GSW spring field trip

Geomorphic Evolution of Great Falls and Mather Gorge

Led by E-an Zen, University of Maryland

Saturday, May 17, 2003

9 a.m. to 12:30 p.m.

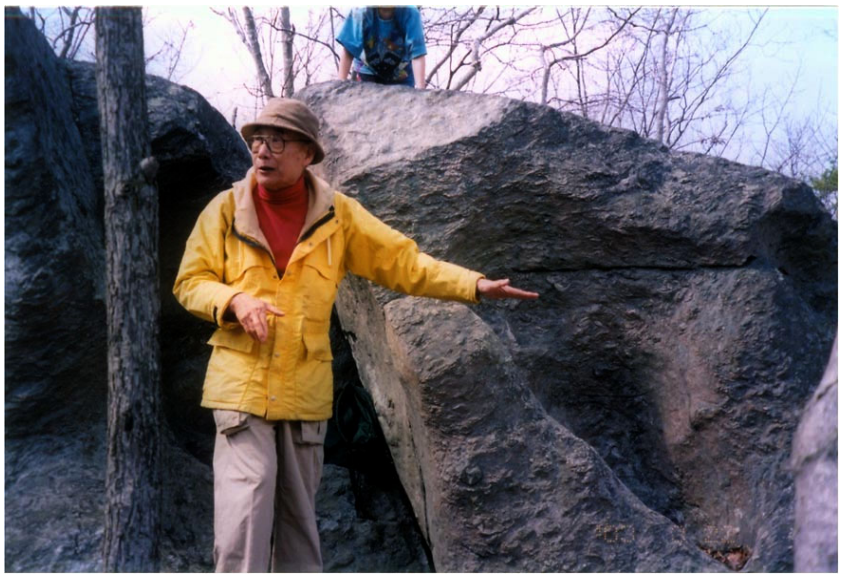
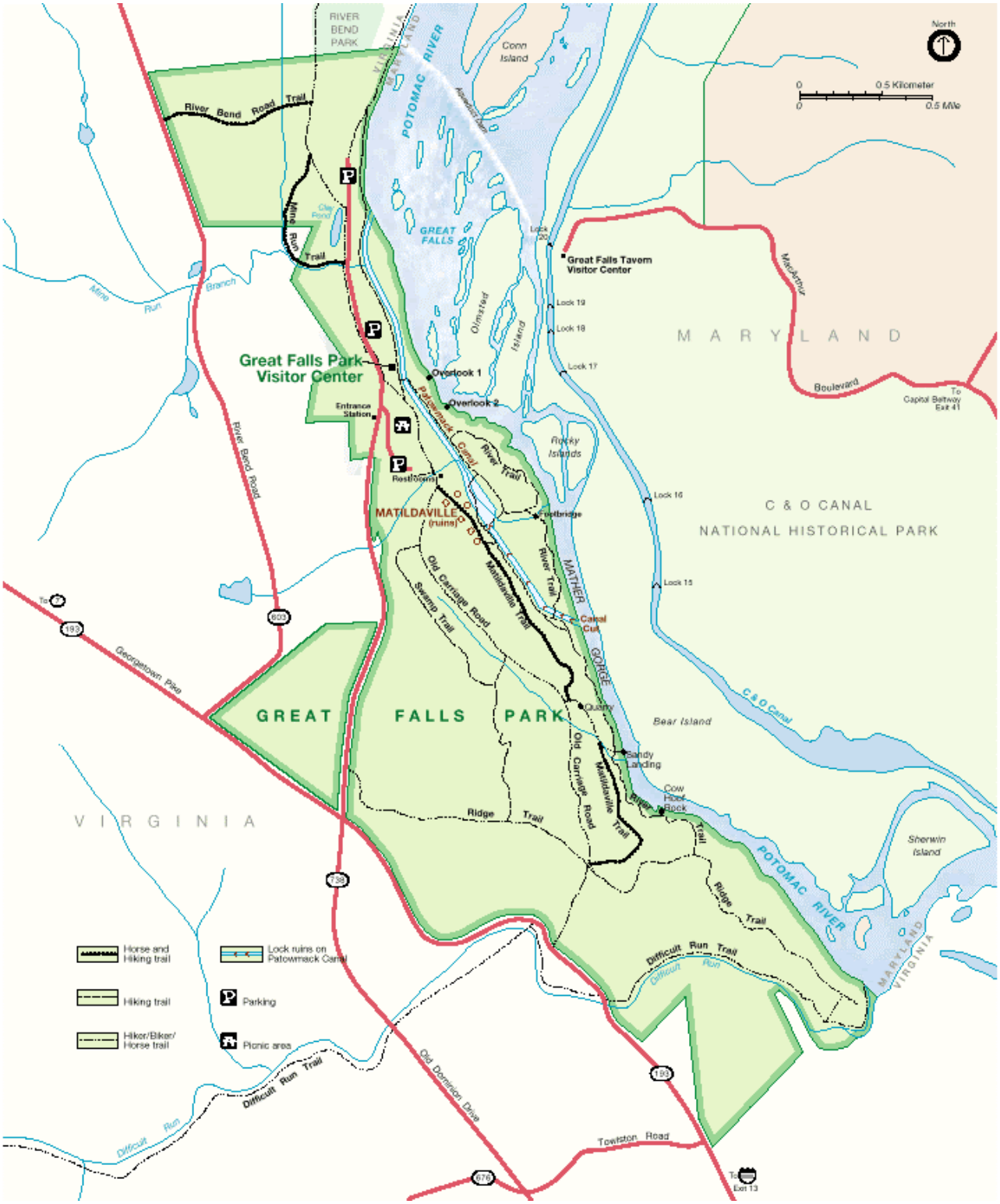


Photo by Priestley Toulmin

The focus of this field trip will be to study the geomorphic story behind the formation of Mather Gorge of the Potomac River, which terminates headward at Great Falls. Three objectives of the trip are: (1) to look at the field relations and evidence for the diachronous formation of seven identifiable straths in the gorge complex; (2) to account for these features in terms of likely processes of bedrock erosion and the relative efficacies of these processes; and (3) to discuss the ages of the features and to estimate the likelihood that these erosion processes are active today. The trip will be held at Great Falls National Park, on the Virginia side.


RIVER BEND PARK
VIRGINIA
MARYLAND
POTOMAC RIVER
Conn Island
North
0 0.5 Kilometer
0 0.5 Mile
River Bend Road Trail
Mine Run Trail
Clay Pond
Mine Run Branch
River Bend Road
GREAT FALLS
Lock 20
Great Falls Tavern Visitor Center
MacArthur Boulevard
To Capital Beltway Exit 41
Olmsted Island
Lock 19
Lock 18
Lock 17
M A R Y L A N D
Great Falls Park Visitor Center
Overlook 1
Overlook 2
Entrance Station
Restrooms
Patowmack Canal
River Trail
Rocky Islands
Lock 16
C & O CANAL
NATIONAL HISTORICAL PARK
MATILDAVILLE (ruins)
Footbridge
Matildaville Trail
Old Carriage Road
Swamp Trail
MATHER GORGE
Canal Cut
Lock 15
To I-495
193
603
Georgetown Pike
GREAT FALLS PARK
C & O Canal
Quarry
Bear Island
Sandy Landing
Cow Hoof Rock
Ridge Trail
V I R G I N I A
Sherwin Island
POTOMAC RIVER
MARYLAND
VIRGINIA
Difficult Run Trail
Difficult Run
Old Dominion Drive
Towlston Road
676
To I-495 Exit 13
Horse and Hiking trail
Hiking trail
Hiker/Biker/ Horse trail
Lock ruins on Patowmack Canal
Parking
Picnic area

GSW spring field trip, 2003:
GEOMORPHIC HISTORY OF THE POTOMAC RIVER GORGE COMPLEX

Leader: E-an Zen, University of Maryland, College Park

9 a.m. to 12:30 p.m., May 17, 2003, Great Falls National Park

Purpose

During this trip, the group will examine the geomorphic story behind Mather Gorge of the Potomac River, which terminates headward at Great Falls. Our objectives are: (1) to look at the field relations and evidence for the diachronous formation of seven identifiable straths in the gorge complex; (2) to account for these features in terms of likely processes of bedrock erosion and the relative efficacies of these processes; and (3) to discuss the ages of formation of the features, and to consider whether these erosion processes are likely active today.

Itinerary

Stop 1. Orientation stop at an observation platform.

Stop 2. Follow the Carriage Road to the flat-topped Glade Hill to see a fluviatile boulder deposit capping the hill: this is the oldest record of the Potomac River in the area.

Stop 3. Sandy Landing; various features of fluvial bedrock erosion.

Stop 4. Follow the River Trail back north, stopping at several features indicative of former straths and erosional features along the way, to the ruins of Matildaville where the next-to-the-oldest strath is recorded.

Stop 5. Via the holding basin of the defunct Patowmack Canal and the trestle bridge to an exposure overlooking the gorge. Offset lamprophyre dikes on the gorge wall form the basis of an extant hypothesis explaining the straight alignment of the gorge. We will review the pros and cons of this idea. We will also briefly consider the P-T-t path of the metamorphic rocks and its implication on the tectonic role of the Mather Gorge Formation.

Stop 6. Continue on the River Trail north to an outcrop featuring lateral potholes; their origin and known rates of excavation.

Stop 7. A fossil waterfall and plungepool. The story of the January 1996 flood at this site will lead us to

Stop 8. The flood marker pole near the Visitor Center. The trip will conclude with a review of the competency of modern decadal floods in the excavation of the gorge.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0 100 200
Meters

2002 Denver Annual Meeting (October 27-30, 2002)
Quaternary Geology/Geomorphology (Posters) I

Vol 34, page 127 Paper No. 58-9 REUSSER, Lucas

MAJOR, CLIMATE-CORRELATIVE INCISION OF THE POTOMAC RIVER GORGE AT GREAT FALLS ABOUT 30,000 YEARS AGO

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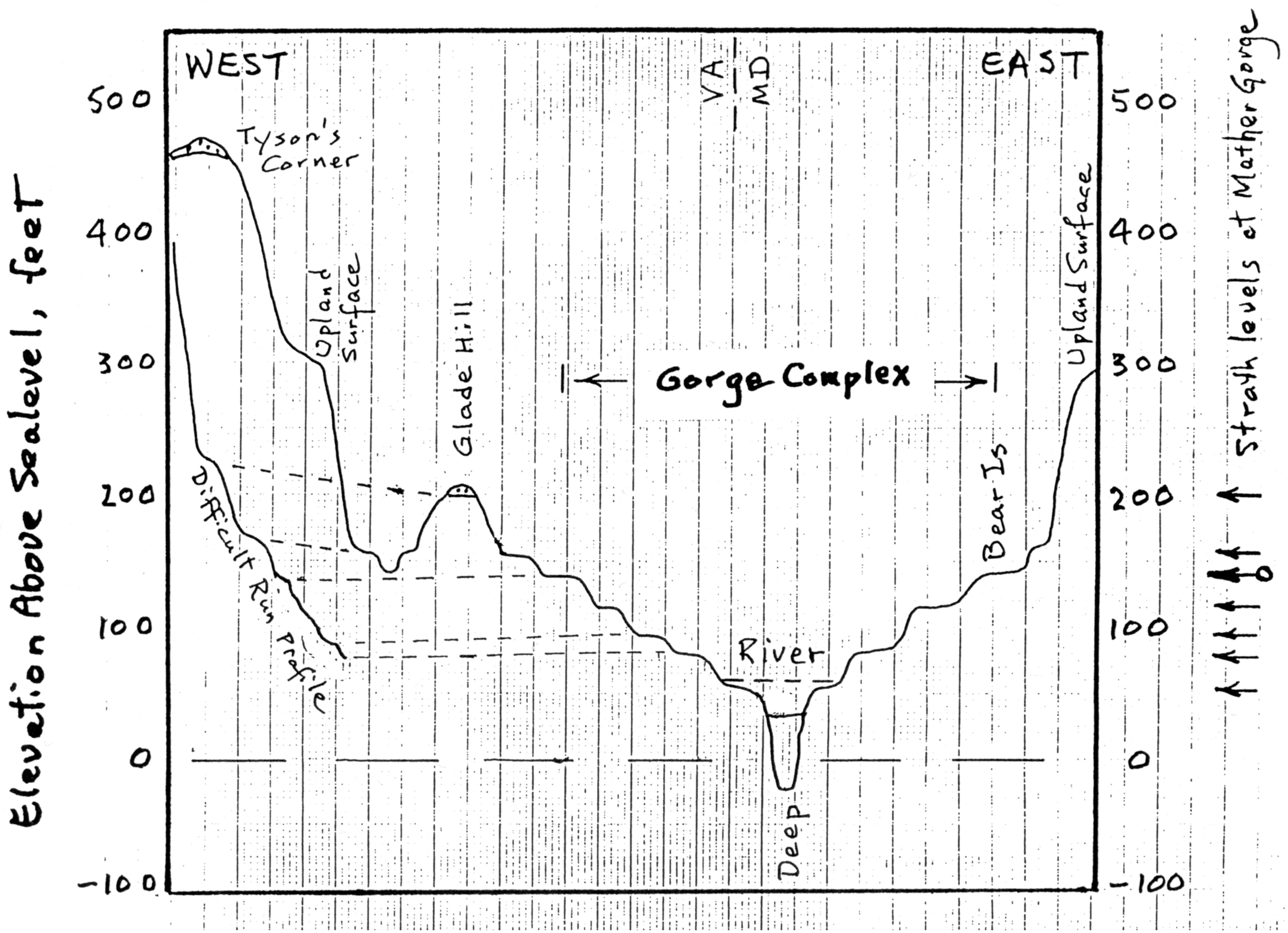
Large rivers along the mid-Atlantic coast flow through spectacular bedrock gorges as they exit the Piedmont onto the Coastal Plain and their tidewater reaches. Was this incision driven by tectonic or climatic forcing? When did it occur?

In order to infer the cause and understand the timing, spatial distribution, and rate of the bedrock incision in two such gorges, we collected >70 samples for 10-Be and 26-Al analysis from exposed, fluvially eroded outcrops of quartz-bearing schist along strath terraces of the Potomac and Susquehanna Rivers at the Piedmont/Coastal Plain transition. Here we report primarily on the Potomac gorge.

The first 18 samples, collected from Mather Gorge below Great Falls on the Potomac River, indicate that the most prominent strath terrace, a several km-long bedrock feature 20 to 25 m above the current low water level, was abandoned rapidly as the Potomac River incised about 30 kya (SL, >60 deg, 10-Be PR=5.17 atoms/g). Nine samples, collected from water-polished rock surfaces down a cross-section from this terrace to just above the river, have decreasing nuclide activities consistent with a fluvial, bedrock incision rate of about 70 cm/ky and an effective 6 ky exposure age at water level. Four samples, collected from below the normal low-flow level during the 2000 drought, have activities equivalent to about 5 ky of exposure. Thus, to account for cosmic-ray dosing at and just below the waterís surface, we have subtracted 6 ky of exposure from older terrace surface ages.

The incision of Mather Gorge began about 30 ky coincident with a major drop (50 m) in eustatic sea level, the result of glacial ice-volume increase. Incision is clearly coincident with cooling climate but we do not know if it was driven by base-level fall or by changes in discharge and sediment loading. However, the similarity of model exposure ages for samples collected from a km-long transect parallel to the river and within 2 km of the present-day knick point at Great Falls, suggests that retreat of the knick point which formed the gorge must have been rapid, lasting only a few thousand years.

Zen Figure 11



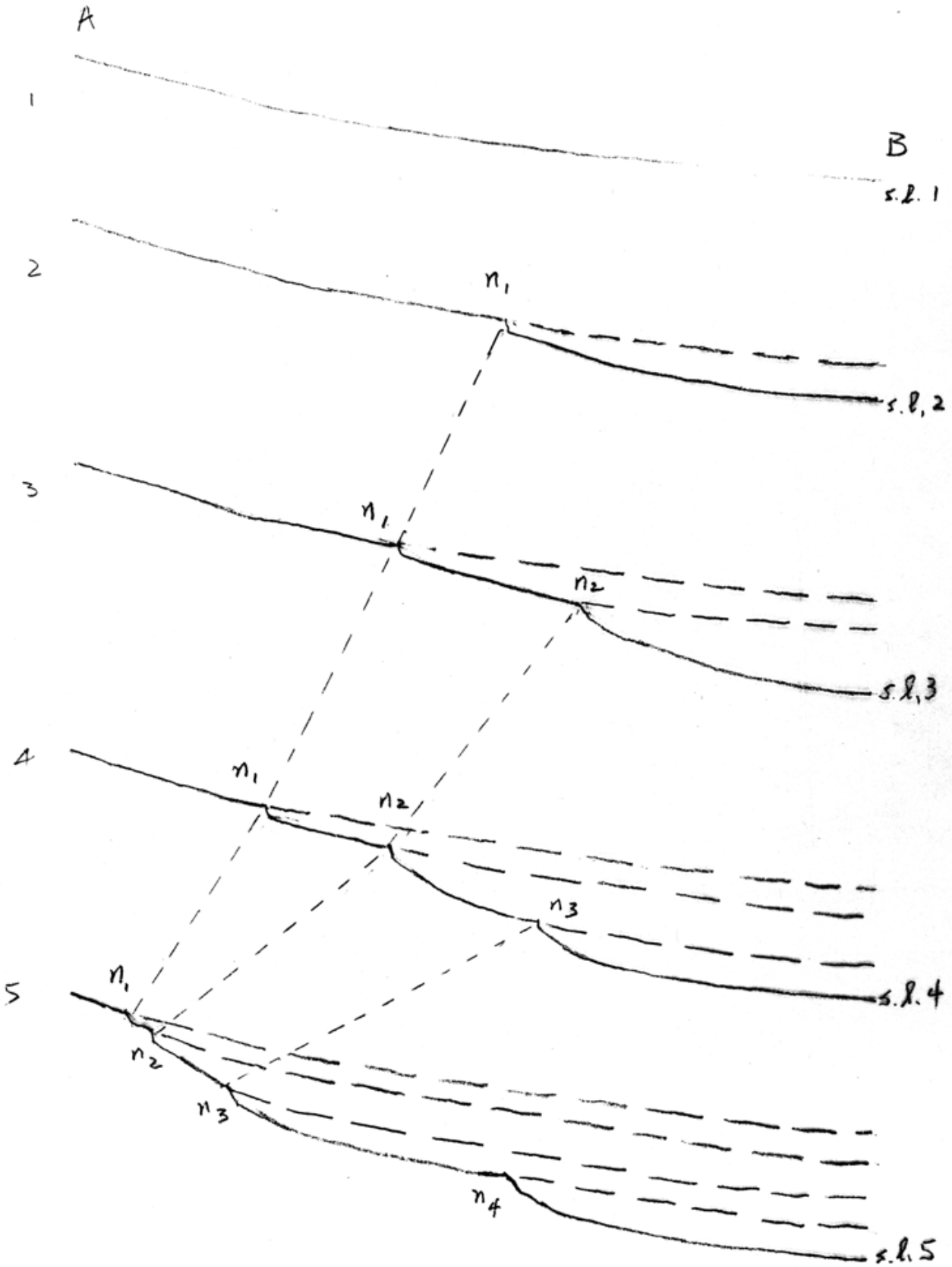
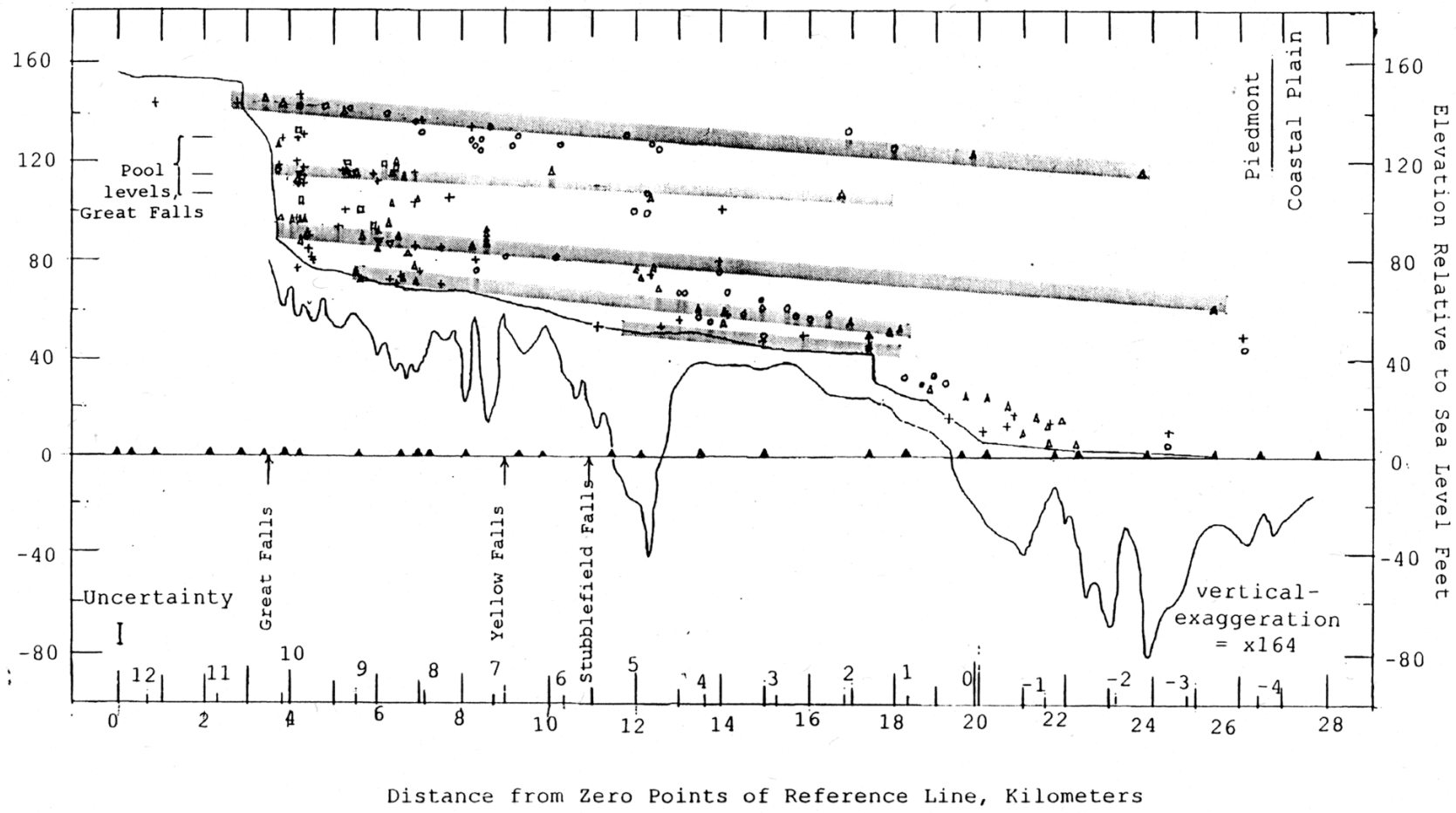
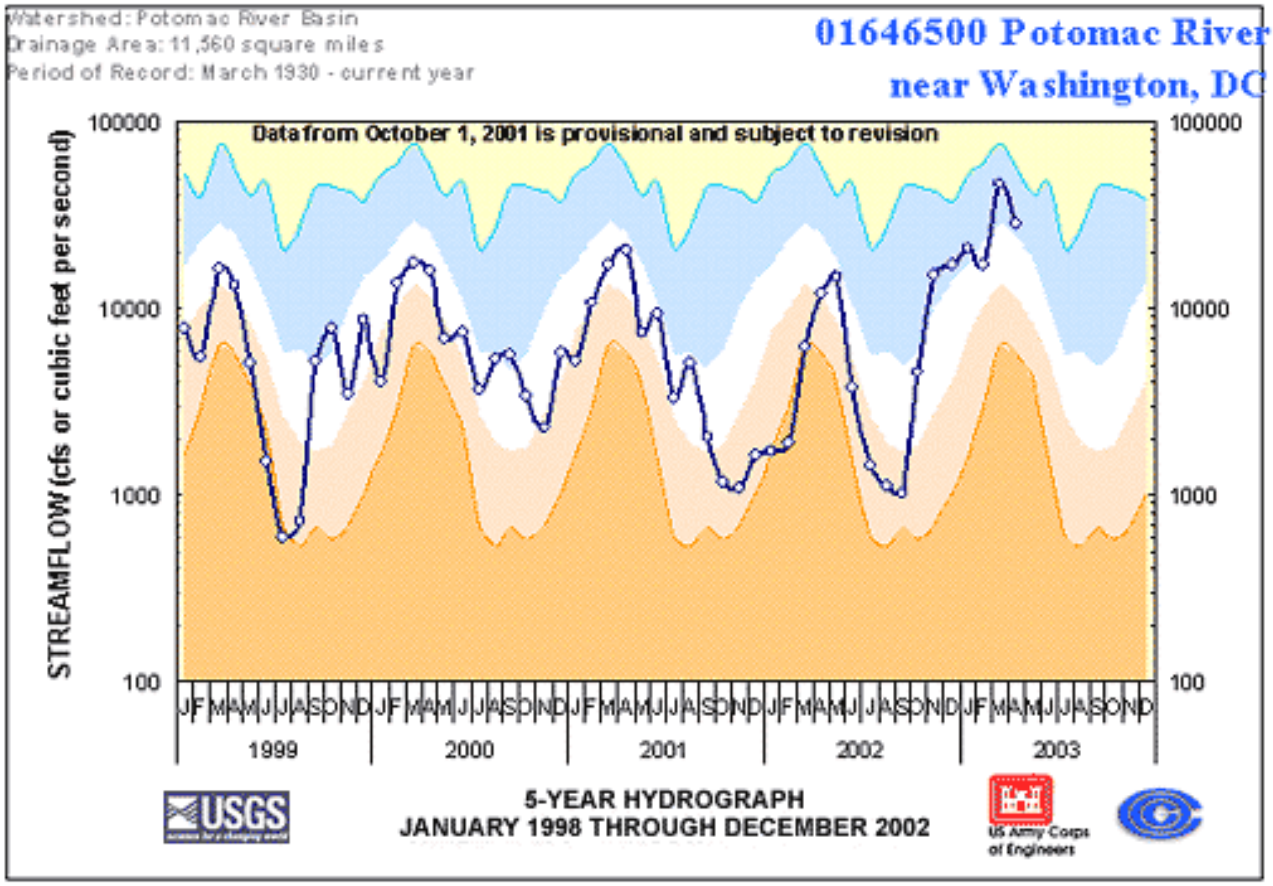
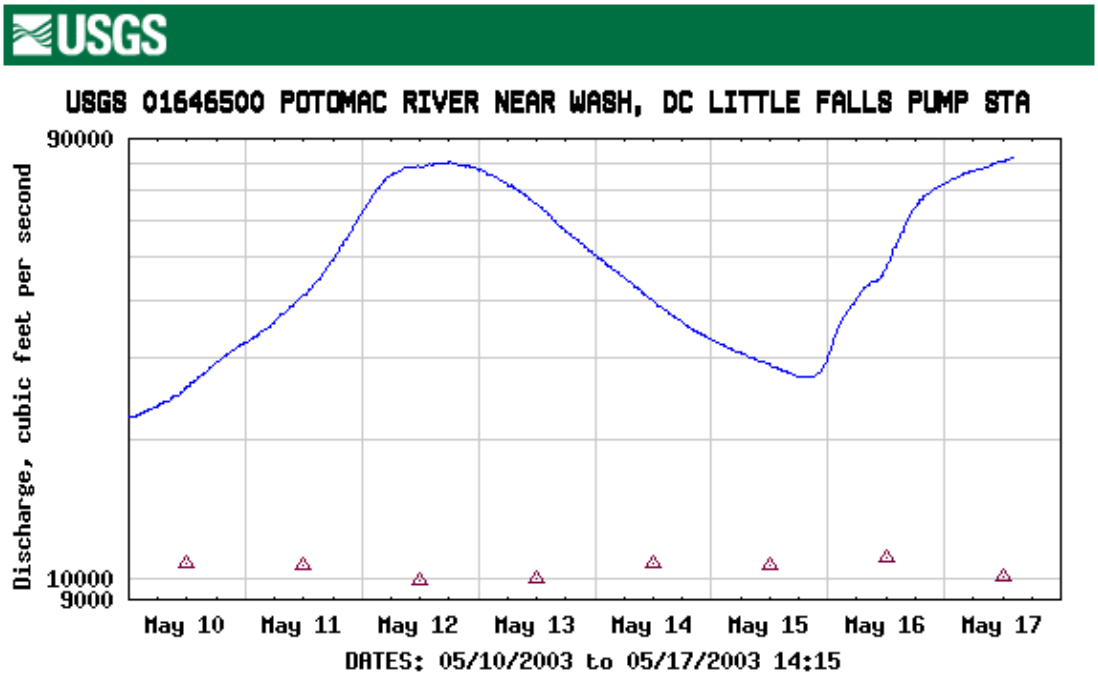

A
B
1
s.l. 1
2
n_1
s.l. 2
3
n_1
n_2
s.l. 3
4
n_1
n_2
n_3
s.l. 4
5
n_1
n_2
n_3
n_4
s.l. 5

Fig. 3B


Pool levels, Great Falls
Uncertainty
Great Falls
Yellow Falls
Stubblefield Falls
Piedmont
Coastal Plain
vertical-exaggeration = x164
Elevation Relative to Sea Level Feet
Distance from Zero Points of Reference Line, Kilometers





May 17, 2003, 2:15 pm Current Flow 81,900 cubic feet per second