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Newsletter of the Mid-Atlantic Association of Professional Soil Scientists
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2021 MAPSS NEWS AND PLANS, President Annie Rossie

Dear MAPSS members, I hope this edition of Pedologue finds you well. Like many things, MAPSS activities have been on pause for the past year, but we are hopeful that will change this year. The Executive Council met on March 2nd, 2021, to discuss planning for the upcoming year. Last year we decided to postpone the election of new officers so that those elected in 2019 would actually have a chance to plan and hold events. We had hoped it would have been a much shorter delay than it ended up being! While we can't yet plan a large group event, we are hopeful that it will be possible later this summer. In the meantime, we are conducting a few of our typical annual business meeting activities electronically.

The 2021 election is being conducted using google forms. Use the following link to vote on this year's nominees: https://forms.gle/udVBKF2qZCRLs2a48

We have multiple candidates for each position, so your vote is important! Please vote by May 1st, 2021. We will send out the results as soon as they are available. Thank you to all the nominees for their willingness to run and serve!

These are the current executive council members who will be staying on for 2021:

President: Susan Lamb

President Elect: Ben Marshall

Vice-President: TBD

Past President: Annie Rossi-Gill

Treasurer: Sarah Roberts

Secretary: TBD

Members at Large: Bill Effland (until 2022) and TBD (until 2023)

Board of Directors: Jim Chaconas (until 2022), John Wah (until 2023), and TBD (until 2024)

Ex-Officio Member (State Soil Scientist): Phil King

Thank you to the officers whose terms are ending: Josh Stallings (Member at Large), Jenwei Tsai (Secretary), Bruce Bagley (Past President), and Barry Glofelty (Board of Directors). Thank you for your service!

If you have not yet paid your annual membership dues, please send them to Treasurer Sarah Roberts. If you'd like to pay using paypal, please contact Sarah at sroberts@biohabitats.com. Thank you to everyone who has already paid their dues! Note renewal form if you care to use it, Page 34 this issue

The executive council has decided to start charging consultants to be listed on the MAPSS website. This is being done to defray the costs of hosting the website. The charge will be $10 a year and you must be a MAPSS member to be listed. If you would like to be listed on the website, please fill out the consultant form (on-line or see page 35 this issue) and send with payment to Sarah. Website listing payments are due April 30, 2021. After the 30th, we will remove anyone listed who has not paid for 2021.

Finally, the treasurer's report is attached to another version of this report that has been sent by Secretary Jenwei Tsai by e-mail to MAPSS members. It shows the 2020 income and expenditures and the 2021 budget. We recognize that the 2021 budget is somewhat subject to change as we determine what events and activities will be possible this year.

If you have any questions about the election, 2021 plans, dues, or the website, please feel free to contact me (ann.rossigill@usda.gov) or President-Elect Susan Lamb (susan.lamb@usda.gov). Please stay safe and healthy, and I look forward to seeing you all at a MAPSS event as soon as it can happen! Annie

Editors' comments:

We are using President, soon to be past-president, Annie Rossi's 2021 MAPSS News and Plans as our cover story in this issue. To see who the candidates for the election of new officers are, readers will need to click on the ballot web site given in Annie's report. This scheme seems to allow one to vote multiple times, but since the voter needs to identify him or herself, our honest vote counters should be able to sort all of this out to give us a fair election. We anxiously await the results that should be known sometime in May. Best of Luck to our new President Susan Lamb and her fellow officers with hopes that the membership may come together in-person sometime this year.

This issue with a total of 35 pages may be the longest Pedologue issue ever published, in spite of only a couple of technical articles and no new soil judging contests to report on.

In this issue

Calendar of some coming events

TBD next MAPSS meeting

Nov. 7-10, 2021 ASA-CSSA-SSSA 2021 Annual Meeting, Salt Lake City, UT. About | ASA, CSSA & SSSA International Annual Meetings (acsmeetings.org)

Nov. 21-26, 2021. 9th International Acid Sulfate Soils Conference, University of Adelaide, Adelaide, Australia. https://biological.adelaide.edu.au/acid-sulfate-soil/iassc/ **A check of this website 4/21/21 indicates that this conference has been canceled again, was originally scheduled for 2020, now to take place in Nov. 2022 or early in 2023.**

June 13-16, 2022. Northeast Soil Survey Work Planning Conference, University of Delaware, Newark, DE https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/partnership/ncss/?cid=nrcs142p2_053541

Future articles etc.,

Pedologue needs articles, pictures, poems, cartoons, letters to the editor or other things soil scientists and/or other readers may be inspired to submit. Please submit such items to the editors (preferably to DelvinDel@aol.com, alternatively dsf@umd.edu Be an author, support your newsletter! It's a way to promote your work, our community, and things we all need to know about soils and the environment.

2021 MAPSS Officers:	**Board of Directors**
President Susan Lamb	Jim Chaconas to serve 1 year
Past President Annie Rossi	John Wah to serve 2 years
President Elect Ben Marshall	TBD to serve 3 years
Vice President TBD	**Chairs of Standing Committees**
Treasurer Sarah Roberts	**Finance** Vacant
Secretary TBD	**Constitution and By-Laws** Gary Jellick
Member at Large to serve 2 years TBD	**Membership and Ethics:**
Member at Large to serve 1 year Bill Effland	**Nominations** Annie Rossi
Ex officio Member Phil King	**Education and Public Relations** Delvin Fanning
	Certification Vacant

CHECK OUT THE MAPSS WEBSITE: http://www.midatlanticsoilscientists.org/

Fragic Soils Occurrence in Maryland

By William R. Effland, Ph.D, weffland@gmail.com
Myersville, MD

Introduction

For this report, "MD Fragic soils" are soils with subsurface horizons described as fragipans that occur in MD and may also occur in other Eastern US states. Most MD counties contain some soil map unit areas of Fragic soils except the region roughly south and east of an east-west line trending along Rt 50 and Rt 404 on the Delmarva peninsula. Fragic soils were not mapped in Caroline, Talbot, Dorchester, Wicomico, Worcester and Somerset counties (Figure 1). MD Soils with fragipans are classified in either the Alfisols or Ultisols Soil Orders which at the Great Group level include Fragiaqualfs, Fragiudalfs, Fragiaquults and Fragiudults plus the Ultisols Subgroup of Fragiaquic Hapludults and the Alfisols Subgroup of Fragiaquic Hapludalfs (USDA Soil Taxonomy).

Fragipans are dense subsurface soil horizons (commonly "Bx, Btx, 2 Btgx, 2Btx", etc.) that typically occur below or within an argillic, cambic, albic or spodic horizon; have high bulk density and low organic matter content relative to adjacent horizons; may have bleached soil prism faces; commonly restrict plant root growth, and in most soils, seasonally "perch shallow groundwater" as zones of episaturation (ST, 2nd ed). Soil structure varies from structureless-massive to coarse prismatic, platy and subangular blocky. Soil rupture-resistance (formerly *consistence*) varies from firm to extremely firm for moist peds, and moderately hard to very hard for dry peds. Soil peds placed in water typically "slake" or auto-disperse into primary particles without agitation or other physical stresses. Various theories have been proposed for the horizon density/ped brittleness and auto-disintegration ranging from close packing, clay bridging/binding, amorphous aluminosilicate cements to hydro-consolidation processes (Schaetzl and Thompson, 2015).

Select morphological indicators of soil saturation include redoximorphic features such as "common medium faint grayish brown (10YR 5/2) redoximorphic depletions and common medium distinct brownish yellow (10YR 6/6) masses of iron accumulation in vertical streaks throughout the horizon" and "common coarse prominent gray (7.5YR6/1) iron depletions and common coarse prominent yellowish red (5YR5/6) masses of oxidized iron on faces of peds." (Official Series Descriptions and USDA Soil Taxonomy, 2nd ed.).

The objectives of this note were: (1) to identify and examine soils mapped (i.e., "occur") in MD described with a fragipan diagnostic subsurface horizon ("MD Fragic soils"); (2) to describe the soil geographic distributions of these Fragic soils; (3) to review, analyze, and summarize selected morphological properties; and (4) to briefly discuss the morphology and genesis of fragipans in MD based on available OSD and NSSC pedon data.

Methods

The occurrence of MD soils classified with the Fragic Great Groups was initially determined from the USDA-NRCS SSURGO 2016 soils data (Soil Survey Staff, 2016) using ArcGIS analysis of the dominant soil components in the gSSURGO database. gSSURGO is the raster version of the SSURGO data. Various USDA-NRCS web-based query tools i.e. Soil Data Explorer, Series Extent Tool were used for data extraction and compilation (https://soilseries.sc.egov.usda.gov/ ; https://casoilresource.lawr.ucdavis.edu/sde/). The Official Series Descriptions (OSDs) were the information source of the year that each soil series was established; fragipan morphology, soil drainage class, parent materials, and horizon depth minimum and maximum data.

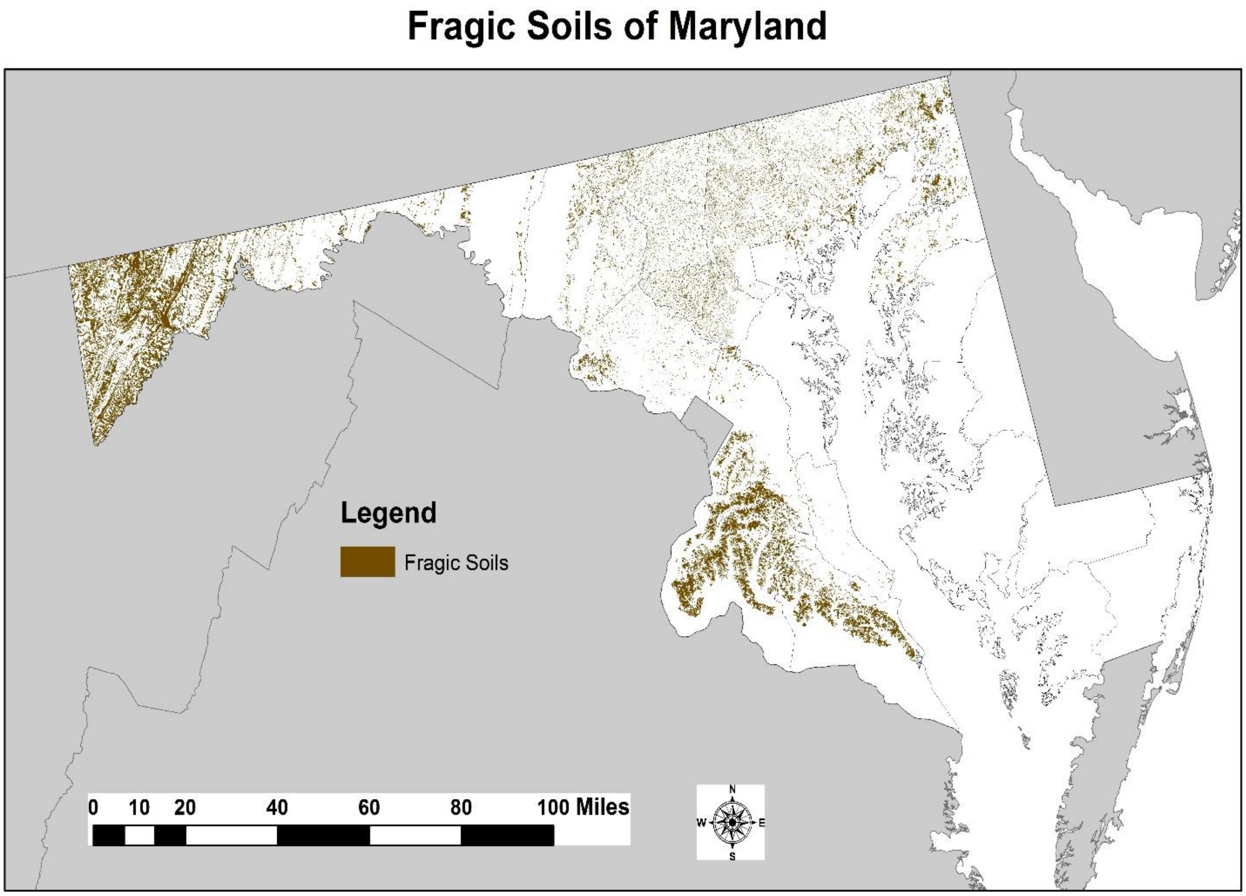


Figure 1. Areas with MD Fragic Soils

<u>Soil Geographic Distribution</u>

Soil Series extent acreages as reported here were determined using the NRCS Series Extent Explorer (SSURGO, February 2017) of <u>ALL acres mapped</u> in the US for the 31 listed Soil Series. MD-specific acre estimates were not reported here except for Soil Series that only occur in MD. Thirty-one Soil Series (Table 1; 6,433,486 acres) were examined for this geospatial taxonomic analysis. Five Soil Series (Buchanan, Laidig, Cookport, Ernest and Brinkerton) occur in about 65% of total acres for the Fragic Soil Series described in this note (Table 1).

Table 1. Fragic Soil Series, Taxa-Subgroup, State Est., ALL US Acres**, and Year Established

Soil Series	**Taxa**	**State_est**	**ALL_acres**	**YR_Estab**
Leonardtown*	Typic Fragiaquults	*MD*	2,047	1900
Tyler	Aeric Fragiaquults	WV	68,383	1907
Robertsville	Typic Fragiaqualfs	MI	55,276	1911
Croton	Typic Fragiaqualfs	NJ	78,261	1917
Monongahela	Typic Fragiudults	PA	284,135	1921
Aldino	Typic Fragiudalfs	*MD*	7,001	1927
#Cookport	**Aquic Fragiudults**	**PA**	**877,651**	**1931**
#Ernest	**Aquic Fragiudults**	**PA**	**808,048**	**1931**
Hustontown	Oxyaquic Fragiudalfs	PA	20,444	1931
#Buchanan	**Aquic Fragiudults**	**PA**	**1,072,141**	**1932**
Raritan	Aquic Fragiudults	NJ	15,317	1937
Readington	Oxyaquic Fragiudalfs	NJ	113,401	1937
Rohrersville	Fragiaquic Hapludalfs	*MD*	21,300	1938
Trego	Fragiaquic Hapludults	*MD*	13,780	1938
Beltsville	Typic Fragiudults	*MD*	145,588	1939
#Brinkerton	**Typic Fragiaqualfs**	**PA**	**404,766**	**1939**
Butlertown	Typic Fragiudults	*MD*	26,762	1939
Glenville	Aquic Fragiudults	PA	197,760	1939
#Laidig	**Typic Fragiudults**	**PA**	**1,063,044**	**1940**
Nolo	Typic Fragiaquults	PA	73,435	1940
Clarksburg	Oxyaquic Fragiudalfs	PA	243,129	1942
Andover	Typic Fragiaquults	PA	135,168	1948
Airmont	Fragiaquic Hapludults	VA	7,284	1954
Albrights	Aquic Fragiudults	PA	137,814	1960
Aura	Typic Fragiudults	NJ	120,320	1960
Meckesville	Typic Fragiudults	PA	269,110	1960
Abbottstown	Aeric Fragiaqualfs	PA	90,295	1965
Bourne*	Typic Fragiudults	VA	45,409	1970
Penlaw	Aquic Fragiudalfs	PA	26,158	1971
Wiltshire	Oxyaquic Fragiudalfs	*MD*	8,123	2001
Aquasco	Aquic Fragiudults	*MD*	23,436	2006

*No NSSC-NSSL lab data; #Greater than 400,000 acres extent
**Sources: Soil Series Extent Maps accessed 4/24/2020

Fragic soils that occur in MD were found in two Soil Orders – Alfisols (1,205,968 acres) and Ultisols (5,248,818 acres). **Acres reported for each Soil Series include all of the US states where it is mapped**. Suborders with Udic or Aquic soil moisture regimes were predominantly Udults (4,969,785 acres) followed by Aqualfs (628,598 acres); Udalfs (577,370 acres); and Aquults (279,033 acres). Five Great Groups of Ultisols and Alfisols - Fragiudults, Fragiaquults, Hapludults, Fragiudalfs, and Fragiaqualfs were identified for soils with fragipans that occur in MD. Eleven Subgroups (Figure 2) included Aquic Fragiudults (46%; 2,994,353 acres); Typic Fragiudults (30%; 1,954,368 acres); Typic Fragiaqualfs (8%; 538,303 acres); with the others below 500,000 acres. Typic Fragiudults (8 Soil Series) and Aquic Fragiudults (6 Soil Series) are the predominant

Fragic Subgroups. Two Soil Series (Trego, Airmont) are Fragiaquic Hapludults that occur on about 21,000 acres, and the Rohrersville Soil Series is a Fragiaquic Hapludalfs that also occurs on 21,300 acres.

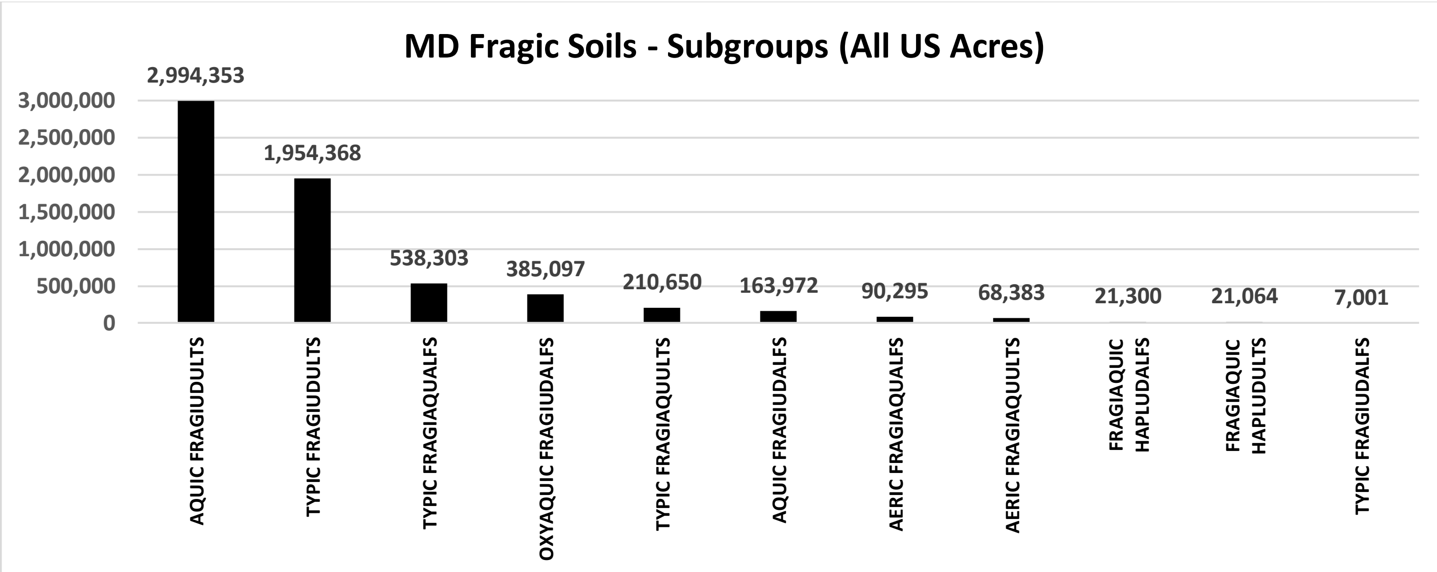


Figure 2. Areas of the MD Fragic Soils by Subgroups

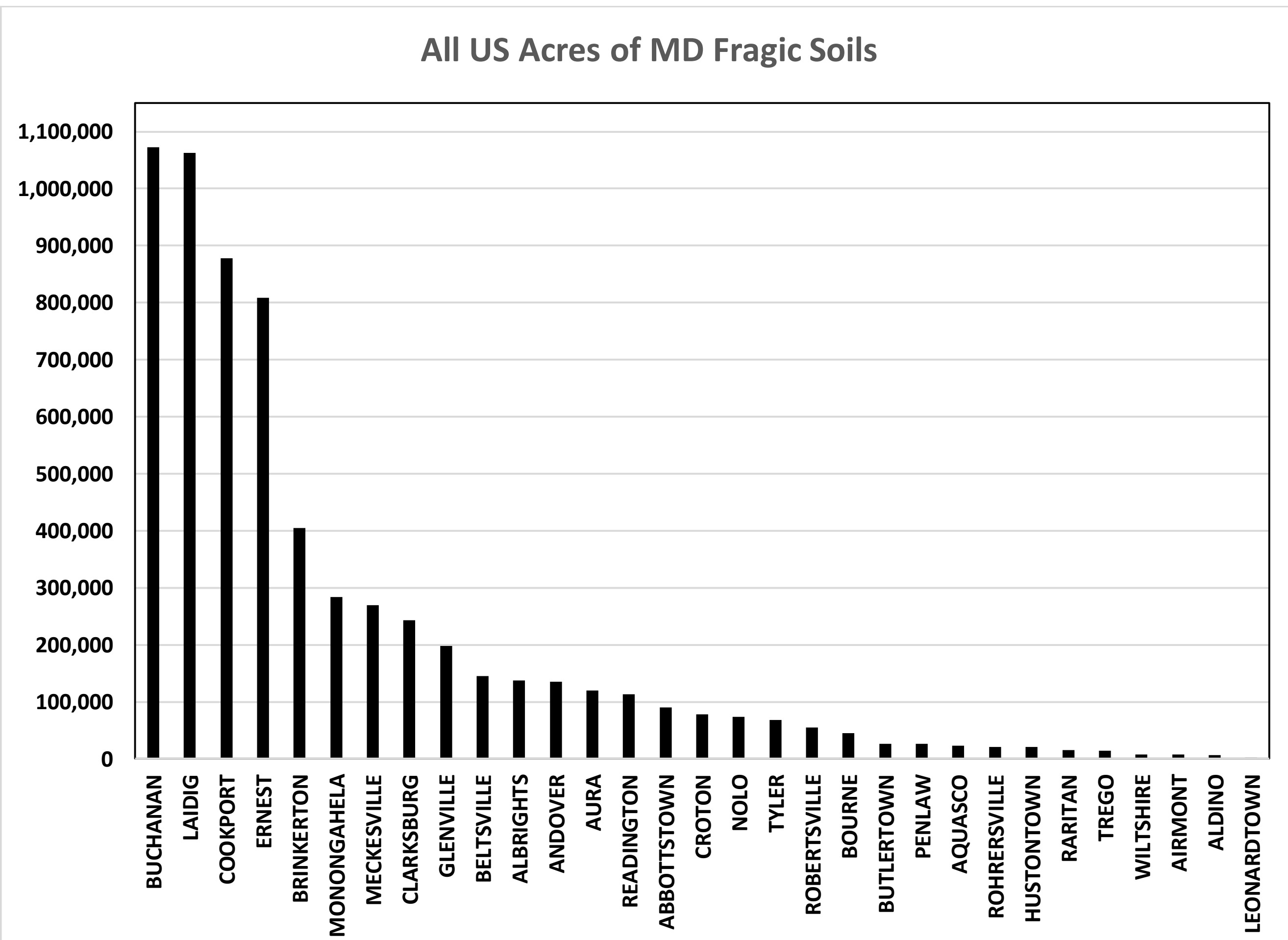


Figure 3. ALL US Acres of the 31 Fragic Soil Series that occur in Maryland

<u>Selected MD Soils within the Fragic Subgroups</u>

This section examines several Soil Series by Fragic Subgroup that occur entirely within MD and/or were established in MD. The Fragic Soil Series and Year established in MD include: Aldino (1927), Aquasco (2006), Beltsville (1939), Butlertown (1939), Leonardtown (1900), Rohrersville (1938), Trego (1938), and Wiltshire (2001).

For this analysis, two SSURGO Soil Components classified as Fragic that were mapped in MD but are not discussed further here include (1) **Stony land, steep (SrF)** classified as fine-loamy, siliceous, mesic Typic Fragiudults formed in old alluvium derived from red shale and siltstone, and well drained; and (2) **Very stony land (VsD)** classified as fine-loamy, mixed, mesic Aquic Fragiudults formed in loamy alluvium derived from greenstone, and well drained.

Table 2. Fragic Soils Occurrence by MD County*

Allegany	**Anne Arundel**	**Baltimore**	**Baltimore City**	**Charles**	**Calvert**
Buchanan	Butlertown	Beltsville	Leonardtown	Aquasco	Aquasco
Clarksburg		Glenville		Beltsville	Beltsville
Ernest		Wiltshire			
Brinkerton					
Hustontown					
Monongahela					
Penlaw					
Tyler					

Carroll	**Cecil**	**Harford**	**Howard**	**Frederick**	**Kent**
Abbottstown	Aquasco	Aldino	Beltsville	Abbottstown	Butlertown
Croton	Beltsville	Beltsville	Glenville	Airmont	
Glenville	Butlertown	Glenville	Wiltshire	Croton	
Raritan	Glenville	Leonardtown		Glenville	
Rohrersville	Leonardtown			Rohrersville	
Wiltshire				Trego	
				Wiltshire	

Montgomery	**Queen Annes**	**Garrett**	**Washington**	**St. Marys**	**Prince George's**
Croton	Aquasco	Albrights	Andover	Beltsville	Aquasco
Glenville	Butlertown	Andover	Airmont	Bourne	Beltsville
		Brinkerton	Brinkerton	Leonardtown	Leonardtown
		Cookport	Buchanan		
		Ernest	Monongahela		
		Meckesville	Rohrersville		
		Nolo	Trego		
			Tyler		

Source: NRCS Soil Series Extent Maps, 2020, https://casoilresource.lawr.ucdavis.edu/

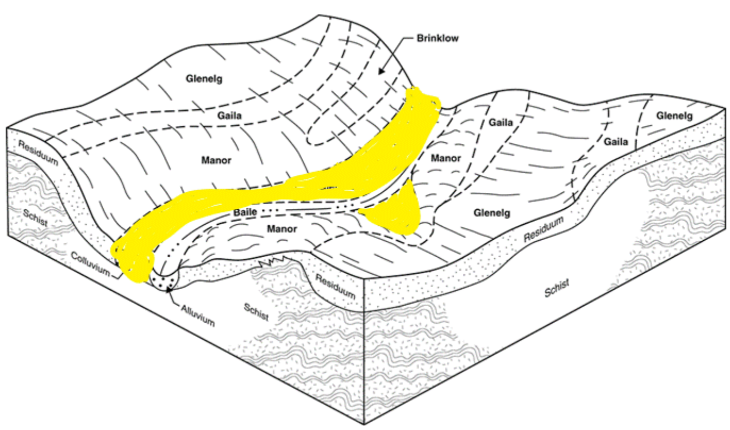
<u>Selected MD Soil Landscapes and Fragipan Soil Morphology</u>

Aquic Fragiudults - Glenville Soils

Glenville soils are Aquic Fragiudults formed in loamy colluvium from phyllite, gneiss and/or schist that commonly occur in the "heads of minor drains." Darmody and Foss (1982) described the MD Piedmont soil landscape relationships for the Glenelg-Manor-Elioak-Chester-Glenville soil series (see Figure 4 lower graphic). [Frederick, Carroll, Montgomery, Howard, Baltimore, Harford, Cecil]

Btx--*19 to 25 inches, brown (10YR 5/3) silt loam; weak coarse prismatic structure parting to moderate thick platy structure; very firm, brittle, slightly sticky, slightly plastic; common distinct clay films throughout; many distinct light brownish gray (10YR 6/2) iron depletions on vertical faces of peds and common many prominent strong brown (7.5YR 5/8) masses of oxidized iron between peds; 10 percent gravel; moderately acid; gradual wavy boundary. (15 to 40 centimeters thick)*
Btgx--*25 to 33 inches; light brownish gray (10YR 6/2), and brown (10YR 5/3) silt loam; weak coarse prismatic structure parting to moderate very thick platy structure; very firm and brittle; slightly sticky and slightly plastic; common distinct clay films on bottom faces of peds; few distinct gray (10YR 6/1) iron depletions and common distinct yellowish brown (10YR 5/4) masses of oxidized iron on vertical faces of peds; 10 percent quartzite channers; common mica flakes; moderately acid; gradual wavy boundary. (0 to 40 centimeters thick)* [Source: OSD from https://soilseries.sc.egov.usda.gov/ on 10/31/2019]

Figure 4. Soil landscape of Glenville Soil Series (modified from https://www.nrcs.usda.gov/Internet/NRCS_DIAGRAMS/graphics/MD-2010-09-10-08.tif)



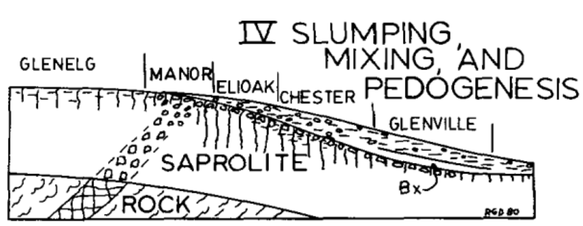


Fig. 4—Idealized sequence of landscape evolution and pedogenesis in the Piedmont of Maryland.

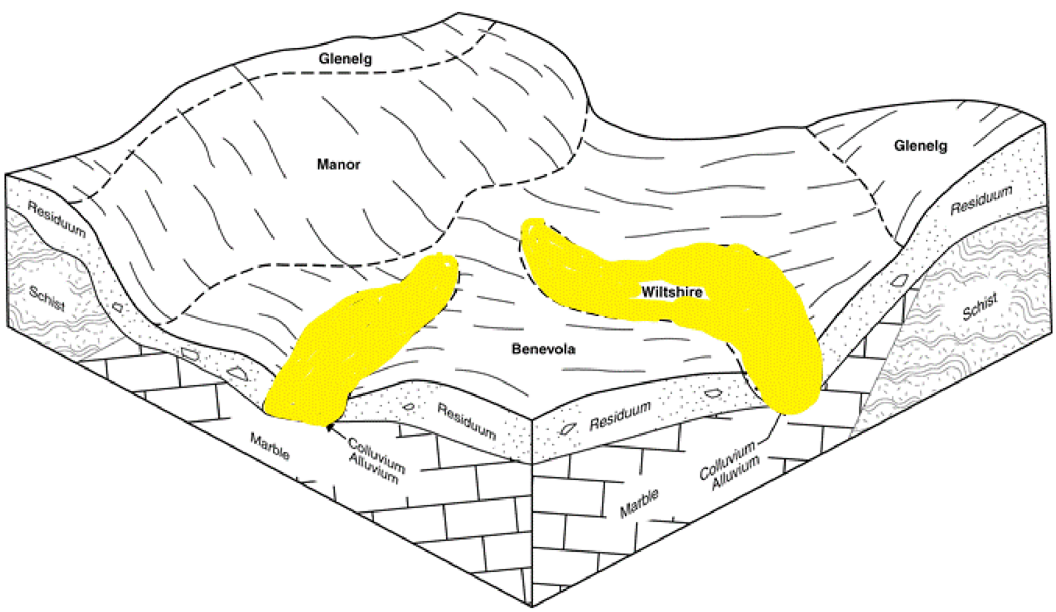
Source: Darmody and Foss, 1982

Oxyaquic Fragiudalfs -Wiltshire Soils

Wiltshire soils are Oxyaquic Fragiudalfs formed in "colluvium of micaceous schist, phyllite, and greenstone schist over residuum from low-grade marble" and occur in upland depressions and footslopes of the Northern Piedmont. [Frederick, Carroll, Howard, Baltimore]

Bx--*29 to 43 inches; dark yellowish brown (10YR 4/6) loam; weak coarse and very coarse prismatic structure parting to moderate medium platy; firm; common fine roots between peds; common fine vesicular pores and common very fine and fine tubular pores; common fine and medium prominent grayish brown (10YR 5/2) soft iron depletions on faces of peds and common fine and medium distinct strong brown (7.5YR 4/6) soft iron accumulations on faces of peds and ped interiors; 12 percent sub-rounded mixed-igneous and metamorphic gravel; brittle in the lower portion of the horizon, slightly acid; abrupt wavy boundary. (10 to 20 inches)* [Source: OSD from https://soilseries.sc.egov.usda.gov/ on 10/31/2019]

Figure 5. Soil landscape of Wiltshire Soil Series (modified from https://www.nrcs.usda.gov/Internet/NRCS_DIAGRAMS/graphics/MD-2010-09-10-07.tif)

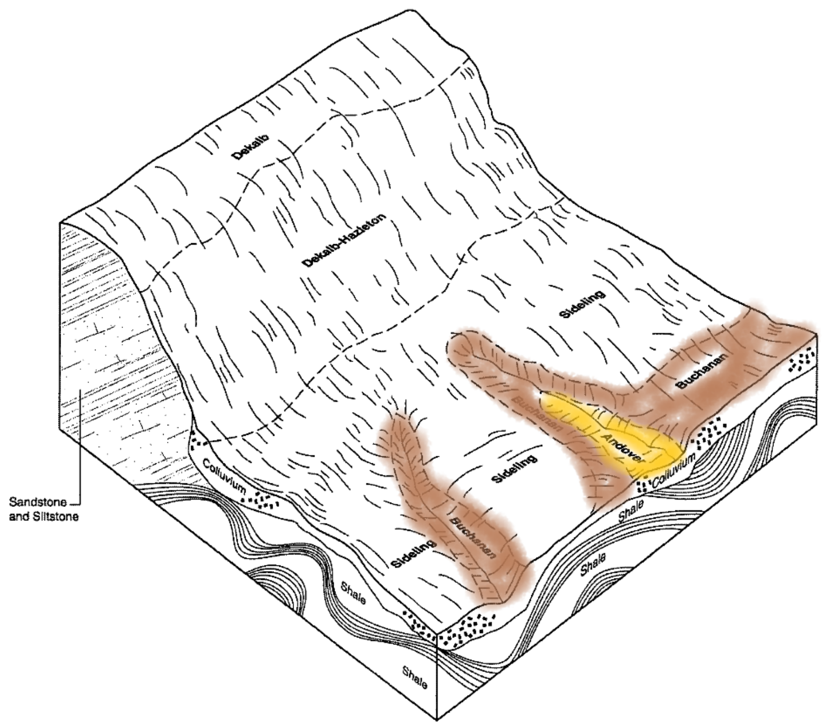


Typic Fragiaquults – Andover

Andover soils are Typic Fragiaquults formed in "loamy colluvium from sandstone-shale" and occur on benches, toeslopes, footslopes, and swales along the base of prominent ridges. [Garrett, Washington]

Btgx1--*19 to 35 inches; yellowish brown (10YR 5/4) cobbly clay loam; prismatic structure parting to moderate thick platy; very firm, brittle, moderately sticky, moderately plastic; common prominent clay films on plates and in pores; gray (10YR 6/1) iron depletions on faces of prisms and light brownish gray (10YR 6/2) iron depletions on faces of plates; 30 percent rock fragments 1 to 6 inches in diameter; strongly acid; clear wavy boundary.*
Btgx2--*35 to 49 inches; brown (10YR 5/3) very cobbly clay loam; weak very coarse prismatic structure parting to weak thick platy; firm, brittle, moderately sticky, moderately plastic; common distinct clay films on plates and in pores; many coarse distinct strong brown (7.5YR 5/6) iron accumulations; very gray (10YR 6/1) and grayish brown (10YR 5/2) iron depletions on faces of plates; 40 percent rock fragments 1 to 6 inches in diameter; strongly acid; clear wavy boundary. (Combined thickness of the Btgx horizon is 26 to 39 inches.)* [Source: OSD from https://soilseries.sc.egov.usda.gov/ on 10/31/2019]

Figure 6. Soil landscape of Andover and Buchanan Soil Series (modified from https://www.nrcs.usda.gov/Internet/NRCS_DIAGRAMS/graphics/MD-2012-02-03-29.tif)

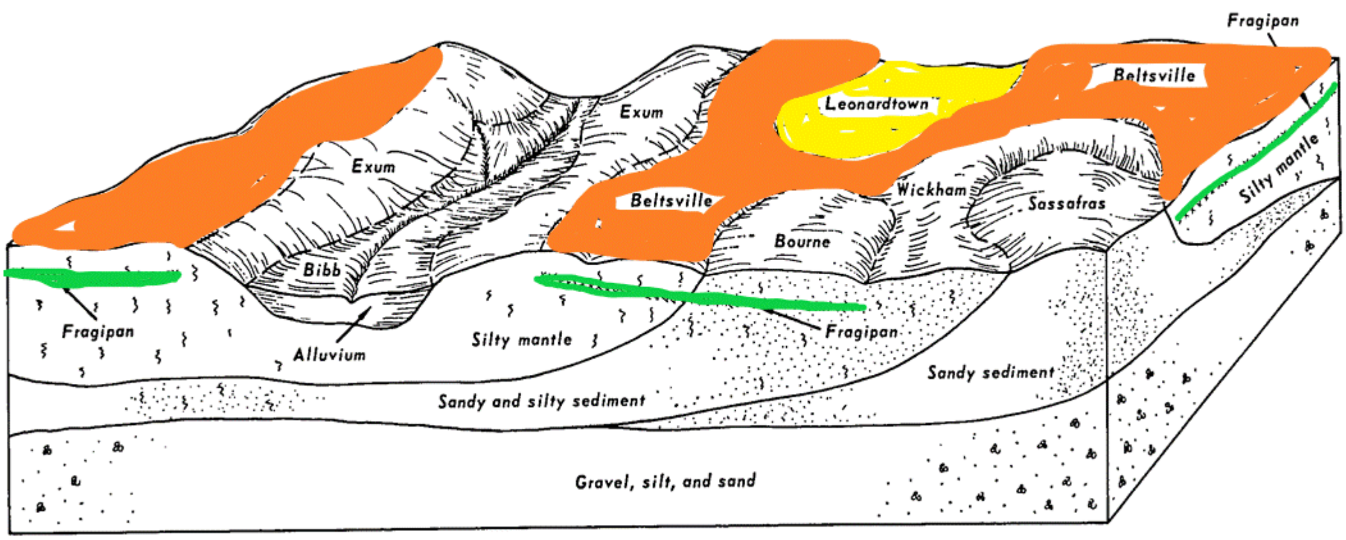


Typic Fragiudults - Beltsville

Beltsville soils are Typic Fragiudults formed in "silty eolian deposits over sandy or loamy fluviomarine deposits" and occur on broad interstream divides, fluviomarine terraces, interfluves, and uplands. Nikiforoff (1955) described early research on the Beltsville soils in the USGS report "Hardpan Soils of the Coastal Plain of Southern Maryland" indicated the Beltsville soil series was originally considered as a member of the Leonardtown soil series. [Charles, Calvert, Prince Georges, St. Mary, Howard, Baltimore, Harford, Cecil]

Btx1--*51 to 71 cm (20 to 28 inches); yellowish brown (10YR 5/6) loam; moderate very coarse prismatic structure parting to moderate thin platy; very firm; many fine roots between peds; many fine vesicular pores; common clay films on faces of peds; common medium prominent light brownish gray (10YR 6/2) iron depletions; and many medium faint strong brown (7.5YR 5/6) iron concentrations; 12 percent gravels; brittle; very strongly acid (pH 4.7); clear wavy boundary.*
Btx2--*71 to 104 cm (28 to 41 inches); light brown (7.5YR 6/4) loam; weak very coarse prismatic structure parting to weak thick platy; very firm; common very fine and fine roots between peds; many fine vesicular pores and common medium vesicular pores and few coarse vesicular pores; common prominent clay films on faces of peds and in pores; 13 percent gravel; brittle in 95 percent of mass; very strongly acid (pH 4.6); clear wavy boundary. (Combined thickness of the Btx horizons is 15 to 124 cm)* [Source: OSD from https://soilseries.sc.egov.usda.gov/ on 10/31/2019]

Figure 7. Soil landscape of Leonardtown, Bourne, and Beltsville Soil Series (modified from https://www.nrcs.usda.gov/Internet/NRCS_DIAGRAMS/graphics/MD-2012-02-03-10.tif)

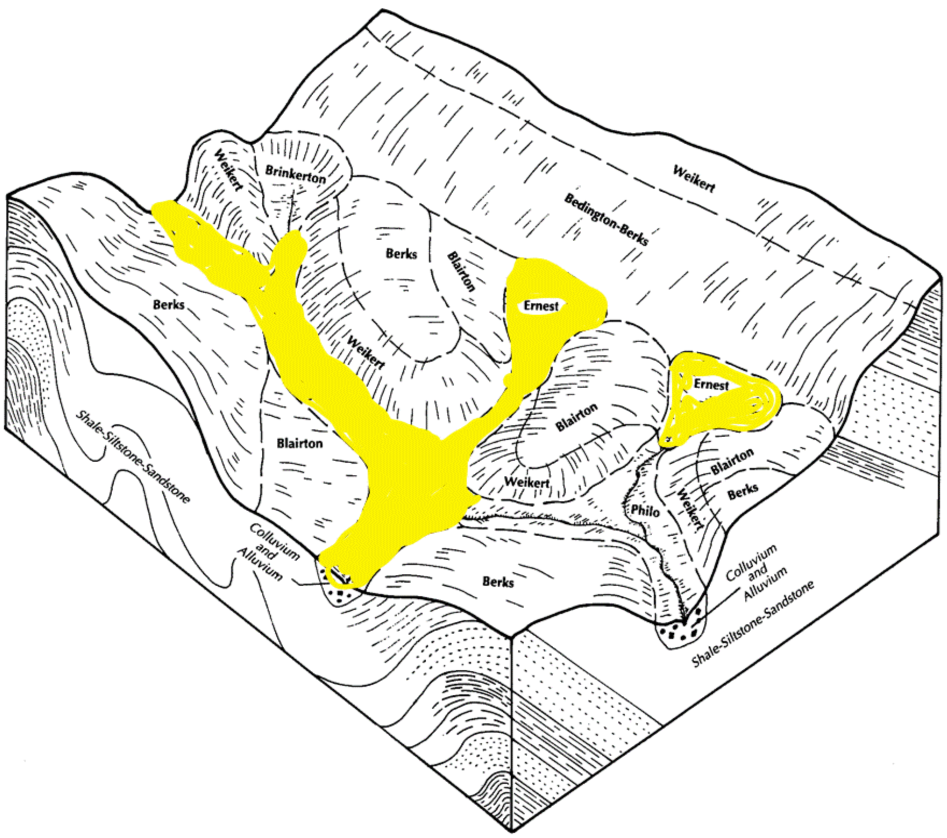


Aquic Fragiudults– Ernest

Ernest soils are Aquic Fragiudults formed in "loamy colluvium from sandstone and shale" and occur on hills and hillslopes. [Garrett, Allegany]

Btx1-- *76 to 94 cm (30 to 37 inches); yellowish brown (10YR 5/6) channery silt loam; moderate very coarse prismatic structure, and moderate medium subangular blocky structure; firm, slightly sticky, slightly plastic; few very fine and fine roots between peds; 10 percent prominent manganese or iron-manganese stains on faces of peds and 60 percent prominent clay films on faces of peds and in pores; 10 percent medium distinct irregular strong brown (7.5YR 5/6) masses of oxidized iron in matrix surrounding redox depletions and 25 percent medium prominent irregular light brownish gray (10YR 6/2) masses of reduced iron on faces of peds; 15 percent subangular acid shale fragments; strongly acid, (pH 5.4); clear wavy boundary.*
Btx2-- *94 to 160 cm (37 to 63 inches); dark yellowish brown (10YR 4/4) channery silt loam; strong very coarse prismatic structure, and weak medium subangular blocky structure; very firm, slightly sticky, slightly plastic; 5 percent prominent manganese or iron-manganese stains on faces of peds and 25 percent prominent clay films on faces of peds; 10 percent coarse prominent irregular light brownish gray (10YR 6/2) masses of reduced iron on faces of peds and 10 percent coarse distinct irregular brownish yellow (10YR 6/6) masses of oxidized iron in matrix surrounding redox depletions; 20 percent subangular acid shale fragments; strongly acid, (pH 5.4); gradual wavy boundary. (combined thickness of the Btx horizon is 25 to 102 cm)* [Source: OSD from https://soilseries.sc.egov.usda.gov/ on 10/31/2019]

Figure 8. Soil landscape of the Ernest Soil Series (modified from https://casoilresource.lawr.ucdavis.edu/ncss_block_diagrams/PA-2012-03-12-12.png)

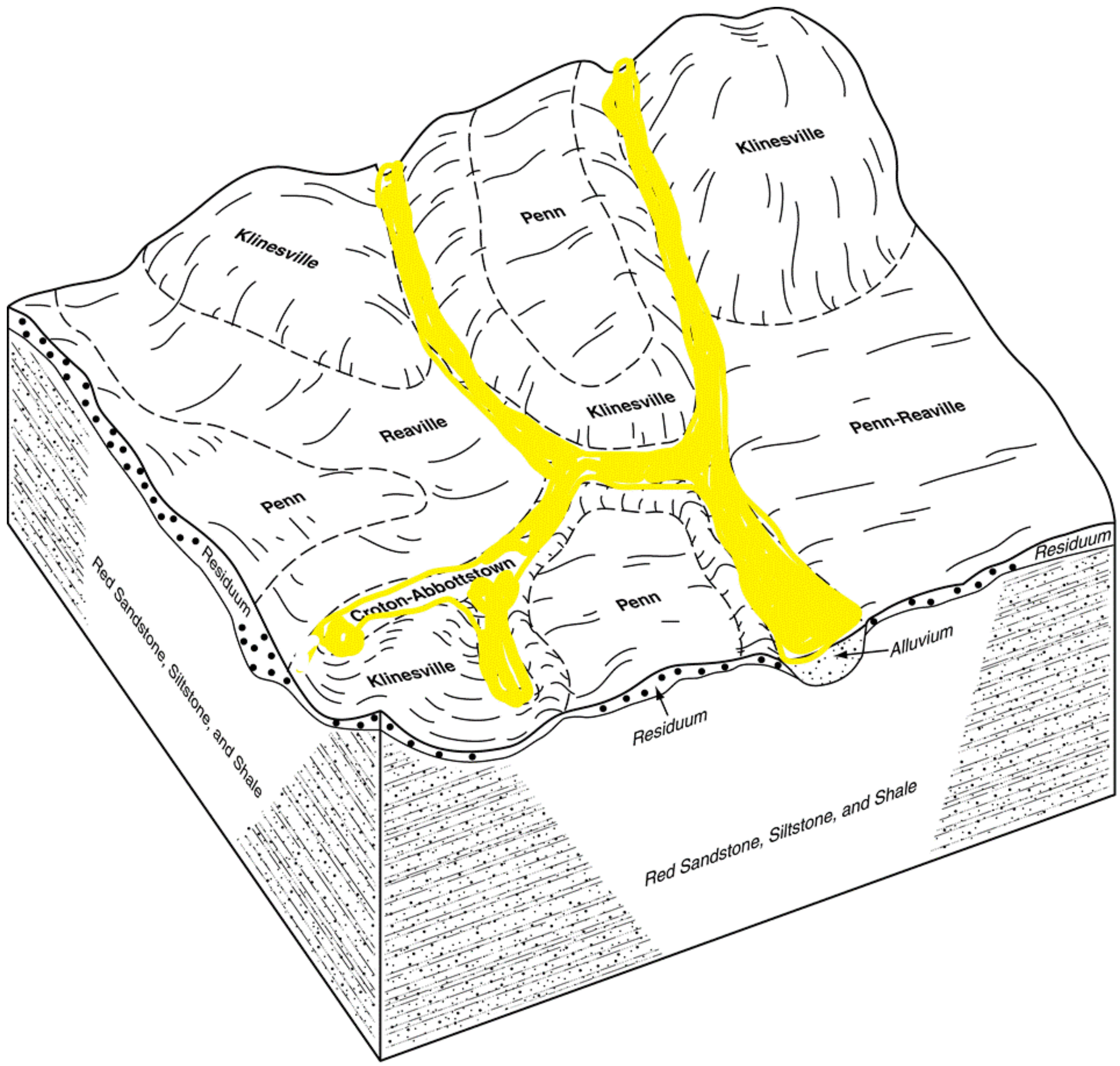


Typic Fragiaqualfs – Croton

Croton soils are Typic Fragiaqualfs formed in "medium textured colluvial materials mainly over Triassic sandstone, siltstone, or shale" and occur in basins, depressions, drainageways, and swales. The OSD states "The [Croton] soils formed mostly in residuum weathered from fine-grained silty sandstones, argillites siltstones or red shales, but the upper soil horizons of some pedons formed in a thin silt layer deposited by either wind or water." [Frederick, Carroll, Montgomery]

Btxg*--18 to 36 inches; strong brown (7.5YR 5/6) silty clay loam; very coarse prismatic parting to moderate medium platy structure; brittle, very firm; few roots distributed along faces of peds; light brownish gray (10YR 6/2) coatings on peds; many medium and coarse dark gray (N 4/) iron depletions; few faint clay films on faces of peds and in voids; 10 percent subangular gravel; strongly acid; gradual smooth boundary. (Combined B-horizon thickness is 27 to 40 inches).*
Cx*--36 to 48 inches; brown (7.5YR 5/4) silty clay loam; massive; very firm; 15 percent subangular gravel; strongly to moderately acid; abrupt smooth boundary. (0 to 20 inches thick)* [Source: OSD from https://soilseries.sc.egov.usda.gov/ on 10/31/2019]

Figure 9. Soil landscape of the Croton and Abbottstown Soil Series (modified from https://casoilresource.lawr.ucdavis.edu/sde/?series=croton)

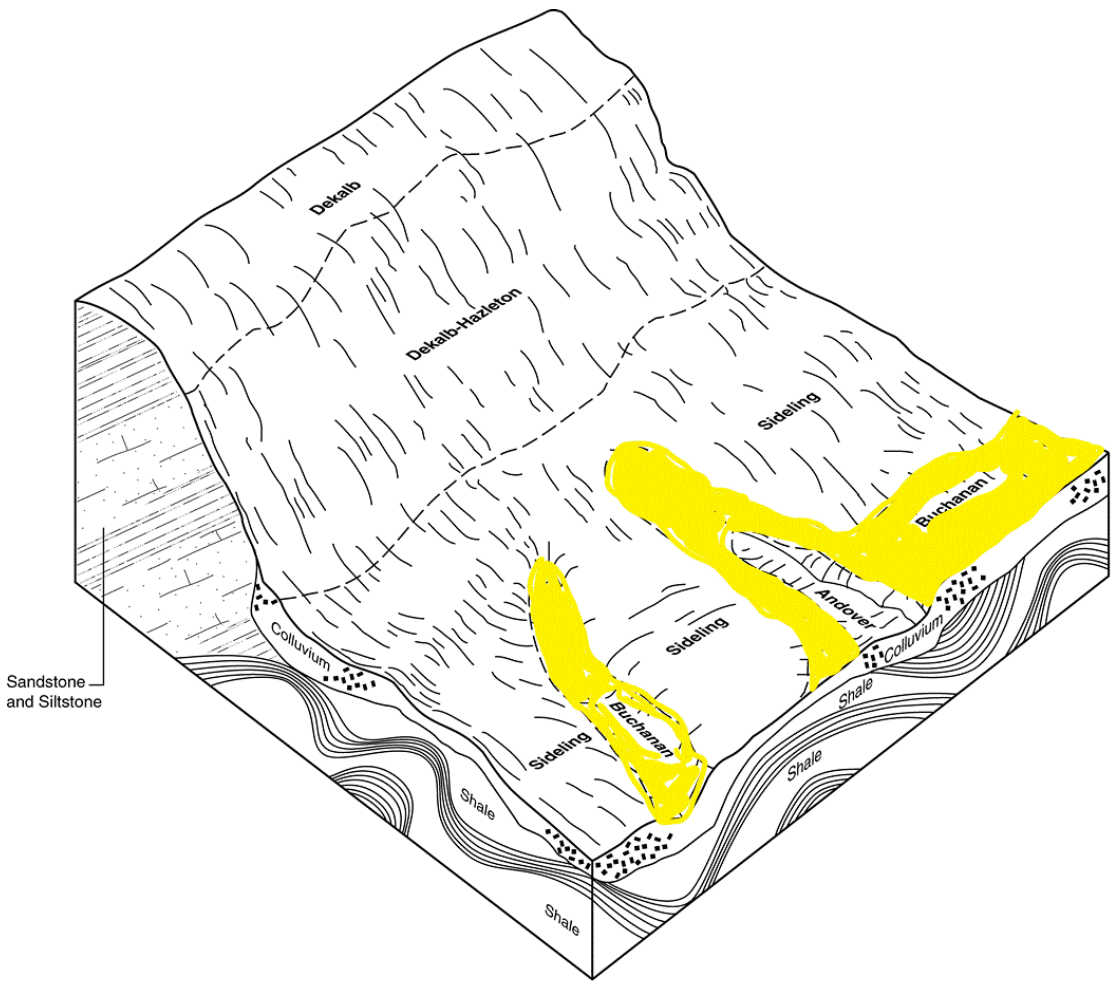


Aquic Fragiudults– Buchanan

Buchanan soils are Aquic Fragiudults formed in "colluvium from sandstone-quartzite-shale-siltstone" and occur on mountain terraces and footslopes extending into valleys along drainage ways. [Allegany, Washington]

Btx1--*74 to 86 cm (29 to 34 inches); yellowish brown (10YR 5/4) gravelly loam; moderate very coarse prismatic structure parting to weak thick platy and weak medium subangular blocky; firm, brittle, slightly sticky, slightly plastic; few faint clay films on faces of secondary peds; 25 percent gravel; strongly acid; common coarse distinct yellowish red (5YR 5/6) masses of iron accumulation and gray (10YR 6/1) iron depletions in ped interiors and on ped faces; clear wavy boundary.*
Btx2--*86 to 124 cm (34 to 49 inches); yellowish brown (10YR 5/6) gravelly loam; weak very coarse prismatic structure parting to weak thick platy and weak coarse blocky; firm, brittle, slightly sticky, slightly plastic; few faint clay films on faces of secondary peds; common dark coatings; 30 percent rock fragments of sandstone gravel; strongly acid; common coarse distinct gray 10YR 6/1) iron depletions in ped interiors and on ped faces and yellowish red (5YR 5/6) masses of iron accumulation in ped interiors; gradual wavy boundary. (Combined thickness of Btx horizons 33 to 125 cm (13 to 50 inches thick)* [Source: OSD from https://soilseries.sc.egov.usda.gov/ on 10/31/2019]

Figure 10. Soil landscape of Buchanan Soil Series (modified from https://casoilresource.lawr.ucdavis.edu/sde/?series=buchanan)

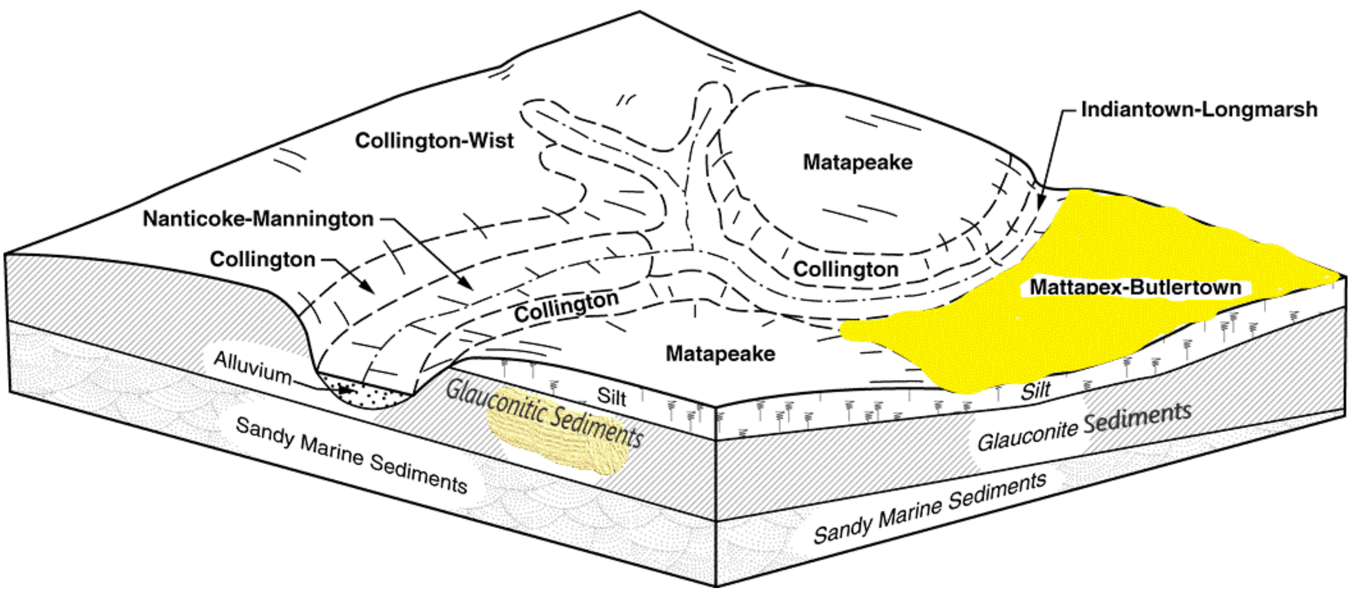


Typic Fragiudults – Butlertown

Butlertown soils are Typic Fragiudults formed in "silty eolian deposits over sandy or loamy fluviomarine deposits" and occur on broad interstream interfluves and uplands. [Anne Arundel, Cecil, Kent, Queen Annes]

Bx--*73 to 83 centimeters (29 to 33 inches); yellowish brown (10YR 5/6) silt loam; weak coarse prismatic structure parting to moderate medium platy; very firm, slightly sticky and plastic; few fine and medium roots in cracks; few very fine and fine tubular pores; few distinct strong brown (7.5YR 5/6) clay films on faces of peds; common medium distinct strong brown (7.5YR 5/8) soft masses of iron accumulation and common medium distinct light brownish gray (10YR 6/2) zones of iron depletion; very strongly acid; clear wavy boundary. (20 to 66 centimeters (8 to 26 inches) thick)*
BCx--*83 to 120 centimeters (33 to 48 inches); yellowish brown (10YR 5/4) loam; weak coarse prismatic structure parting to weak medium platy; very firm, slightly sticky and slightly plastic; few fine and medium roots in cracks; common very fine and fine vesicular pores; vertical lenses of very pale brown (10YR 7/3) loamy fine sand on prism faces; common fine distinct dark brown (7.5YR 3/2) soft masses of iron-manganese accumulation at top of horizon; common fine and medium distinct strong brown (7.5YR 5/8) soft masses of iron accumulation and common fine and medium distinct light brownish gray (10YR 6/2) zones of iron depletion; strongly acid; clear wavy boundary.* [Source: OSD from https://soilseries.sc.egov.usda.gov/ on 10/31/2019]

Figure 11. Soil landscape of Butlertown Soil Series (modified from https://www.nrcs.usda.gov/Internet/NRCS_DIAGRAMS/graphics/MD-2010-09-10-03.tif; "glauconitic sediments" as shown based on D. Fanning's personal communication)

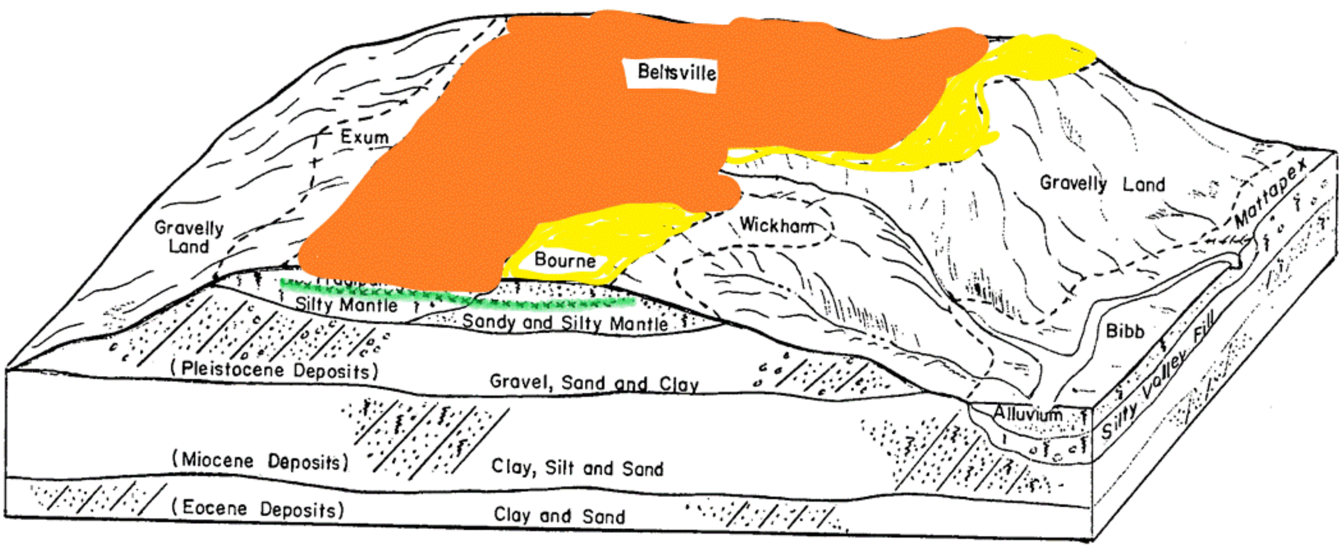


Typic Fragiudults – Bourne

Bourne soils are Typic Fragiudults formed in "silty eolian deposits over sandy or loamy fluviomarine deposits" and occur on broad interstream divides and uplands. [St. Marys]

Bx1--*28 to 35 inches; yellowish brown (10YR 5/6) loam; strong very coarse prismatic parting to moderate, very thick platy structure; firm; brittle; few fine roots; thin continuous strong brown (7.5YR 5/6) clay films; 15 percent rounded fragments of quartz up to 4 inches in diameter; common medium distinct light gray (10YR 7/2) iron depletions; very strongly acid; clear wavy boundary.*
Bx2--*35 to 52 inches; yellowish red (5YR 5/6) sandy clay loam; many medium and coarse distinct red (2.5YR 4/6), very pale brown (10YR 7/3), and strong brown (7.5YR 5/8) mottles; strong very coarse prismatic parting to moderate very thick platy structure; firm, slightly sticky, slightly plastic; brittle; thin continuous clay films; 10 percent rounded pebbles of quartz up to 2 inches in diameter; very strongly acid; clear irregular boundary. (Combined thickness of the Bx horizons is 6 to 47 inches).* [Source: OSD from https://soilseries.sc.egov.usda.gov/ on 10/31/2019]

Figure 12. Soil landscape of the Bourne and Beltsville Soil Series (modified from https://www.nrcs.usda.gov/Internet/NRCS_DIAGRAMS/graphics/MD-2012-02-03-09.tif)



Aeric Fragiaqualfs - Abbottstown

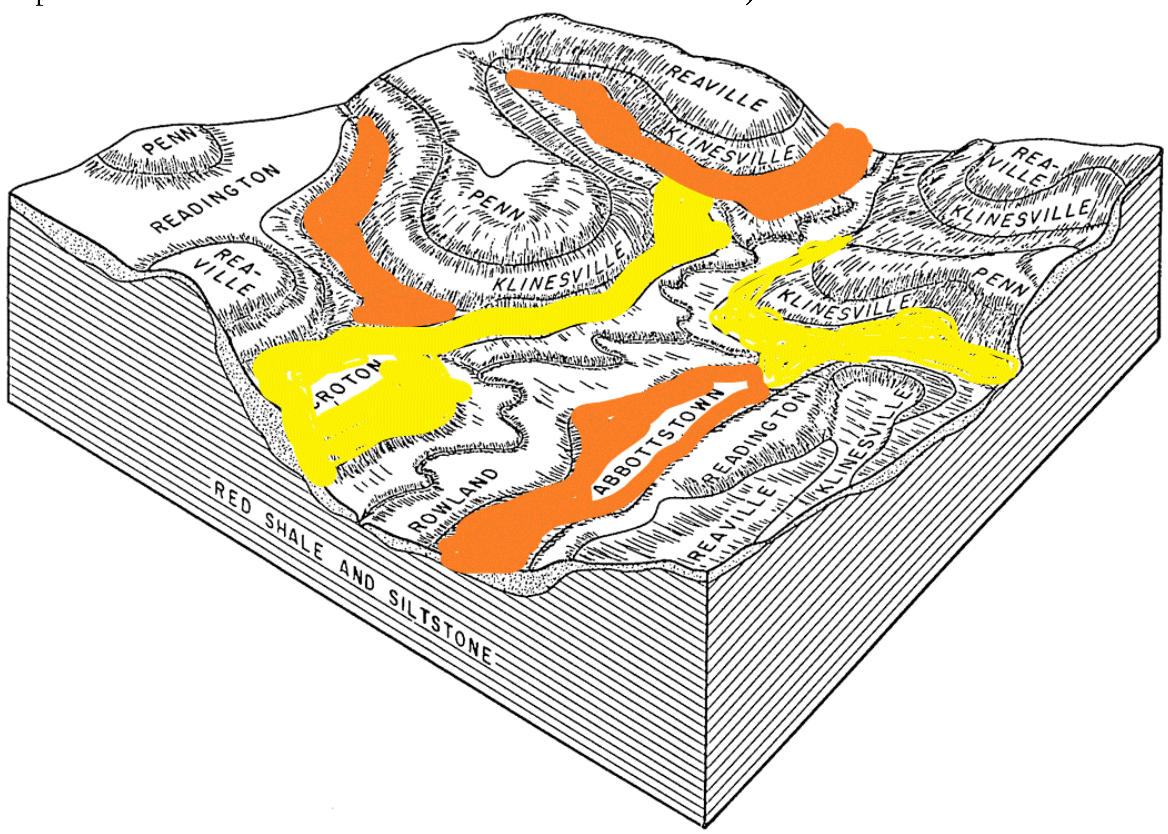
Abbottstown soils are Aeric Fragiaqualfs formed in acid reddish brown loamy colluvium over residuum weathered from Triassic age shale and siltstone, and occur in basins, depressions, drainageways, and hillslopes. [Frederick, Carroll]

Btxg *- 19 to 30 inches; weak red (2.5YR 4/2) channery loam; strong coarse prismatic parting to moderate medium platy structure; very firm and brittle, slightly sticky, moderately plastic; common coarse prominent gray (7.5YR6/1) iron depletions and common coarse prominent yellowish red (5YR5/6) masses of oxidized iron on faces of peds; few clay films on faces of peds; few distinct black (N2.5/0) manganese coatings; 15 percent subangular channers; strongly acid; clear wavy boundary. (12 to 30 inches thick)* [Source: OSD from https://soilseries.sc.egov.usda.gov/ on 10/31/2019]

Croton soils are Typic Fragiaqualfs formed in colluvium over residuum weathered from Triassic age acid shale, siltstone and sandstone and occur in basins, depressions, drainageways, and swales. [Frederick, Carroll]

Btxg*--18 to 36 inches; strong brown (7.5YR 5/6) silty clay loam; very coarse prismatic parting to moderate medium platy structure; brittle, very firm; few roots distributed along faces of peds; light brownish gray (10YR 6/2) coatings on peds; many medium and coarse dark gray (N 4/) iron depletions; few faint clay films on faces of peds and in voids; 10 percent subangular gravel; strongly acid; gradual smooth boundary. (Combined B-horizon thickness is 27 to 40 inches).*
Cx*--36 to 48 inches; brown (7.5YR 5/4) silty clay loam; massive; very firm; 15 percent subangular gravel; strongly to moderately acid; abrupt smooth boundary. (0 to 20 inches thick)* [Source: OSD from https://soilseries.sc.egov.usda.gov/ on 10/31/2019]

Figure 13. Soil landscape with Abbottstown and Croton Soil Series (modified from https://casoilresource.lawr.ucdavis.edu/sde/?series=croton)



Genesis of Fragic Soils

Soil parent material and soil landscape age are two important soil forming factors of MD soils with fragipans (Table 3). Fragic soils in MD occur principally in loamy colluvium or alluvium from sedimentary rocks and some metamorphic rocks on soil landscapes that are likely Pleistocene and could be older. Waltman et al., 1990 discuss the Cookport soil series in PA with "Bx" fragipans formed in Wisconsinan colluvium and residuum above red subsoil horizons in truncated pre-Wisconsinan paleosols. Soil Series formed in loamy colluvium or alluvium include Monongahela, Raritan, Brinkerton, Buchanan, Wiltshire, Meckesville, Albrights, Clarksburg, Penlaw, Glenville, Hustontown, Ernest, Laidig, and Andover. Some alluvial soils such as Monongahela and Tyler occur in older (Pleistocene?) stream terrace deposits. Other soils with fragipans formed in residuum and some in eolian sediment parent materials. Soils with fragipans in colluvial/residual parent materials include Abbottstown, Nolo, Cookport and Croton series. Soils with eolian deposits overlying fluviomarine sediments were the Aura, Leonardtown, Aquasco, Beltsville, Bourne, and Butlertown series. Mixed parent materials such as alluvium/colluvium occur in the Trego and Robertsville soils.

Table 3. Soil Series Classification and Associated Parent Materials

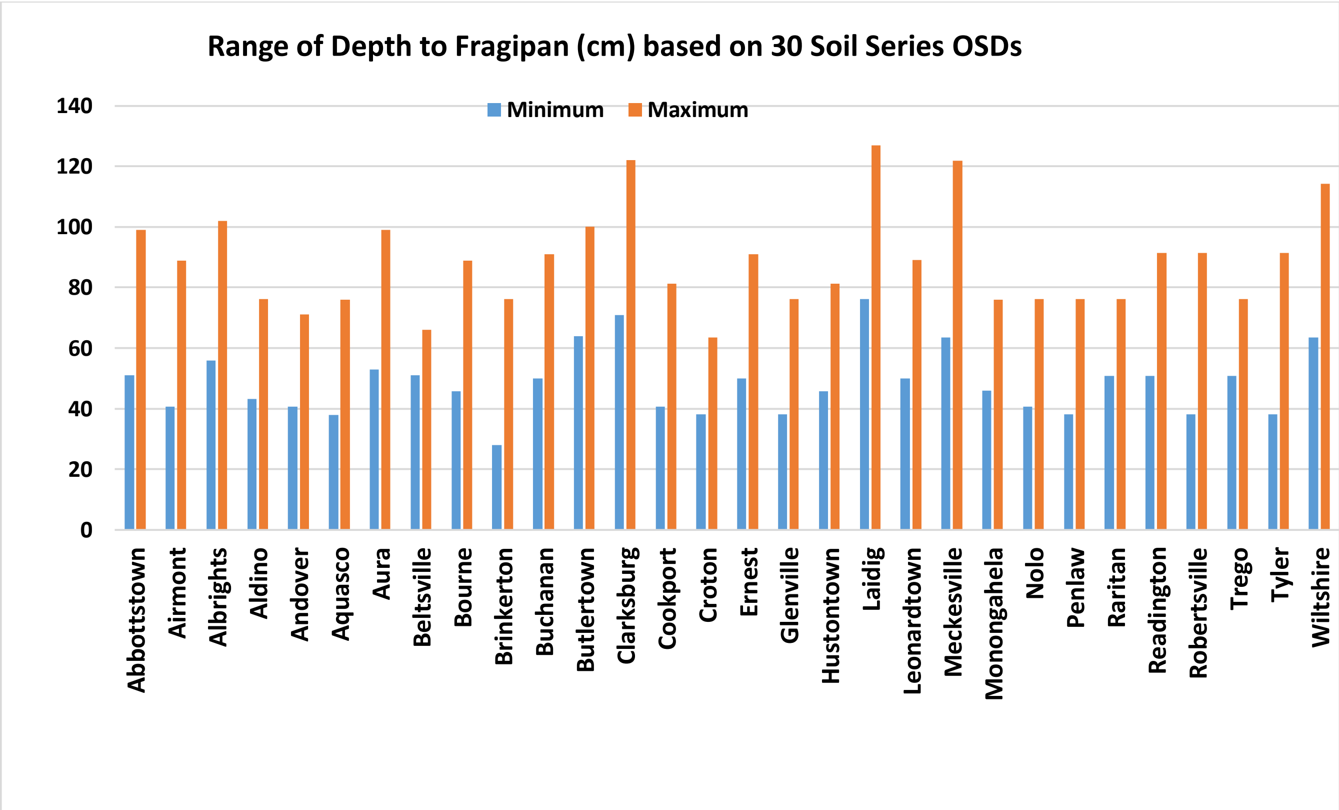
Map Unit Symbol*	**Soil Series**	**Soil Family Taxonomic Class**	**Parent Material**
MgA	Monongahela	Fine-loamy, mixed, semiactive, mesic Typic Fragiudults	loamy old alluvium from acid sandstone and shale
TyA	Tyler	Fine-silty, mixed, active, mesic Aeric Fragiaquults	silty alluvium with a loess mantle on Illinoian age high terraces and valley fills
RaA	Raritan	Fine-loamy, mixed, active, mesic Aquic Fragiudults	alluvium sediments from reddish, noncalcareous shale, siltstone and sandstone uplands
TrA	Trego	Fine-loamy, mixed, active, mesic Fragiaquic Hapludults	alluvium/colluvium from metamorphic crystalline rocks
ArB	Airmont	Fine-loamy, mixed, active, mesic Fragiaquic Hapludults	colluvial or debris flow materials from schist, quartzite and phyllite
BrA	Brinkerton	Fine-silty, mixed, superactive, mesic Typic Fragiaqualfs	colluvium from acid gray shale and siltstone
BuB	Buchanan	Fine-loamy, mixed, semiactive, mesic Aquic Fragiudults	colluvium from sandstone-quartzite-shale-siltstone
WhA	Wiltshire	Fine-loamy, mixed, semiactive, mesic Oxyaquic Fragiudalfs	colluvium of micaceous schist, phyllite, and greenstone schist over residuum from low-grade marble
McB	Meckesville	Fine-loamy, mixed, active, mesic Typic Fragiudults	colluvium or glacial till from acid sandstone, siltstone and shale
AbB	Albrights	Fine-loamy, mixed, semiactive, mesic Aquic Fragiudalfs	colluvium or glacial till from reddish shale, siltstone and fine-grained sandstone
ChB	Clarksburg	Fine-loamy, mixed, superactive, mesic Oxyaquic Fragiudalfs	loamy colluvium from limestone, sandstone, and shale
PeB	Penlaw	Fine-silty, mixed, semiactive, mesic Aquic Fragiudalfs	loamy colluvium from limestone, with some shale and sandstone
5A	Glenville	Fine-loamy, mixed, active, mesic Aquic Fragiudults	loamy colluvium from phyllite, gneiss and/or schist

HuB	Hustontown	Fine-loamy, mixed, active, mesic Oxyaquic Fragiudalfs	loamy colluvium from red sandstone and shale
CuB	Ernest	Fine-loamy, mixed, superactive, mesic Aquic Fragiudults	loamy colluvium from sandstone and shale
LaB	Laidig	Fine-loamy, siliceous, active, mesic Typic Fragiudults	loamy colluvium from sandstone, siltstone and shale
AnB	Andover	Fine-loamy, mixed, active, mesic Typic Fragiaquults	loamy colluvium from sandstone-shale
RoA	Robertsville	Fine-silty, mixed, semiactive, mesic Typic Fragiaqualfs	loamy colluvium/alluvium from interbedded shale, siltstone, and sandstone
AbA	Abbottstown	Fine-loamy, mixed, active, mesic Aeric Fragiaqualfs	acid reddish brown loamy colluvium/residuum weathered from shale and siltstone
NoB	Nolo	Fine-loamy, mixed, superactive, mesic Typic Fragiaquults	colluvium over residuum primarily from sandstone with some shale and siltstone
23A	Croton	Fine-silty, mixed, active, mesic Typic Fragiaqualfs	colluvium over residuum weathered from acid sandstone
CtB	Cookport	Fine-loamy, mixed, active, mesic Aquic Fragiudults	colluvium over residuum weathered from acid sandstone
AuB	Aura	Coarse-loamy, siliceous, semiactive, mesic Typic Fragiudults	coarse-loamy eolian deposits over loamy gravelly fluviomarine deposits
20B	Leonardtown	Fine-silty, mixed, active, mesic Typic Fragiaquults	silty eolian deposits over fluviomarine deposits
ApA	Aquasco	Fine-silty, mixed, semiactive, mesic Aquic Fragiudults	silty eolian deposits over loamy fluviomarine deposits
2B	Beltsville	Fine-loamy, mixed, semiactive, mesic Typic Fragiudults	silty eolian deposits over sandy or loamy fluviomarine deposits
BrB2	Bourne	Fine-loamy, mixed, semiactive, thermic Typic Fragiudults	silty eolian deposits over sandy or loamy fluviomarine deposits
BuA	Butlertown	Fine-silty, mixed, semiactive, mesic Typic Fragiudults	silty eolian deposits over sandy or loamy fluviomarine deposits
AdA	Aldino	Fine-silty, mixed, active, mesic Typic Fragiudalfs	silty materials over residuum weathered from serpentinite
RgB	Readington	Fine-loamy, mixed, active, mesic Oxyaquic Fragiudalfs	medium textured residuum weathered from noncalcareous shale, siltstone, and fine-grained sandstone
RoB	Rohrersville	Fine-loamy, mixed, superactive, mesic Fragiaquic Hapludalfs	local colluvium and alluvium over residuum from metabasalt and meta-andesite
*Selected Examples [(Soil Series, Slope Class, Soil Erosion Class (infrequently shown)]			

Depth to Fragipans

Based on the OSDs from 30 Soil Series with fragipans, the average minimum depth to the fragipan was 49 cm and the average maximum depth was 89 cm. The average range of fragipan thickness (maximum minus minimum depths) is 40 cm and the range of the maximum thickness varies from 55 to 106 cm. For Alfisols and Ultisols, the average minimum depth to the fragipan is 47-50 cm and the average maximum depth to the fragipan is 86-90 cm. The Aqualfs and Udalfs show comparable average minimum depth to the fragipan of 47-48 cm and the average maximum depth to the fragipan is 85-87 cm. For Aquults and Udults they also show comparable average minimum depth to the fragipan is 45-48 cm and the average maximum depth to the fragipan is 89-90 cm.

Figure 14. Depth to Fragipan by Fragic Soil Series



The following table has the Fragic soils arranged by USDA *Great Group* or *Subgroup* and shows the associated Soil Drainage Class(es) and Geomorphic Description based on the OSDs.

Table 4. MD Fragic Soils Series, Soil Drainage Classes and Geomorphic Descriptions

***Great Group*/ Soil Series**	**Drainage Class(es)**	**Geomorphic Description**
Fragiaqualfs		
Abbottstown	Somewhat poorly drained	basins, depressions, drainageways, hillslopes
Croton	Poorly drained	basins, depressions, drainageways, swales
Robertsville	Poorly drained	stream terraces and concave upland areas
Brinkerton	Poorly drained	hillslopes on plateaus
Fragiudalfs		
Hustontown	Moderately well drained	colluvial fans, drainageways, headslopes, foot slopes and toe slopes
Readington	Moderately well drained	concave, nearly level to sloping lower hillsides, upland flats, drainage ways, and stream heads
Albrights	Moderately well to somewhat poorly drained	upland toeslopes, footslopes and drainageways
Wiltshire	Moderately well drained	upland depressions and footslopes of the northern Piedmont
Clarksburg	Moderately well drained	hills, hillslopes
Aldino	Moderately well drained	hills, piedmonts
Penlaw	Somewhat poorly drained	hills, hillslopes
Fragiaquults		
Andover	Poorly drained	benches, toeslopes, footslopes, and swales along the base of prominent ridges
Nolo	Poorly drained	broad ridgetops and plateaus
Tyler	Somewhat poorly drained	river valleys, stream terraces
Leonardtown	Poorly drained	flats, depressions, ephemeral drainageways on broad interstream divides
Fragiudults		
Aura	Well drained	fluviomarine terraces and flats
Cookport	Moderately well drained	broad ridgetops and sideslopes
Glenville	Moderately well to somewhat poorly drained	upland flats, footslopes or near the heads of drainageways
Raritan	Moderately well to somewhat poorly drained	river valleys, stream terraces
Meckesville	Well drained	concave sideslopes of upland ridges
Monongahela	Moderately well drained	river valleys, stream terraces
Buchanan	Moderately well drained	mountain terraces and footslopes extending into valleys along drainageways
Beltsville	Moderately well drained	broad interstream divides, fluviomarine terraces, interfluves, uplands
Bourne	Moderately well drained	broad interstream divides, uplands
Ernest	Moderately well to somewhat poorly drained	hills, hillslopes
Laidig	Well drained	mountain slopes, mountains
Aquasco	Somewhat poorly drained	broad interstream divides, uplands
***Subgroup*/ Soil Series**	**Drainage Class(es)**	**Geomorphic Description**

****Subgroup** - *Fragiaquic Hapludults***		
Trego	Moderately well drained	concave alluvial fans, and colluvial footslopes
Airmont	Somewhat poorly drained	mountain drainageways, concave side slopes and backslopes
****Subgroup** - *Fragiaquic Hapludalfs***		
Rohrersville	Somewhat poorly drained	lower footslopes, along drainageways and heads of drainageways

References

Darmody, R.G. and J.E. Foss. 1982. Soil-Landscape Relationships in the Piedmont of Maryland. Soil Sci. Soc. Am. Jour., Vol. 46: 588-592.

Nikiforoff, C.C. 1955. Hardpan Soils of the Coastal Plain of Southern Maryland – Geology and Soils of the Brandywine Area, Maryland. USGS Prof. Paper 267-B. USGPO, Washington, DC. 63 pp.

Schaetzl, R.J. and M.L. Thompson. 2015. Soils Genesis and Geomorphology, 2nd Ed. Cambridge University Press, New York, NY.

Soil Survey Staff. 2016, Natural Resources Conservation Service, United States Department of Agriculture. Soil Survey Geographic (SSURGO) Database, **Dominant Component Selection. Available online at https://sdmdataaccess.sc.egov.usda.gov Accessed [4/14/2016] by W.R. Effland.

USDA Natural Resources Conservation Service Soil Survey Staff. 1999. *Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys*. U.S. Department of Agriculture Handbook 436. 2nd edition.

Waltman, W. J., R. L. Cunningham, and E. J. Ciolkosz. 1990. Stratigraphy and Parent Material Relationships of Red Substratum Soils on the Allegheny Plateau. Soil Sci. Soc. Am. J. 54:1049-1057.

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THE UNIVERSITY OF MARYLAND SOIL MONOLITHS COLLECTION

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I have previously published papers and made oral presentations about the UM soil monoliths collection (e.g. Fanning, 2004, Fanning, 2020) and some information in this paper is repeated from them. This presentation is intended especially for readers of Pedologue, as a kind of introduction to planned subsequent presentations in subsequent issues about individual monoliths of the collection and as an introduction to a web site that I and others are developing on the collection that I hope may someday be recognized as the University of Maryland Soil Museum (Fanning, 2020).

Our collection was started in 1953 by Canadian Dr. Gerard A. (Gerry) Bourbeau (Fig. 1) shortly after he joined the faculty of the UM Department of Agronomy after he completed his Ph.D. at the University of Wisconsin in Madison, WI, where he learned skills for making monoliths by methods described by Berger and Muckenhirn (1946) that he and others have employed in making the UM soil monoliths. Dr. Bourbeau had a set of monolith display cases (Fig. 2) constructed in the old (opened 1931) wing of H. J. Patterson Hall while he was at the University. Dr. Bourbeau left Maryland and returned to Canada in 1962, where he subsequently underwent special religious training by which he became a priest of the Catholic Church in Canada in 1969, after which he returned to soil science work at Laval University in Quebec City, Quebec.

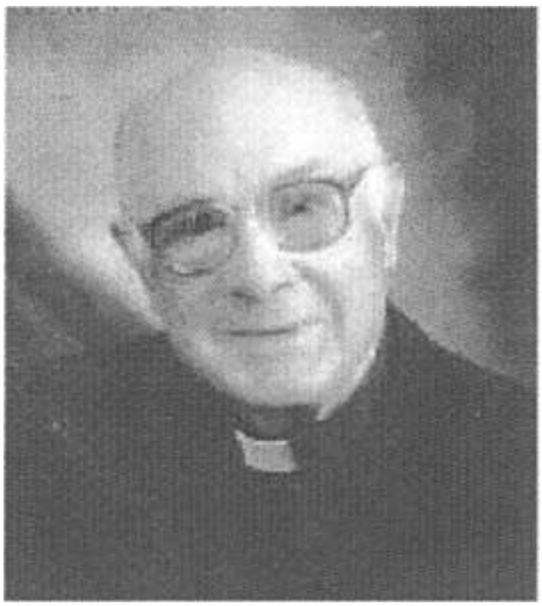

Fig. 1. Picture of Fr. Dr. Gerard A. Bourbeau, the initiator in 1953 of the University of Maryland Soil Monoliths

Collection. This picture was taken in 1999 for the 30th anniversary of Fr. Bourbeau's ordination into the priesthoodof the Catholic Church in Canada. Fr. Dr. Bourbeau died in Ottawa, Canada, 21 March, 2001.

Bourbeau's leaving UM opened the position in which he taught mineralogy and soil classification and geography and did soil science research and worked in soil survey programs in the Department of Agronomy, for which I was hired and came to the University in March, 1964 as an Assistant Professor, immediately after completing requirements for becoming a Ph.D. at the University of Wisconsin where M. L. Jackson was my advisor, with whom Bourbeau had also worked when he was a student there, although his advisor there was Muckenhirn, one of the authors on the publication on making monoliths (Berger and Muckenhirn, 1946). Shortly after my arrival at UM I was told by my new colleague, soil physicist Ed Strickling, that as Bourbeau's replacement I would be in charge of the Department's soil monolith's collection. However, I only first became involved in making a monolith in June, 1965, when working with my first graduate student, Mike Tapper, we were sampling a soil, at that time classified as belonging to the Collington soil series, on what was referred to as the UM Tobacco Farm south of highway Rt. 202, west of Upper Marlboro, MD, the farm subsequently named the Southern Maryland Research and Education Center. Mike and I were assisted in digging a pit and sampling that soil by a college student (although not at UM) worker James (Jim) C. Patterson. Patterson had previously worked for Bourbeau helping to make monoliths for him. Jim, Mike and I decided that since Bourbeau's monolith-making equipment, steel frames etc., were available to us, I was in charge of it, we should make a monolith of the soil profile that we had been describing and sampling that day, June 22, 1965, to keep the UM soil monoliths collection tradition alive. So we collected a profile of the Collington soil (subsequently reclassified as Annapolis, monolith no. 18, Table 1) that day, completing the work of assembling and applying the monolith glue and labeling the monolith in my (previously Bourbeau's) laboratory on subsequent days (some details including field pictures provided by Fanning, 2020).

Fig. 2. A view from near the north end of the hall of the basement of the old (1931) wing of H. J. Patterson Hall showing the monolith cabinets built for Bourbeau in about 1960. Each cabinet, 10 feet long, has 3 sliding glass doors. The first two cabinets, occur before the break shown in the picture, where the door to Dr. Hills soil physics lab is located. The door before the first cabinet, at extreme right side of the picture, leads to the stairwell that leads up to the door of the building that opens toward the HH parking and bus lot in the south side of Campus Drive. The office of D. S. Fanning and E. R. Landa at the north end of the hall, Rm. 0111, is behind the position from which the picture was taken. The interior lights in the cabinets were turned off at the time the picture was taken. The first cabinet contains introductory info and a state soil assoc. map.

Jim Patterson's mother was a secretary in the UM Department of Agronomy previous to the time that I came into the department, and Jim's father also worked for the university; their family lived close to the university. As far as has been determined, Jim is not genealogically related to H. J. Patterson, for whom HJP Hall was named when the old wing of the building was constructed in 1931. H. J. Patterson was President of the Maryland Agricultural College, that subsequently became the University of Maryland, from 1913 to 1917 (Fanning, 2020). However, the other Patterson Hall on campus, J. M. Patterson, is named for Jim Patterson's grandfather. Jim himself became a student at West Virginia University in Morgantown, WV, where he obtained his B,S. degree and subsequently his M.S. degree, working there with Professor Richard Merriweather Smith, after which he became employed by the then Ecological Services Lab. of the NPS (National Park Service) in Washington, DC, which at the time (early 1970's) had its Lab. at the southern tip of Haine's Point, human- constructed island-peninsula in the Potomac River in DC. One reason for mentioning these details here is that Jim, and those who worked with him (one of whom was John Short, who obtained his UM M.S. degree studying the soils of the Mall in DC) with the NPS, collected many monoliths of urban soils including many in human-deposited materials. These monoliths, perhaps the biggest collection of monoliths of urban soils in the world, are now displayed in the NPS Center for Urban Ecology, 4598 Mac Arthur Blvd., Washington, DC 20007. Jim's work with NPS, including his collaboration with us at UM to build a portable exhibit including soil monoliths of urban soils, was very influential in starting the soil survey of Washington, DC (Smith, 1976), a cooperative venture by USDA and USDI in which soil scientists at UM were also heavily involved.

After I took over Bourbeau's soil classification and geography course, at that time identified by course no. AGRO 114, the course was renamed Soil Morphology. Genesis and Classification and was given a new number, AGRO 414, a 4 credit course, for which the Fanning and Fanning (1989) book, at first published by the authors as a set of mimeographed notes, was developed. To encourage the making of more monoliths, monolith-making was encouraged as a subject for term paper projects for the course and several monoliths were made and added to the collection by students who took the course. Others were made by graduate students, as part of their graduate programs, and by other faculty members These efforts led to the making of so many monoliths that another set of cabinets was needed for displaying them, which fortunately the Department of Agronomy, when Richard Weismiller was Chair of the Department, in collaboration with the Maryland Agricultural Experiment Station, provided funds to have constructed on the long wall on the south side of the basement hall in the new (opened in 1967) wing of HJP Hall, cabinets constructed by the University Carpentry Shop in 1994. However, eventually, and now again, we have too many monoliths for both the older (Bourbeau) and the new (1994) cabinets, that today monoliths are additionally displayed on walls of the HJP soils teaching lab, also in Room 0210 and elsewhere (see Table 1).

Fig. 3. View of the UM soil monolith "new", constructed in 1994, cases on the south wall of the hall in the "new" (opened1967) wing of HJP Hall on the College Park Campus, interior fluorescent lights in cabinets turned on at time picture was taken by author, Nov. 3, 2020.

Currently our total collection consists of 120 monoliths (Table 1), each identified by a number, from 1 thru 120, beginning with No. 1 for the Evesboro loamy sand monolith as the first monolith at the north end of the display cases built for Bourbeau in the old wing of HJP Hall (Fig.2, see previous page) with monolith number increasing progressively in those cases proceeding down the hall to the south, such that there are 58 monoliths in that set of cases. The bulk of these monoliths are from Maryland, arranged geographically, with those from the Coastal Plain (monoliths 1 thru 29) occurring first, those from the Piedmont (30-41) next, and those from the Appalachian Mountains (42-52) next. The last 5 monoliths (53-57) at the south end of this old set of cases (Fig. 2) are from out of state, including 4 in glacially deposited materials from New York and Vermont, with the fifth, a green soil, Colemantown, (no. 54) in highly glauconitic geologic sediments from Burlington County, NJ.

The newer set of six monolith cases/cabinets, Fig. 3, in the HJP new (1967) wing contains monoliths numbered from 58-98. These monoliths are arranged with accompanying text (Fig. 3) with a different theme in each of the cases. The first case is for acid sulfate soils, with a monolith of a submerged upland tidal marsh soil, No. 58, as the first monolith in this case. The second case (cabinet) has monoliths of several highly human-influenced soils (e.g. monoliths in mine spoils and a soil from a native American oyster-shell kitchen-midden). The third has monoliths of two soil drainage catenas, one the Sassafras drainage catena with data on water table fluctuation patterns from the well-drained Sassafras thru the very poorly drained Pocomoke soil. The fourth cabinet has pictures and explanations showing the making of a soil monolith (Comus soil series) of a Hawling's River floodplain soil on a natural levee in the Piedmont, plus natural (Beltsville soil with fragipan) and deliberately human-constructed (e.g. a sand painting) soil art. The fifth is a mini soils of Maryland exhibit with reference to the more complete state soils exhibit in the cabinets in the HJP Hall old wing, described in more detail in regard to Fig. 2 earlier in this document. The sixth has monoliths of ditch soils constructed by Dr. Needelman and assistants plus three monoliths in "tins" of a catena of Mollisols in loess from Illinois, plus a monolith of an Aridisol from New Mexico, and a historical book translated from Russian to English on

Chernozems in Russia by V. V. Dokuchaev (considered by some the father, working in Russia in the late 19th century, of the current pedology branch of soil science.

LIST OF MONOLITHS IN THE UM COLLECTION

For book keeping purposes and for enabling ourselves and visitors to know where to go to view particular monoliths, we have recently numbered them in a consecutive way and made a list of them (Table 1) by the names that are on the label at the top of each one. For the list to be useful in referring to where individual monoliths may be found, those who use the monoliths removed from the places shown in the table, should return them to the location stated on the list. As new monoliths are added etc., the list will need be updated or redone if reorganized or with the addition of more information.

TABLE 1. LIST OF UM SOIL MONOLITHS

ID No.	Name/Comments	From	Store Case-Cabinet/Place
1	Evesboro loamy sand	Wicomico Co., MD	Old Wing 1
2	Galestown sand	Coastal Plain, MD	Old Wing 1
3	Atsion sand	Worcester Co., MD	Old Wing 1
4	Matapeake silt loam	Wicomico Co., MD	Old Wing 1
5	Othello silt loam	Wicomico Co., MD	Old Wing 1
6	Johnston (taxajunct) mucky sandy loam	Caroline Co., MD	Old Wing 2
7	Downer sandy loam	Caroline Co., MD	Old Wing 2
8	Keyport silt loam	Queen Anne's Co., MD	Old Wing 2
9	Elkton silt loam	Anne Arundel Co., MD	Old Wing 2
10	Butlertown silt loam	Coastal Plain, MD	Old Wing 2
11	Matapeake silt loam (Jim Chaconas, Lydia Schlosser collectors)	Anne Arundel Co., MD	Old Wing 2
12	Howell very fine sandy loam	Prince George's Co., MD	Old Wing 2
13	Marr fine sandy loam	Prince George's Co., MD	Old Wing 2
14	Woodstown silt loam	Prince George's Co., MD	Old Wing 2
15	Fallsington silt loam	Prince George's Co., MD	Old Wing 2
16	Adelphia sandy loam	Prince George's Co., MD	Old Wing 3
17	Monmouth loamy sand	Prince George's Co., MD	Old Wing 3
18	Annapolis fine sandy loam from UM Tobacco Farm, fossil casts	Prince George's Co., MD	Old Wing 3
19	Collington sandy loam, copper plate label, MAPSS gift to DSF	?	Old Wing 3
20	Downer sandy loam, Bill Barkley collector from his yard, BH	Prince George's Co., MD	Old Wing 3
21	Leonardtown silt loam	Prince George's Co., MD	Old Wing 3

TABLE 1. LIST OF UM SOIL MONOLITHS -- CONTINUED

No.	Name/Comments	From	Store Case/Place
22	Anthill on Beltsville silt loam Newcomb/High 1973 term paper,	Montgomery Co., MD	Old Wing 3
23	Beltsville sandy loam	Coastal Plain, MD	Old Wing 3
24	Chillum silt loam	Prince Georges Co., MD	Old Wing 3
25	Sunnyside fine sandy loam	Prince George's Co., MD	Old Wing 3
26	Keyport silt loam, on Cretaceous PM	Prince George's Co., MD	Old Wing 3
27	Christiana (taxadjunct) NE-96 project	Prince George's Co., MD	Old Wing 3
28	Mystery soil, probably from floodplain, recent alluvium	?	Old Wing 4
29	Codorus sandy loam, thin Hurricane Agnes (1972) sediment at top	Prince George's Co., MD	Old Wing 4
30	Elioak sil loam	Montgomery Co., MD	Old Wing 4
31	Neshaminy silt loam	Baltimore Co., MD	Old Wing 4
32	Monalto silt loam	Piedmont, MD	Old Wing 4
33	Talladega silt loam	Frederick Co., MD	Old Wing 4
33A	Glenelg silt loam	Piedmont, MD	Old Wing 4
34	Chester silt loam	Montgomery Co., MD	Old Wing 4
35	Chester silt loam	Montgomery Co., MD	Old Wing 4
36	Glenelg? silt loam	Piedmont, MD	Old Wing 4
37	Brandywine loam	Howard Co., MD	Old Wing 4
38	Relay silt loam	Howard Co., MD	Old Wing 5
39	Glenville channery loam	Baltimore Co., MD	Old Wing 5
40	Watt (taxadjunct) silt loam	Frederick Co., MD	Old Wing 5
41	Watt (taxadjunct) silt loam	Frederick Co., MD	Old Wing 5
42	Myersville silt loam	Frederick Co., MD	Old Wing 5
43	Fauquier silt loam	Frederick Co., MD	Old Wing 5
44	Duffield silt loam	Washington Co., MD	Old Wing 5
45	Benevola silt loam	Washington Co., MD	Old Wing 5
46	Hagerstown silt loam	Washington Co., MD	Old Wing 5

TABLE 1. LIST OF UM SOIL MONOLITHS -- CONTINUED

No.	Name/Comments	From	Store Case/place
47	Warners silt loam	Washington Co., MD	Old Wing 5
48	Dekalb fine sandy loam	Garrett Co., MD	Old Wing 5
49	Ungers silt loam	Garrett Co., MD	Old Wing 6
50	Cavode silt loam	Garrett Co., MD	Old Wing 6
51	Leetonia loamy sand (Podzol)	Garrett Co., MD	Old Wing 6
52	Greenwood peaty muck from where peat was mined	Garrett Co., MD	Old Wing 6
53	Covington clay, see cracks in lacustrine deposits	Addison Co., VT	Old Wing 6
54	Colemantown sandy loam, highly glauconitic green NE-96,	Burlington Co., NJ	Old Wing 6
55	Colton sandy loam, in glacially deposited materials	Rutland Co., VT	Old Wing 6
56	Sodus gravelly silt loam, in glacially deposited materials	Ulster Co. NY	Old Wing 6
57	Lima silt loam, in glacial till, NE-96 project	Cayuga Co., NY	Old Wing 6
------end of old wing, above, beginning of new wing, below			
58	Sunken silt loam submergered upland, tidal marsh soil	Dorchester Co., MD	New Wing 1
59	Cat Clay, active acid sulfate soil on scalped land surface	Prince George's Co., MD	New Wing 1
60	Annapolis fine sandy loam, post-active acid sulfate soil	Anne Arundel Co., MD	New Wing 1
61	Mine Spoil, Prince William Forest Park active as-soil	Prince William Co., VA	New Wing 2
62	Unnamed silty clay loam, active as-soil in dredged materials	Baltimore City, MD	New Wing 2
63	Lindside silt loam in "old" dredged materials, Haine's Point in DC	Washington, DC	New Wing 2
64	Kenilworth sandy loam, "sanitary landfill" soil	Washington, DC	New Wing 2
65	Laidig sandy loam, mate to 66, unmined land	Allegany Co, MD	New Wing 2
66	Reclaimed Mine Soil, mate to 65	Allegany Co.	New Wing 2
67	Rendoll in oyster shell kitchen midden over buried Matapeake	Kent Co., MD	New Wing 2
68	Downer sandy loam, thin kitchen midden soil, see shells	Queen Anne's Co., MD	New Wing 2
69	Bucks loam, catena mate, well-drained, to 70 and 71	Montgomery CO., MD	New Wing 3
70	Readington silt loam, moderately well drained, mate to 69 & 71	Frederick Co., MD	New Wing 3
71	Croton (taxadjunct) silt loam, poorly drained, mate to 69 & 70	Frederick Co., MD	New Wing 3
72	Sassfras fine sandy loam, well-dr. catena mate to 73, 74, & 75	Queen Anne's Co., MD	New Wing 3

TABLE 1. LIST OF UM SOIL MONOLITHS -- CONTINUED

No.	Name/Comments	From	Store Case/Place
73	Woodstown loam, mod. Well-dr., mate to 72, 74 & 75	Queen Anne's Co., MD	New Wing 3
74	Fallsington loam, poorly dr., mate to 72, 73 & 75	Queen Anne's Co., MD	New Wing 3
75	Pocomoke loam, very poorly drained, mate to 72, 73 & 74	Queen Anne's Co., MD	New Wing 3
76	Comus loam, <u>pictures of making this monolith posted beside it</u>	Montgomery Co., MD	New Wing 4
77	Beltsville silt loam, soil with fragipan	Queen Anne's Co., MD	New Wing 4
78	Beltsville silt loam, soil with fragipan, mate to 79	Prince George's Co., MD	New Wing 4
79	Lateral monolith of fragipan in 78, Mark Magness mate to 78	Prince George's Co., MD	New Wing 4
HUMAN CONSTRUCTED SOIL ART IN NEW WING CABINETS 4 AND 5 E.G. SAND PAINTING IN NEW WING 4			
NEW WING 5 CABINET IS A MINI-SOILS OF MARYLAND MONOLITHS COLLECTION			
80	Gilpin silt loam in residuum from sedim. rocks in Appalachian Mtns.	Garrett Co., MD	New Wing 5
81	Hagerstown silt loam, in limestone residuum in Appalachian Mtn. Region	Washington Co.	New Wing 5
82	Jackland silt loam from metamorphic rock, Piedmont region	Montgomery Co. MD	New Wing 5
83	Manor loam, from residuum from schist rocks in Piedment region	Montgomery Co., MD	New Wing 5
84	Christiana sandy loam, Cretaceous sediment in Coastal Plain	Prince George's Co., MD	New Wing 5
85	Downer sandy loam with thin kitchen midden shells	Queen Anne's Co., MD	New Wing 5
86	Sunken peat tidal marsh	Worcester? Co., MD	New Wing 5
87	Ditch soil, Dr. Needleman	Somerset Co., MD	New Wing 6
88	Ditch soil, Dr. Needleman	Somerset Co., MD	New Wing 6
89	Ditch soil, Dr. Needleman	Somerset Co., MD	New Wing 6
90	Ditch soil, Dr. Needleman	Caroline Co., MD	New Wing 6
91	Catlin silt loam Mollisol catena 1, well drained	Champaine Co., IL	New Wing 6
92	Flanagan silt loam Mollisol catena 2, somewhat poorly drained	Champaine Co., IL	New Wing 6
93	Drummer silt loam Mollisol catena 3, poorly drained	Champaine Co., IL	New Wing 6
94	Geary silt loam Udic Argiustoll (more humid region than 95)	Riley Co., KS	New Wing 6
95	Richfield silt loam Typic Argiustoll (less humid region than 94)	___ Co. KS	New Wing 6
96	Stellar clay loam Aridisol: Ustollic Haplargid	New Mexico	New Wing 6

TABLE 1. LIST OF UM SOIL MONOLITHS -- CONTINUED

No.	Name/Comments		From	Store Case/Place
------------end of new wing storage/display cases, above, beginning of Soils Teaching Lab. below-----------------				
97	Hagerstown silt loam	in limestone residuum	Washington Co., MD	Teach Lab[1]
98	Glenelg loam	Earthworm casts, Dr. Weil	Lancaster Co., PA	Teach Lab
99	Keyport		Coastal Plain, MD	Teach Lab
100	Collington (Annapolis?) lfs		Anne Arundel Co., MD	Teach Lab
101	No label, Sunnyside?		Coastal Plain, MD?	Teach Lab
102	Active AS-soil	In sulfidic spoil, Carriage Hills development	Stafford Co., VA	Teach Lab
103	Elkton		Prince George's Co. MD	Teach Lab
104	no label, Sunnyside?			Teach Lab
105	Penn silt loam		from Beallsville, MD	Teach Lab
106	Matapeake silt loam	Bill McMahon collector?	Washington, DC, TRI	Teach Lab
107	Myersville soil series	Number missing on monolith?	Frederick Co., MD	Teach Lab
108	Landfill soil sulfidic clay cap covered with sand, sandy loam Ap		Burlington Co., NJ	Teach Lab
109	Marr silt loam, in diatomaceous earth		Anne Arundel Co., MD	Teach Lab
110	Brandywine? No label		MD Piedmont?	Teach Lab
111	Evesboro taxadjunct		Beltsville, P.G. Co., MD	Teach Lab
112	Elkton loam	with nodules/concretions	Fairfax Co., VA	Teach Lab[1]
No no.	Glenelg loam, monolith flat on bench top in teach lab		Howard Co., MD	Teach Lab
---End of monoliths in Soils Teaching Lab., above, beginning of ones in New Wing Rm. 0219, below---				
113	SRAP CUT, OZ-UOZ boundary[2]		Stafford Co., VA	Rm. 0219 HJP
114	SRAP CUT into UOZ sulfidic geologic marine sediments		Stafford Co., VA	Rm. 0219 HJP
115	Active acid sulfate soil, duripan at surface, scalped land surface		Anne Arundel Co., MD	Rm 0219HJP
116	Acid sulfate soil, early post-active in dredged materials		Somerset Co., MD	Rm. 0219 HJP
---end of monoliths stored/displayed in HJP Hall, UM campus, above, ones on loan to Smithsonian, below				
117	Mt. Airy loam shows rock to soil, MD Piedmont, on loan to Smithsonian Mus. of Natural History in DC			
118[3]	Ground Water Podzol, used to display soil organic matter storage, Worcester Co., MD			

[1] Teach Lab is Soils Teaching Lab., Rm. 0210 in basement of the "New" Wing of H. J. Patterson Hall.

TABLE 1. LIST OF UM SOIL MONOLITHS -- CONTINUED

[2] SRAP is abbreviation for Stafford County Regional Airport. OZ-UOZ is abbreviation for oxidized-unoxidized zone boundary.

[3] Monoliths, numbers 117 and 118, are yet, as of 4/13/21, to be stamped with these numbers, are on long term loan to the Smithsonian Museum of Natural History in DC, for a current total of 120 monoliths in the UM collection. Note that two monoliths, 33B and one with no no. after no. 112 are not in the exact 1, 2, 3 etc. sequence system. DSF 3/14/2021.
---------------------------end of Table 1 above.

SOIL MUSEUMS, COLLECTIONS, EXHIBITS IN THE WORLD

I have recently become aware of the large number of soil museums and other soil collections and exhibits, most with soil monoliths, in the world, far more than I previously knew existed. This new awareness on my part has come through my being put in contact by Ed Landa with soil scientist David Lowe at the University of Waikato in New Zealand, one of the co-authors of the paper recently published in Advances in Agronomy by Richer-de-Forgesa et al. (2021). To provide readers of Pedologue and others a brief summary of the Richer-de-Forgesa article I am inserting here the abstract of that paper, quoted below.

> The soil science community needs to communicate about soils and the use of soil information to various audiences, especially to the general public and public authorities. In this global review article, we synthesis information pertaining to museums solely dedicated to soils or which contain a permanent exhibition on soils. We identified 38 soil museums specifically dedicated to soils, 34 permanent soil exhibitions, and 32 collections about soils that are accessible by appointment. We evaluate the growth of the number of museums since the early 1900s, their geographical distribution, their contents, and their attendance. The number of museums has been continuously growing since the early 1900s. A noticeable increase was observed from 2015 to 2019. Europe (in a geographical sense), Eastern and South-East Asia have the highest concentration of soil museums and permanent exhibitions related to soils. Most of the museums' attendance ranged from 1000 to 10,000 visitors per year. Russia has the largest number of soil monoliths exhibited across the world's museums, whereas the ISRIC-World Soil Museum has the richest and the most diverse collection of soil monoliths. Museums, collections, and exhibitions of soil play an important role in educating the population about this finite natural resource that maintains life on the planet, and for this reason, they must be increasingly supported, extended, and protected.

However, I now want to record my disappointment that the UM soil monoliths collection is not recognized in the Richer-de-Forgesa paper, mentioned above even though to my knowledge we have the second largest collection of soil monoliths in the United States, readily available as displayed in H. J. Patterson Hall, near the center of the University of Maryland campus, as described in this paper. I have also found that what I think is the largest collection of soil monoliths at a single location in the U.S., the one at the University of Idaho, is also not mentioned in the Richer-de-Forgesa paper, nor is the collection of monoliths on urban soils at the Center of Urban Ecology in DC mentioned earlier in this paper.

I want to thank the many soil scientists and others who have helped in making soil monoliths or who have otherwise participated in assembling and displaying the University of Maryland soil monoliths collection. I ask everyone to support our recognition as the Maryland (or University of Maryland?) Soil Museum, which I think should remain mainly for the foreseeable future in the basement of H. J. Patterson Hall on the College Park campus of the University.

REFERENCES:

Berger, K. C. and R. J. Muckenhirn. 1946. Soil profiles of natural appearance mounted with vinylite resin. Soil Sci. Soc. Am. Proc. 10: 368-370.
Fanning, D. S. 2004. The University of Maryland soil monoliths collection and some associated history. Soil Survey Horizons 45: 7-13.
Fanning, Delvin (Del) S. 2020. Developing UM ENST Web Site for UM soil monoliths collection. Power Point Presentation for Nov. 6, 2020 presentation to UM soil science research group. Available upon request to the author.
Fanning, D. S. and M. C. B. Fanning. 1989. Soil: Morphology, Genesis and Classification. John Wiley & Sons, New York.
Richer-de-Forgesa. Anne C., David J. Lowe, Budiman Minasny, et al. (42 total authors). 2021. A review of the world's soil museums and exhibitions. Advances in Agronomy, Vol. __, Chapter 5, Published by Elsevier.
Smith, H. 1976. Soil survey of District of Columbia. U.S. Dept. Agric., Soil Conservation Service, in cooperation with U.S. Dept. Interior National Park Service, U.S. Government Printing Office, Washington, DC.

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