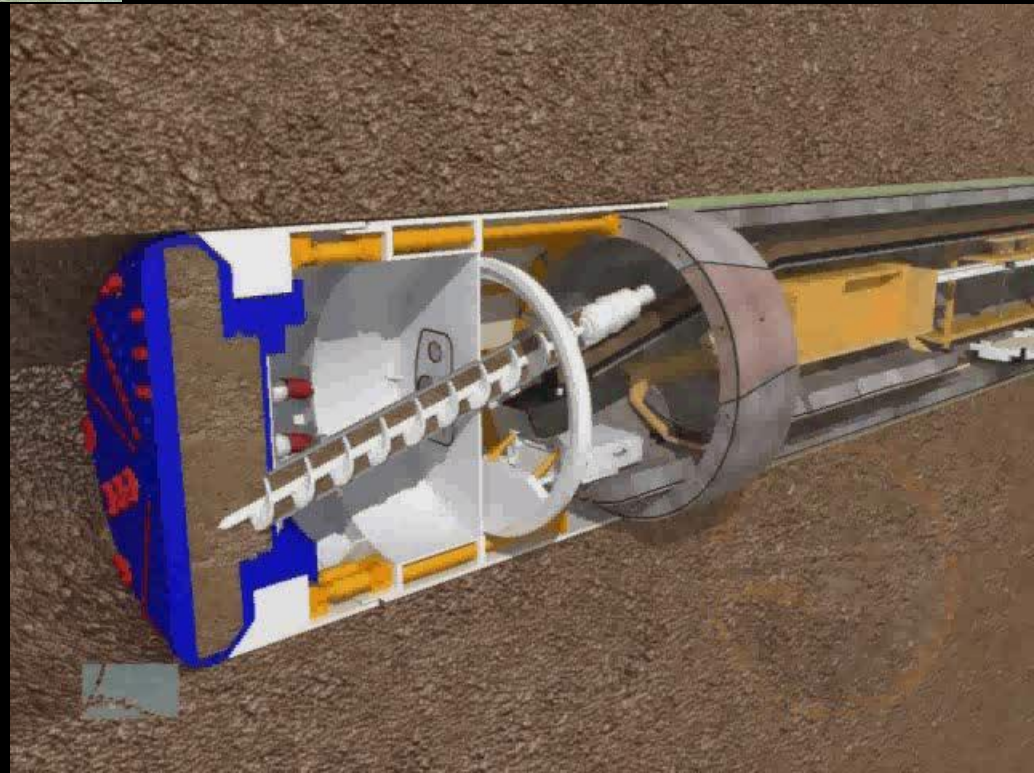
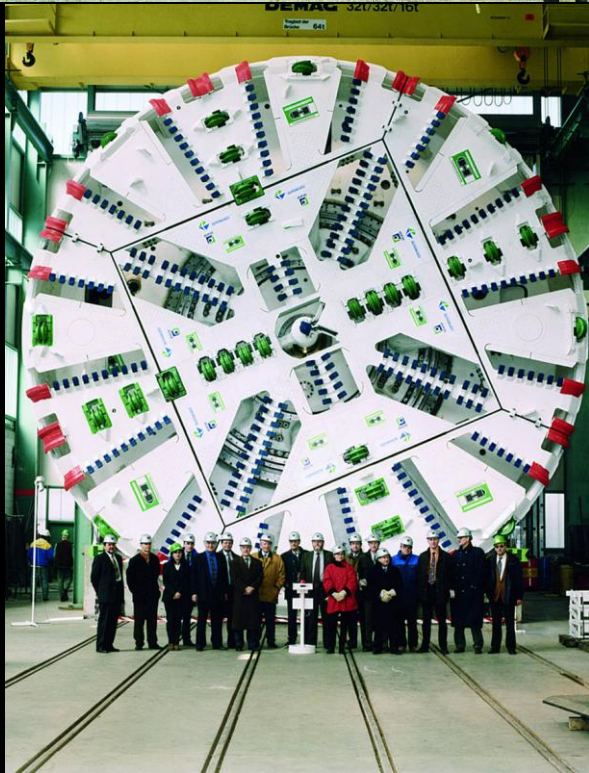


# Cross Sound Link Project





# Soft Ground TBMs





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**[www.dukelabs.com](http://www.dukelabs.com)**

**What's That  
Noise?**

