Marvels in the Mud: Microscopic Wonders from the Hudson River and their Historical Connections

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Parts of Talk

1) Beautiful burning (transportation and power generation)

2) Exquisite skeletons (hurricanes)

3) Disasters and discoveries (extraterrestrial material and climate?)
Hudson samples of mud and dust- how small is the dust?
1 page size sheet of graph paper-
see squares within squares
Typical dust on graph paper squares
Moon like spherule - industrial debris from Hudson
Mr Potato Head?
Mutant Budding?
More industrial debris
Early steamboats on Hudson burned wood—later burned coal.
Coal-flowing like molten glass
Spherule with metal rich stars and needles: from Hudson near Tappan Zee bridge
Jaws in the Hudson?
Jaws in the Hudson

Worm jaw (scolecodont)  Worm-terrestrial
Diatom (cleaning agent and roach killer)

Visible light

Scanning electron microscope
Hudson diatom

Visible light

Electron microscope
Brackish Foraminifer
Hurricanes in New York Area

Great New England Hurricane- Sept 21, 1938, 120 mph winds, 14 ft. storm surge, 742 deaths (large ship sank)

August 22-24, 1893  74 mph winds, 30 ft storm surge,  60 deaths

Norfolk and Long Island-Sept. 3, 1821, 74 mph winds, 13 ft storm surge,  17 deaths
Debris from hurricane Sandy-Nyack-storm surge 14 ft.
Oceanic material in Hudson mud:

- radiolarian
- foraminifer
- glauconite
Coccosphere - made up of coccoliths.

Can only live in the open ocean.
Hurricanes in the Hudson: Open ocean foraminifera with coccoliths in their pores
Coccoliths on surface of foraminifer
Marine foraminifer with coccoliths in pores
Hurricane Layers in the Hudson
Best Fit Foram Assemblage and Hurricane Tracks (last 150 years)
Relation to Storm Surge Height?
Hudson River disaster - rockfall
Hudson at Storm King Mountain
Extraterrestrial impact in Hudson valley - Peekskill meteorite
Sources of Impacts

Comet
- Dirty ice ball
- Black body-only visible near sun

Asteroid
- Rock
- Appears as a small star.
Impact shrapnel?- open ocean foraminifer with shot in Ni-Fe-Si-Al Oxide-(found near Tappan Zee Bridge)
Importance of Ni- Abundant in Material from Outer Space (Example: Iron Meteorite-5-13% Ni)
Tin Oxide Crystals on Marine Foraminifer (32 km N. of NY Harbor) - Tin contains nickel
Why is Tin Interesting?
Tin-Enriched by 1000 Times in Some Cometary Material- too old to be manmade
Space Object Coming In-Produces a Shock Wave (like a sonic boom only MUCH bigger)-
Result: Shock Metamorphism
Shocked Ilmenite and Glass- Hudson River-~208 B.C- formed in an impact?
Hudson River-Piermont, NY-basaltic glass w/shocked feldspar (Brazil twins)- formed in impacts
C spherule from near Tappan Zee bridge- some contain tiny diamonds
Diamonds are a Girls best friend? Hexagonal Diamond-only found in Meteorites or impact material 58% harder than regular diamond!
Hudson River- hexagonal impact diamond-unique to meteorites and impacts
Tree Rings-
Frost Ring in 536 A.D.

Related to comet dust?
208-204 B.C. climate downturn and impact

• 208 B.C. -stars invisible in China
• 207-204 B.C. severe famines in China
• 208-204 B.C. narrow tree rings in German oaks
• Coincident with impact diamonds, shocked ilmenite in the Hudson River? (circa 208 B.C.)
Hudson River ~208 B.C. layer-impact ejecta? - shocked ilmenite and glass
Climate downturn: 1159-1141 B.C. and possible impact association-

Narrow tree rings from 1159-1141 B.C.
- When King Wu-wang waged a punitive war against King Chòu, a comet appeared with its tail pointing towards the people of Yin
- By tradition the Shang Dynasty ends when
- Wu-wang defeats Chòu at the Battle of Mu
- In the 12th century BC.

Hero of the Battle of Mu is Li No-cha, famous for killing the Dragon King
Dragons and extraterrestrial objects-Chelyabinsk?

1. There is a trail of smoke
2. There can be hissing noises.
3. There is fire and a loud roar.
High Si glass with coccoliths embedded - ~1159-1141 B.C. - Hudson valley
Sn covered foraminifera in Hudson River circa 1159 B.C.
Questions?