Issue #8: Paleosols

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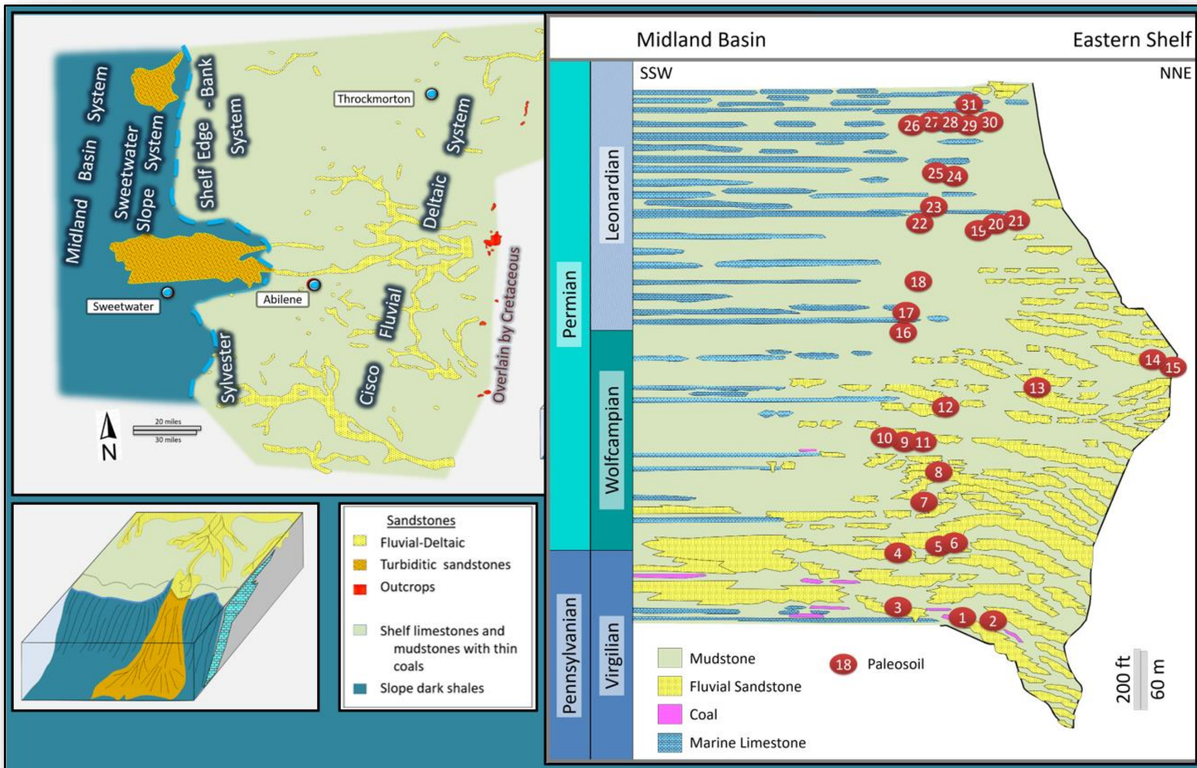

Figure 1: Paleosols from the Eastern Shelf of Texas. On the right is a stratigraphic column through the Eastern Shelf area. Shown in yellow are river deposits. The circled numbers are documented paleosols that developed from the upper Pennsylvanian through the middle of the Permian. Thirty-one paleosols are recognized. (Tabor and Montanez 2004). The left shows a paleogeographic map for one zone and schematic drawing of what the mapped area would have looked like at the time of deposition. (Galloway and Brown 1973)

Assertions:

1. Modern soils are recognized to have developed over time from recognizable processes with recognizable profiles and characteristics.

- Many distinct types of soils are recognized dependent on such factors as the substrate they are developed on, the elevation, the climate and unique historical factors, such as ice ages, volcanic eruptions, etc.
- How long does it take to develop a paleosol? Most experts believe that it takes hundreds of years to form one inch (2.5 cm) of good soil.

2. We find many different paleosols in rock record, some of which are quite thick with a similar variety of types to those found today.
3. Some modern soils are distinctive to arid and semiarid climates. Semiarid climates in many settings develop caliche profiles as rainwater leaches carbonates from the soils but there is not enough water to move it out of the section.
4. Ancient caliches are common through the geologic periods.
5. Any section with an ancient soil cannot be part of an ancient flood deposit because there would not have been enough time for the soil to develop.
6. Ancient soils with caliche profiles developed in stable semiarid climates and such sections cannot be part of a global flood deposit.
7. Ancient soils, particularly thick caliches would have required more time than was available in the post-flood period to have develop, particularly because rates should have been essentially the same as modern rates.

Key assumptions:

a) It is possible to recognize how sediments were deposited and, in this case, to recognize ancient soils that formed by similar processes to those today

b) There are limits to the rates of deposition that should be applied to interpreting both ancient and recent sediments. Although the rate of soil formation in ancient times might have been different than today, well-developed soils were not deposited in 1 year. (as assumed by YEC authors as well).

Discussion:

Probes of Mars and other rocky planets can find dust and debris, but as far as we know, soil is a feature of Earth alone. Soils have been defined as "complex mixtures of minerals, water, air, organic matter, and countless organisms that are the decaying remains of once-living things." In the area that I called my "study area", paleosols are found in the Cambrian, Devonian, Pennsylvanian, Permian, Triassic, Cretaceous, Paleocene, Eocene, Oligocene, Miocene, Pliocene and Pleistocene. (Mitchell, 2018)

One example area is in the area east of Abilene, Texas. Bill Galloway and Frank Brown (1973) documented deposition packages from the Pennsylvanian and Permian systems in great detail using outcrops and well data (**Figure 1**). Sands and shales were deposited that show all the features and scale of modern rivers, deltas and deeper basin deposits. Deposits are well organized and predictable. Tabor and Montanez (2004) have now worked this area and documented paleosols there. It is not that just one paleosol is found. 31 separate paleosols have been mapped! These paleosols might not all have been good soils but all are over 3 feet (1 m) thick so they represent substantial time. Conventional geologic dating indicates that such soils each represent between two to thirty thousand years of time (Kraus 1999).

Another interesting example from my area comes out of the Eocene in east-central Texas. Yancey described two of them this way:

> '*The paleosol zone, a 2.5 m (8 ft.) unit of stream and overbank deposits with two thick paleosols, overlies the lower ash unit. The lower paleosol is a fine grained mudstone that overlies siltstones containing lenses of small (cm-scale) cross-bedded sandstone, suggesting deposition by small streams. The upper paleosol formed on sand deposits, which have thin zones of carbonaceous wood debris and logs. Both paleosols contain common large and small (to 10 cm diameter) vertical root penetrations and stump casts (to 30 cm diameter), which also penetrate down into underlying sediments. The rooting horizons within the paleosols record <u>the presence of a deeply rooted forest cover on the land before deposition of overlying sediments</u>. The upper paleosol is directly overlain by a thick layer of altered volcanic ash.*' (Yancey 1995; emphasis added)

The post where I discussed the Upper Cretaceous Blackhawk Formation in Utah also noted deeply rooted soils as well as Iguanodon tracks on surfaces with desiccation mudcracks. We find mudcracks in many locations of many ages, including others associated with dinosaur tracks.

Calichified soils are very easily identified, whether recent or ancient. We commonly find rooted zones, rhizoliths (filamentous to tubular structures that range in diameter from 1 millimeter to greater than several meters. Complex network of traces that regularly branch, and interweave with one another. Commonly taper downwards.) I wrote about these in more detail here: *Llano Estacado in New Mexico and Texas Vs. YEC and Flood Geology* (**Figures 2 and 3**) This area is where I grew up, so I am very familiar with the caliches there. These typically show very advanced calichification. Many YEC authors include these in their flood units, though some consider them post-flood deposits. These were not deposited by a flood and took longer to form than is available in the YEC post-flood period.

Figure 2. Roadcut north of Crosbyton, Texas. The caliche paleosols here are very thick, indicative of a very long period of fairly stable semiarid conditions.

Figure 3. Caliche paleosols from roadcuts in Palo Duro Canyon State Park. Nodular development along soils have coalesced along layers, probably representing Bachman and Machete (1977) Stage 3 or 4.

West Texas is far from the only place where caliches developed in the interpreted post-rift interval. Rates of processes during this period should reflect normal rates today, unless some local catastrophic processes are identified. Fellow Christian geologist / Geographic Information Specialist, Kevin Nelstead provided this example from Washington:

> *"I investigated this roadcut near Washtucna, Washington as part of my research for my M.S. in geology ("Correlation of Tephra Layers in the Palouse Loess", Washington State University, 1988). There are approximately 17 distinct buried soils, each with a calcrete (caliche) horizon, which is indicative of a dry climate. The soils contain root casts and animal burrows, and it would be difficult to say "these only look like paleosols." Soils do not form rapidly in dry climates.*
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> *These paleosols are in the Quaternary (ice age) Palouse loess, so almost all YECs would classify them as post-flood. In this YEC model, these paleosols, and the associated volcanic ash layers (dashed lines) would have formed over a period of a few centuries after the flood. This roadcut is adjacent to a large channel of the Channeled Scablands, and the soil layers are truncated on the left (west) side by the channel. In the timeline pushed by AiG, the loess must have incrementally accumulated seventeen times in about 200 years. This would have included times of stability at each paleosol level for plants to grow roots, animals to burrow, and a calcrete to form in a dry climate. Like many flood geology problems, this has the difficulty of "too many events, too little time."*
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> *A better solution is to look to the Bible, which does not require that the stratigraphic record, with its paleosols, is a product of Noah's flood*."

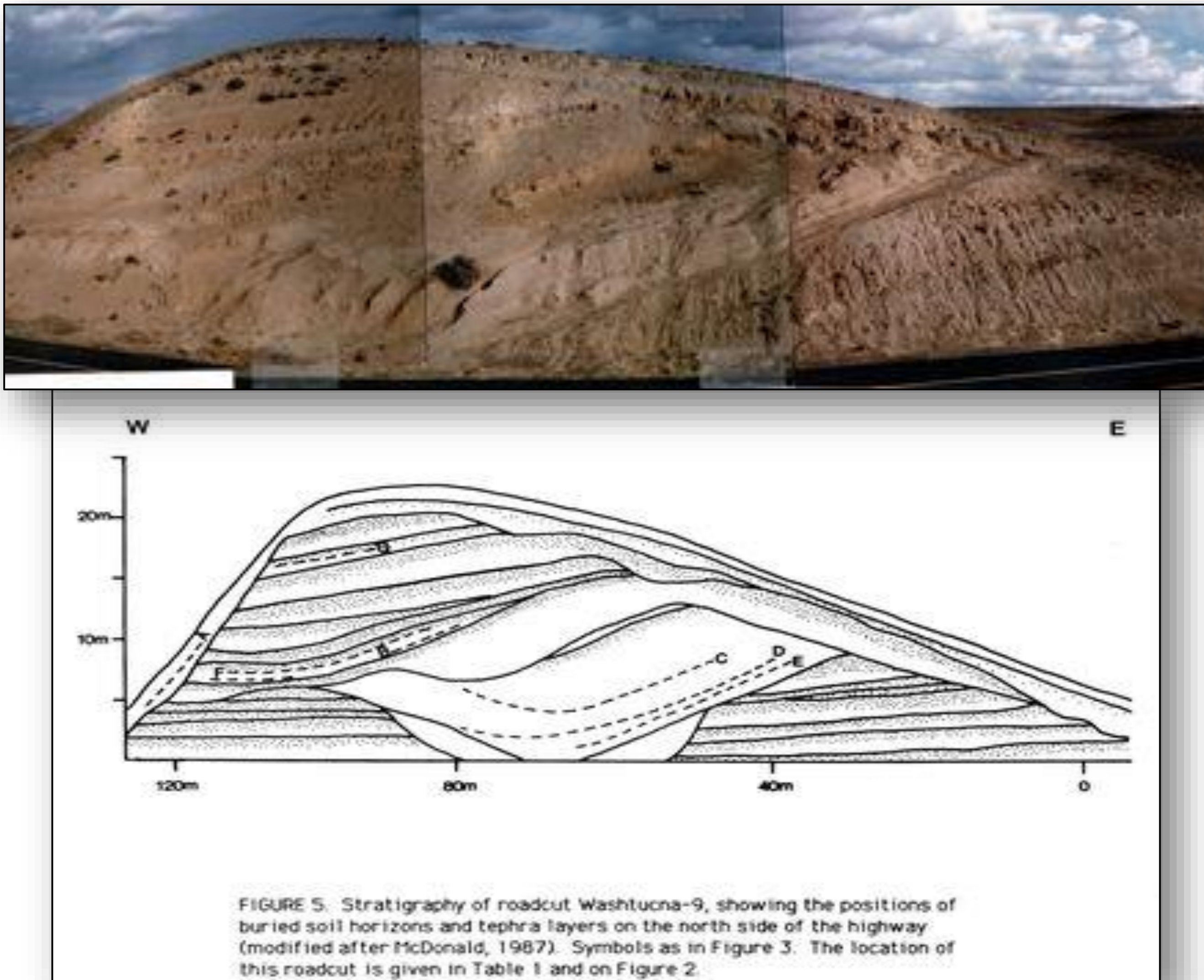

Figure 4: *"Here's a sketch I made of the paleosols and volcanic ash layers (tephras) in the roadcut. Two tephras are not shown: Mazama (Crater Lake) is at the base of the modern soil at the top, and Mt St Helens 1980 tephra can still be seen in the topsoil. (Nelstead, 1988, "Correlation of Tephra layers in the Palouse Loess," Washington State University, p. 10)."*

YEC explanations:

YEC author, Michael Oard published an article entitled, "*'Paleosols' can form faster than secular scientists think*". He suggests that paleosols can form fast enough not to be ruled out, presumably in the post-flood period. What about those during the flood? He writes, "*Without doubt creation scientists need to analyze paleosols in more death, but are paleosols are really buried soils? The evidence for paleosols is equivocal*." I don't doubt that the evidence is "equivocal" in some cases, but many have much to support this interpretation. The caliches are particularly confidently characterized.

YEC author, Tas Walker also addressed paleosols in this article: "*Paleosols: digging deeper buries 'challenge' to flood geology*". He says that paleosols could be valid from the pre-flood period or post-flood period. He recognizes that valid soils would be difficult to include during the flood interval. He uses 2 examples from the literature. One is from an article by Joseph Meert which was published to counter YEC claims. The "paleosol" from Missouri is a Cambrian deposit that sits on very weathered granite. Walker points out that it shows no evidence of roots. That really is no surprise, because there is no evidence of roots anywhere in the world in Cambrian sediments. Nothing was around that grew them. The "soil" is actually described more accurately as a "regolith", an aggregate of loose (originally) varied superficial deposits over the granite. It is hard to tell from either Meert or Walkers descriptions what type of internal profile the deposit has. Fortunately, Pevehouse, et al wrote an article published in June, 2020, "*Paleotopography Controls Weathering of Cambrian-age profiles beneath the Great Unconformity, St. Francois Mountains, SE Missouri, U.S.A*." Interestingly, they support Walkers view that the unit in question does shows evidence a large amounts of fluid movement through it, well after the Lamotte Sandstone was deposited in several phases, an explanation from older articles as well. However, they show clear evidence that the granite was deeply weathered over a fairly long period of time. Walker proposes the regolith was small bodies that were formed by water movement after the sand was deposited. He indicates that the weathered unit was already there, but though fluid movement did take place later. Pevehouse et al shows good evidence that a chemical weathering profile that was there before the Lamotte SS was ever deposited. Their cross-section and photos show that the Lamotte SS onlaps both the granite and the regolith. The transition zone in lowest part of the Lamotte is a real depositional feature. Walker's explanation does not fit the data.

Walker also uses a thin unit between lava flows from Australia is referred to as a paleosol. He doesn't give any geologic articles that reference it and it is difficult to assess it from his paper. All I can see is that it is a loose deposit that he says does not have root traces in it. It is not difficult to find examples of paleosols with good evidence of root systems in them. If you want to see well developed root systems, see Stein, et al, 2020 article: "*Mid-Devonian Archaeopteris Roots Signal Revolutionary Change in Earliest Fossil Forests*". Long documented root systems in a well-documented early developed soil. A less technical view is here: Remains of Earth's oldest forest found in New York | Earth | EarthSky

The flood geology model dictates that there be *no* real paleosols in the flood interval. One can make the case that there is not definitive evidence for some unit called paleosols in the literature, any valid examples must limit the flood interval. In fact paleosols in the pre-flood or post-flood units provide challenges that are difficult to reconcile.

References:

Bachman, G0, Machette, MN, 1977, *Calcic soils and calcretes in the southwestern United States,* US Department of the Interior Geological Survey, *Open-File Report 77-794*

Galloway, W, and Brown, L. J. 1973. "Depositional Systems and Shelf-Slope Relations on Cratonic Basin Margin, Uppermost Pennsylvanian of North-Central Texas." *AAPG Bulletin*

Kraus, M. 1999. "Paleosols in clastic sedimentary rocks: their geologic applications." *Earth-Science Reviews*

Meert, J., 2003, *Radiometric Dating, Paleosols and the Geologic Column: Three strikes against Young Earth Creationism*, http://www.gondwanaresearch.com/hp/paleosol.htm

Mitchell, SM, 2018, *A Texas-Sized Challenge to Young Earth Creation and Flood Geology*, Meadville, PA, Christian Faith Publishing, Inc.

Nelstead, 1988, "*Correlation of Tephra layers in the Palouse Loess*," Washington State University MS Thesis

Oard, 2017, *'Paleosols' can form faster than secular scientists think, https://creation.com/paleosol-formation*

Pevehouse, K.J., Sweet, D.E., Segvic, B., Monson, C.C., Zanoni, G., Marshak, S., 2020, Paleotopography Controls Weathering of Cambrian-Age Profiles Beneath the Great Unconformity, St. Francois Mountains, SE Missouri, U.S.A., *Journal of Sedimentary Research*

Stein, W. E., Berry, C.M., Morris, J.L. Hernick, L.V., Mannolini, F., Ver Straeten, C., Landing, E., Marshall, C.H., Beerling, D.J., Leake, J.R., 2020, Mid-Devonian *Archaeopteris* Roots Signal Revolutionary Change in Earliest Fossil Forests, *Current Biology*

Tabor, N., and Montanez, I. 2004. "Morphology and Distribution of Fossil Soils in the Permo-Pennsylvanian Wichita and Bowie Groups, north-Central Texas, USA: Implications for Western Pangean Palaeoclimate during Icehouse-Greenhouse Transition." *Sedimentology*

Walker, *Paleosols: digging deeper buries 'challenge' to flood geology*

Yancey, T. 1995. "Depositional Environments and Stratigraphy of Late Eocene Sediments, East-Central Texas." USGS Open-File Report 95–595. (1996). "Stratigraphy and Depositional Environments of the Cretaceous-Tertiary Boundary Complex and Basal Paleocene section, Brazos River, Texas." *GCAGS Transactions*, Vol XLVI