THE PROBAUGER

WINTER 2008 EDITION

THE MISSOURI ASSOCIATION OF PROFESSIONAL SOIL SCIENTISTS

In this edition of the Probauger:

Innocuous Gibberish II

October, 2007

by jp

"Life is Good!!"

Again, I give many thanks to the Supreme Editor for allowing me to contribute to this issue of the ***Probauger***. This recount, as well as all other stories I tell, is entirely a figment of my overactive imagination and are therefore not to be used to prosecute anyone, especially me.

My opening comment is Schopenhauer's Law of Entropy. "If you put a spoonful of wine in a barrel full of sewage, you get sewage. If you put a spoonful of sewage in a barrel full of wine, you get sewage." (Entropy: Inevitable and steady deterioration of a system or society.) Don't know what that has to do with anything, but I like it. Actually, I know that it has a lot to do with everything, but I will not go there at this time.

Mr. Richard Henderson and I recently attended the Arkansas Association of Professional Soil Classifier's Annual Meeting that was held in Fayetteville. It was a good time and a good meeting. Amazingly enough, the soil scientists in Arkansas are very similar to Missouri soil scientists in a number of ways. A few brief observations:

- Like us, they like to play jokes. They gave Dr. Rutledge (University of Arkansas) his own pocketknife for a door prize. A nice touch.
- Like us, they like to eat. They had some pretty good barbeque catered for lunch. I have to admit though, I was surprised that they had brisket as well as pork, after all, it was Arkansas.
- They had private consultants who probably didn't care about soil surveys attending the meeting as well as project soil scientists who did not care about on-sites and then they had the university types in the middle who had their fingers in both pots. Kinda, sorta, like our MAPSS meetings.
- They had university types working with the NRCS on phosphorous movement, much as DeWitt & Motavalli did here in Missouri.
- They had consultants that designed a drip irrigation waste treatment system for a whole subdivision, seemingly, much like Saddlebrooke/Dr. James here in Missouri.
- Like us, they had a bunch of people who enjoyed talking "dirt".

Here is a novel idea. How about all of the soils folks in the 2 states, agency, university, consultants, getting together and comparing notes? Naw, that wouldn't work, Missouri joins not only Arkansas, but Iowa, Illinois, Tennessee, Kentucky, Oklahoma, Kansas & Nebraska. Too many meetings! The incredible duplication of efforts across the nation

boggles my mind. Somebody fix it please! Hey wait a minute, maybe we have taken a step forward with the addition of Iowa & Illinois to our Monday Morning Call-In Conference.

All of our Soil Scientist detailees have returned home. Hope that they all had a good time and learned much Soil stuff. I know that I learned a lot of stuff on every detail that I went on, even if it wasn't Soil stuff. With that in mind, I will now recount a detail that I was on, even though it wasn't a detail to another state like our guys went on this year. Here goes.

Ajo is a small town in southern Arizona. It is bordered on the south by the Organ Pipe Cactus National Monument, on the west by the Cabeza Prieta National Wildlife Refuge, on the east by the Tohono O'odham Nation and on the north by the Goldwater Gunnery Range. It was about 2 ½ hours from our office to the town and it was determined that to map efficiently we must go down there and stay through the week. The BLM was paying for the travel, so that may have had something to do with the efficiency thing.

Now, a lot of this area was thermic, instead of hyperthermic, but it was still hotter than a hoot! We liked the luxury of an air conditioned motel, and so we liked staying at the Marine Motel. There were no Marines in Ajo, lots of Army, Navy & Air Force guys, but no Marines. Nor was there anything resembling anything to do with the ocean, so we do not know where the name Marine Motel came from, but it had air conditioning. Sometimes, the military would have all of the rooms booked at the Marine Motel and we had to stay at the Hotel Cornelia which had no air conditioning.

The Hotel Cornelia was a historic place, probably around 100 years old, and had been built to house the big shots that came to visit the copper mine, which was why Ajo was there. The mine had shut down, but the hotel was still there. The first time we stayed there we were blown away. We walked into the hotel, there was a dog in the lobby watching the television, which turned out to be the only television in the hotel. There were lots of chairs around it. A cat ran by at about warp factor 7 as we neared the registration desk. We asked for a room. The old clerk (in her nightgown at about 11 in the morning) asked if we wanted a room with a private bath. We asked what the difference in cost was. She said that it was $3 a night for a regular room and $5 a night for a room with a private bath. We splurged. She put a box of "skeleton" keys on the counter and told us to pick one, they all worked on all of the doors. Very comforting.

As I said earlier, Ajo is bordered on the south by the Organ Pipe Cactus National Monument. Another Missouri Soil Scientist, Kenny Vogt, participated in the final correlation of that special survey. There was always a story about that event, and Kenny confirmed it after I transferred to Missouri. The story goes like this. Kenny and some other state office types picked up the Soil Correlator from Portland, Oregon on a Monday morning at the airport and headed for the Monument. Upon their arrival at the Monument, they entered the Soil Survey Office, a trailer, where the Party Leader, Earl Chamberlin (a crusty, old Soil Scientist), was waiting for them. Introductions were made and Earl sat down at his desk. He opened a drawer of his desk, reached into the drawer and pulled out a bottle of Tequila and a pistol and said, "Now by God, let's correlate!"

There wasn't a lot to do in Ajo. Eat breakfast, go to work, eat supper, drink a beer. No movies or any other forms of amusement. Sometimes when we were really bored, we would drive up on a nearby hill and watch the bombing and strafing on the gunnery range. Pretty colors lighting up the night sky! Sometimes we would drive out to the old airport and watch the military guys drag race their vehicles. Mostly we watched television, all 3 channels.

Soil surveying there was cool. We did a lot of it on motorcycles. I biked up on what they called a Mexican red wolf, which was not supposed to be in Arizona, but I saw one. It was also a volcanic area, there were areas of tuff and ash, different from the hyperthermic area I had been working. Plants were different, too, there were lots of Mexican jumping bean bush and jojoba, as well as the Organ Pipe Cactus.

The correlation of the area was fun. The Correlator had too much to do at home so we drove back and forth each day (so much for efficiency). Couldn't expect him to give up a week even though it took us 7 months to do the area, but I'm not bitter! The day we were going to the farthest area, about 4 hours from Phoenix, we knew it was going to be a long day. My buddy, Bruce & I packed double lunches, one to serve as supper. We had brought along range conservationists who have to jump out of the truck every time they see a weird plant (sort of like our foresters), so that added to the length of the day. Now picture this, here we all are, on top of a basalt mountain, it is 6 o'clock, the sun is setting (it is winter, Correlators correlate when the weather is nice), we are 4 hours from Phoenix, and our Correlator says, "Let's go home now, I have a meeting at 7:00." Well, Bruce and I break into hysterics and fall to the ground laughing. The

Correlator looks confused and asks what's wrong. We tell him to ask Bill, the Party Leader. Bill hem-haws a while and finally tells him that he is going to miss his meeting as well as the 10:00 news. The Correlator gets really mad which makes Bruce and me even more hysterical. We did not share our second lunch with anyone! That fully irritated everyone, but if 2 mere GS-9 soil scientists could figure out that we were going to be late, why couldn't the GS-11's & GS-12's? Tough cookies!

Another good time was one night after we had been out all day and gone to supper, we returned to the beautiful Hotel Cornelia. We were puzzled, there were 2 of those great big military 6x6 trucks and Army guys carrying other Army guys out and throwing them into the back of those trucks. We went to the bar. It was a good bar that had cheap, really cold beer. On Mondays, they also fired up a grill and you could drink beer and cook your own steak. In the bar, there were passed out Army guys everywhere. They had had a big, big party. The bar was covered with bottles of beer. When we ordered a beer, the bar tender said take your pick, the ones on the bar were all paid for. He showed us how to hold the beer bottles up to the light and swirl them around and see if there were any cigarette butts in them. We drank free beer that night.

Ajo was very memorable. It had a beautiful downtown plaza, a huge abandoned open pit mine, huge tailings piles & slag heaps, military guys, and different plants and animals. But my favorite memory will always be the Hotel Cornelia. – jp

P.S. -- How about this for a sick thought? Fred Young is always talking about modeling something or another. It brought to our sick minds one Monday morning at the conference call while he was talking about modeling with Melvin, the old song by Twice Said Fred, "I'm Too Sexy for This Song". Can you imagine Fred as a fashion model on the "runway"?

I'm too sexy for this dirt!
Too sexy for this dirt!
In the soil pit!
In the soil pit!
I'm strutting my stuff
In the soil pit!

Don't Forget

The MAPSS Annual Meeting

Wednesday Jan. 30th 2008

Tan-Tar-A Resort

Osage Beach, MO

$5.00 registration fee

9:00 – 10:00	Registration
10:00 – 10:10	Welcome from the MAPSS President
10:10 – 10:45	Lifetime Achievment Awards
	George Simmons presented by: Mark Abney
	Ken Benham presented by: Bill Pauls
	Jerry Dodd presented by: Kenny Vogt
	Turn-Key Award
	Dennis Potter presented by Bryan Mayhan
10:45 – 11:15	Dr Charles Rovey – paleosols of North Missouri
11:15 – 11:30	Mike Chalfant - deep coring project and paleosols
11:30 – 1:00	Lunch
1:00 – 1:15	Bill Pauls & Clayton Lee - Prairie Fork Dedication
1:15 – 2:15	University Panel discussion with
	Dr. Ben Fuqua Missouri State
	Dr. Michael Aide SEMO
	Dr. Randy Miles University of Missouri
	Dr. Jamie Patton Northwest Missouri State
2:15 – 2:30	Break
2:30 – 3:00	Annual MAPSS business meeting.

Thoughts and Ramblings of
Dennis Potter
SCS/NRCS
1975-2008

Caryl Radatz asked if I would write a brief article about my career, my memories and any insight/advice that I might leave behind following my retirement scheduled for January 3, 2008. I could get really windy, but will try to be as brief as I can and say what I want to say.

History:

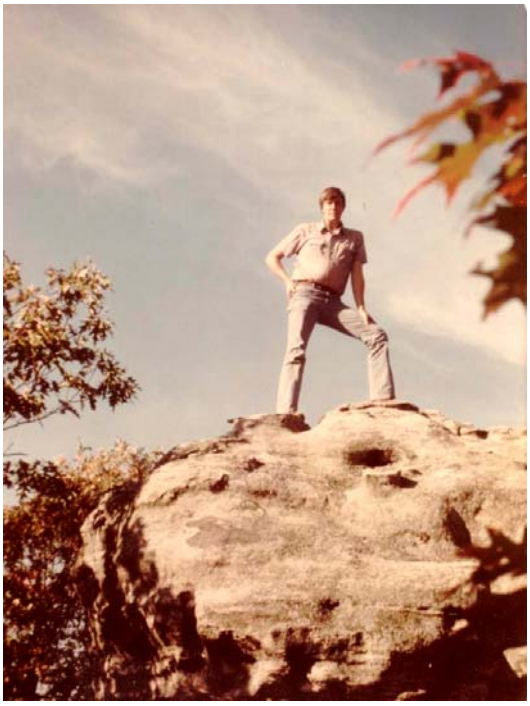
I was born on, according to my Mother, the hottest day of 1952, to Karl and Kathryn Potter in Lexington, Missouri. I grew up in the Wellington, Missouri area located in Lafayette County, Missouri. I graduated from Wellington-Napoleon high school in 1970. I obtained my under graduate degree, much to the surprise of my family and teachers, from Central Missouri State College/University in 1975.

In 1973 I married Bonnie Hillebrand and lived happily ever after. Following are excerpts from this amazing story. It's long, so you may want to wait for the movie.

In 1975, I'm not sure of the exact date, Bonnie, my wife of 2 years and I moved to the Bootheel of Missouri where I started my career mapping soils in Mississippi County, Missouri with the Mississippi County Soil and Water Conservation District. At that time, districts were hiring soil scientists to accelerate the completion of the soil survey in Missouri. I worked with Mr. Les Tobin, SCS Soil Scientist. At that time we were working on the 3 county soil survey of Cape Girardeau, Scott and Mississippi Counties. Our own Richard Tummons worked on the same survey and spent his time in Cape County.

Working in the flat Boot Heel landscapes was tough, but I certainly learned a lot about alluvial soils. I learned that the Boot Heel

was a good place to "be from" and I looked forward to the day that I could "be from" there and would be someplace else (no offense intended to Boot Heel natives).



Dennis Potter guided Missouri's Soils Program
to amazing heights

In November of 1976, I finally got the opportunity to go to work for the Soil Conservation Service and moved to the State Office in Columbia, Missouri. My job was to supervise the Map Compilation Shop. I was promised that if I stick it out for a year, I could go back to the field and continue my mapping career. At that time, Mr. Jim Lee was the State Soil Scientist. Jim was a scholar and a Gentleman originally from the state of Kentucky. Others on the State Staff were, Ferris Allgood, Kenny Vogt, Gil Lantiser, Ival Persinger and a young Assistant State Soil Scientist by the name of Bruce Thompson. Tragically, while working on a detail in Saudi Arabia, Ival was bitten by a viper and died.

In April of 1978, I was transferred back to the field and was placed on Mr. Burton Brown's soil survey party located in Farmington, Missouri where we were mapping St. Francois, Ste. Genevieve and Iron Counties. Dan Childress

and Jim Gross were also on the staff there and we had a lot of interesting times. It was a time where my priorities changed as our first born, Ben came on the scene. Ben is now a Senior Account Executive with a Public Relations firm and is the father of our first grandchild, Kate. We enjoyed Farmington and I especially appreciated the beautiful eastern Missouri Ozarks. Burton was a great teacher. The most useful thing I learned from Burton was to work hard and to be back in the office every day by about 4:30. Burton indicated that if we did not return from the field that he and the remaining staff would come looking for the missing soil scientist immediately after coffee the next morning. This guidance seemed to work as no one was left to spend the night in the field.

In 1981 I was given the opportunity to move to Macon, Missouri as the Soil Survey Party Leader for the Randolph County, Missouri Soil Survey Area. At the time I moved to Macon, Mr. Steve Black was the Area Conservationist in Hannibal. Steve was a great supervisor and later moved to the state of Virginia as their State Conservationist. A lot of ACs threaten to go to the field with soil scientists, but Steve actually did go with me and spent the day in the field mapping. Later, Lynn Kilpatrick became the AC in Hannibal and I actually taught him most of what he knows about Northeast Missouri.

While in Macon, I had the privilege of working with the late Conrad Watson, Soil Survey Party Leader in Marion, Ralls, Lewis and other soil survey areas in NE Missouri. A young Gary Noel and Carol Bartles were on Conrad's staff in Hannibal. My crew in Macon included Lisa Gaughn, Rex Jackson, Sam Grimes, Henry Ferguson and Mike Chalfant. A little known fact is that I was instrumental in hiring Mike for his first soil scientist job. Our second child, Susan was born while we were in Macon. Susan is now an elementary school teacher in Columbia and is expecting our second grandchild. I have more stories than I have room for about my time in Macon, but it was a great time in my life.

In 1986, we packed up the kids and the few personal positions and moved to New Haven, Missouri where I began my work with technical soil services in the Washington, Missouri Area Office. Mr. Vic Simpson, AC, hired me for this position. I was only there for a short 2 ½ years, but the experience was invaluable. At that time initial soil surveys were going on in Phelps and Gasconade Counties in that area. Some very interesting times indeed.

In early 1989 I was offered the Assistant State Soil Scientist job on the Missouri Soil Survey Staff under the guidance of Mr. Bruce Thompson, State Soil Scientist at the time. My major responsibility was to conduct reviews for soil surveys in South Missouri. At one time there were 12 initial soil surveys going on in southern Missouri. This kept me on the road. I learned a lot from a lot of folks during this assignment. I worked with such notables as: Max Aldrich, Bob Held, Buddy Festervand, Ken Benham, John Preston, Dave Wolf, Dan Childress, Dale Sprankle, Jim Fortner, Jerry Dodd, Keith Davis, Mike Cook, Donnie Holbrook, Dave Skaer, Scott Larsen, Melvin Simmons, Caryl Radatz, Fred Young, Sid Vander Veen, Gary Sturdevant, Dick Henderson, Wyn Kelley, Mike Burney, Larry Kichler, Chad Remley, Dennis Meinert and many others too numerous to mention. As you can see by looking at the above list, I had quite a varied group to work with. Most experiences were good and always very interesting. My hat is off to all of these folks and others that I did not mention for honing my skills and making me the person I am today.

As the reorganization of the soil survey took off, MLRA Regional Offices were established. This was in about 1995 or so. The State Conservationist at that time, Russ Mills, had the concept that if we had MO Leaders, we certainly didn't need State Soil Scientists. Bruce Thompson was selected to be the MO Leader in Amherst, Ma. and left Missouri. For about 4 years Missouri did not have a State Soil Scientist. I was reassigned at this time to be the Soil Scientist Liaison for Missouri. Basically, my job was to represent the State Conservationist in discussions to set up MLRA Project Offices, to maintain a positive relationship with the Missouri Soil Survey Partnership and to provide guidance to the Key Staff and ACs related to staffing and work to be done by soil scientists in Missouri.

Then in January 2000 I as promoted to State Soil Scientist and the rest is history.

Thoughts of a nearly retired State Soil Scientist:

The State Soil Scientist position wasn't quite what I expected. Please don't ask me what I expected. I know I have said this many times in the above text, but I'll say it again, I learned a lot from a lot of people. My appreciation of staff and partners overwhelms me. And I'm not just blowing smoke. I could not be prouder of what we have accomplished here in Missouri.

I'm in a stage of my life where I look ahead, but also spend quite a bit of time looking back. Following are a few brief notes of things I have learned.

1. A program does not succeed as we have without the support of our managers. I owe a great debt of gratitude to Roger Hansen our State Conservationist. Without Roger's support our success would have been minimal. Thank you Roger!

2. Don't underestimate the abilities and potentials of people. From the experience I have had as a State Soil Scientist, I have learned that staff will surpass your expectations every time if they are given ownership and know that they are appreciated and that their opinions are valued.
3. The success we have had in Missouri is due to our pro-active approach. We have been innovative and have taken a leadership role in the development of guidelines for updating soils information. We have not been afraid of failure and have welcomed scrutiny of our concepts and approach.
3. We owe a lot to those who came before us. Many times we have the tendency to think we have invented soil survey, but we are only building on the success of our predecessors. Don't take yourself too seriously. What we do is important, but we need to keep it in context and remember that we are only a small cog in a bigger machine.
4. What a wonderful work atmosphere we are privileged to work in where no one is standing behind us waiting for us to falter so they can climb over us and benefit from our failure. At no time in my career have I had the feeling that someone wished I would fail. The cooperative and caring approach that has been a tradition here in Missouri is unique after listening to folks in other states.
5. Everyone needs a "Clayton Lee". I think you all know what I mean. What a guy. Thanks Clayton!!

There are so many I want to thank. First, the good Lord for giving me life and allowing me this opportunity. I want to thank my family: My Parents my Brother and my In-laws for encouraging me to move on out and give it a try. Bonnie, Ben and Susan for letting me drag them to nearly every nook and cranny of Missouri. I'm sure it was tough for you to pull up stakes and move in the middle of the school year. I love you all and you are all very special to me.

I again want to thank all of the agency people and partners for a great career. Most of my very best friends are among those I have had the privilege of working with. I feel that I have been a small part of something special. We need to be mindful that our discipline is an honorable one that has contributed significantly to society and has ultimately made life better for the citizens of Missouri. I am proud that I was allowed to be a part of this great program. I thank you all for allowing me to tag along.

In closing, I would like to take some advice from Bob Held, retired soil scientist. Following a rather intense progress review in Gasconade County he said to me "Don't go away mad, just go away" and that is exactly what I intend to do.

WHAT'S GOING ON WITH MAPSS MEMBERS

Dennis Potter - Missouri State Soil Scientist and past MAPSS President, Will retire from NRCS effective January 3rd.

Keith Davis – NRCS Project Leader and Resource Soil Scientist is retiring effective Jan 3rd. Keith and his wife Eunice are planning a trip this summer to Alaska to celebrate their freedom.

Scott Larsen – Will be relocating to the Warrensburg Wetland Office Effective this coming Spring.

Scott Paine – Will be moving to the Springfield Soil Survey Office in January.

Tracey Wiggins and her husband Shane Welcomed a baby boy Gavin Floyd On December 16th.

Little Gavin Wiggins

Hopefully a lot of this is in Dennis's future

Surficial Geological Materials Mapping Project, pedology from the ground down

Michael Chalfant

The Surficial Materials (SM) Geological Mapping project is associated with the MoDNR STATEMAP program. A partnership of Missouri's Department of Natural Resources' (DNR) Soil and Water Conservation Program (SWCP) soil scientists and Division of Geology and Land Survey (DGLS) geologists started in 2002 as a pilot project for exploratory, deep core identifications of the stratigraphies overlying the bedrock on the Trealor (7.5') Quadrangle. This initial work was published in 2003 and over the next five years DNR soil scientists with a geologist field coordinator have completed and published eighteen 1:24,000 scale quadrangles across the Fulton 1:100,000 Quadrangle. North of the Missouri River, this database now extends from the eastern towns of Troy and New Melle to Fulton and Williamsburg in the west. The Missouri Department of Transportation (MoDOT) staff has contributed to this interagency effort by supplying drill/core rigs and an operating crew.

The soil geological investigations, "From the ground down", are attempts to described and sample all the surficial materials and to correlate lithologic units, and any associated buried paleosols, to the stratigraphic column. The resultant SM maps are created digitally using geo-referenced digital files that include soil survey geographic databases' (SSURGO) spatial and attribute data as an aid in defining the surficial materials map units. These surface units are constructed as facies, geological landscape components (e.g., Loess/Glacial Till, Glacial Till, Paleozoic Residuum/Colluvium, St. Peters Residuum/Colluvium, Alluvia, and Terraces). Each of the 7.5' quadrangle include sections on physiography, surficial materials, and map unit descriptions. DGLS well-log data also is added to supplement our field findings for thickness and depths to hard bedrock. (Due to a contractual publication time schedule, data from laboratory analyses are not available and therefore, soil material characteristics and lithologic units are based primarily on the fieldwork and empirical findings.)

Project map objectives are to identify and describe the soil landscape and its underlying geologic materials. We obtain stratigraphy samples for laboratory analyses that provide data for determinations on engineering values/or properties that can be applied to both shallow and deep construction activities, (e.g., lakes, landfills, roads/bridges, mining) and to address management concerns related to possible interactions between the vadose (aeration) zone and underlying groundwater sources, (e.g., glacial till aquifers). Scientific goals are to extend and further knowledge of pedologic and geomorphic features and identify their natural boundaries with scientific parameters as they apply to the entire soil material body (some cores have gone over a 100 feet deep). Entities are then taxonomically classified, according to U.S. geology's *North American Stratigraphic Code* and USDA's *Soil Taxonomy*. Geosols (formally recognized, buried paleosols) and lithostratigraphic units (formations, members, and bands) are then compiled with the concurrent bedrock geologic update mapping being conducted across the Fulton Quadrangle.

Geomorphic processes have altered and redistributed sediments and modified surfaces throughout history. Recognition of buried surfaces and paleosols, and discontinuities or unconformities are essential for understanding landscape evolutions and for determining extent of local strata and sequences of events. This surficial materials study and mapping project has incorporated a "whole-earth" scientific approach to gain and provide as much information as we can, while the opportunity exist. The findings provide a more comprehensive understanding of the sequence of surficial events and soil development histories. Presentation of this data also extends our soil science and geomorphic studies beyond any limiting arbitrary management depths (e.g., 60 to 80 inches) to include all the soil material profile(s). Professionals from surrounding Midwest states have recognized the importance of studying the stratigraphy of soils' geologic materials for some time, and their available data has been used for locating soil material use sources and modern subsurface management concerns.

Our collected samples are sent to the Columbia's University of Missouri (UMC) Soil Laboratory for a full soil characterization of the entire cored profiles' stratigraphy. Additional analyses have determined engineering classifications. An additional core length sample is placed in DGLS storage for further studies. From this source, samples of the paleosols are being examined for flora remains, pollen and fossilized opal phytolith plant cells, by UMC graduate students (in Archaeology and Geography) in hopes to identify the associated vegetation history. Dr. Charles Rovey, from Missouri State University, has been studying and documenting Missouri's glacial stratigraphy for over a decade and he has provided expertise and training to the SM project. Over the years, Dr. Rovey has also performed and contributed laboratory analyses on selected soil material samples to determine clay mineralogy and the till's lithologic content for identifying the till units. He also has obtained core samples for cosmogenic dating of the till units and has had magnetic inclination and stability determinations. The younger, McCredie tills have normal remnant polarity while the older tills have reverse polarity. Our findings in Missouri are also being correlated to the other Midwest till studies in Iowa and Nebraska, their Wolf Creek and Alburnett till formation and "A type" tills.

Missouri's McCredie Formation is differentiated (by Chronostratigraphic units) from top to bottom into the Macon, Columbia and Fulton members and paleosols have been found to have developed in each of theses till deposits. Cosmogenic dates obtained from SM samples along with correlation of other collected data have indicated that the Macon Member may be as young as 250 Ka (or 250,000 BP). The Columbia Member dates back to the Middle Middle Pleistocene with a date of ~ 390 Ka and the Fulton Member ranges from 720 to 750 Ka placing it in the Early Middle Pleistocene sub-division (geologic sub-divisions/isotope stages, along with till terms and lithostratigraphic ranks are listed in the NRCS *Field Book for Describing and Sampling Soils* 2002:5-8 to 12). The cosmogenic dating technique can determine when former soil surfaces were deeply buried by a younger deposit, however, material mixings and superimposed contaminations can alter burial dates so more than one dated sample is preferred (Balco and Rovey 2007). The underlying till formations are the undivided Moberly and Atlanta formations and they date to over a million years old. The Moberly, an Early Pleistocene deposit is thought to have occurred ~ 1.6 Ma and the basal Atlanta till, the first glacial deposit in Missouri, dates the beginning of the Pleistocene at 2.3 to 2.5 Ma (Chalfant and Siemens, 2007 7.5 quadrangles, citing Balco *et al*. 2005 and 2007, Rovey comm. 2007). These two older till units have remnant, reverse magnetic properties (a diagnostic feature) indicating they were deposited during the Matayuma-Bruhnes Reverse Epoch which ended about 780,000 years ago when the Bruhnes Normal Epoch started (Rovey and Kean 1996).

In northern Missouri the dissected till plains retain some geomorphically stable upland summits on divides and the connecting higher primary (or, first-order) interfluves. Within the study area (e.g., near the I-70 Interstate corridor) all five glacial till units have been found. The upper McCredie till is mantled by aoelian loess deposition that relates to the Peorian Loess of Late Wisconsin times (~ 28,000-12,000 years old). A silty basal loessial component often has more eluvial vs. illuvial soil features, exhibiting Eb like characteristics. This lower component may relate to earlier Roxanna and/or Loveland loess deposition. Leon Follmer in, "Glacial Deposits of Williamson County" (ISGS, handout with no date) writes that the loess cover in Illinois that is five to eight feet thick in places and has a sequence of Peoria-Roxana-Loveland loesses. Some of our silty basal sediments now include a few glacial pebbles that can be related to fauna and flora bioturbations, (e.g., krotovinvinas from rodent and crayfish burrowing) between a paleo loessial surface and the underlying till subsoil. Burrows traced from the till to a paleo-surface within the lower loess profile were noted within trench excavations of a Mexico soil. At the top of crayfish burrow(s), some till pebbles had accumulated as a fauna lag line, seemingly pushed up when the crayfish dug up below a rising water table (recollections from pers. comm. Dr. Hammer 2006). Another bioturbation process for creating pedisediment-like soil reworking on a depositional surface can be uprooting of vegetation by the associated Pleistocene megafauna, e.g., ground sloths and Mastodons, browsers that fed on coarse vegetation (Mehl's *Missouri's Ice Age Animals* 1962:52 & 59, DGLS). On lower erosional surfaces, the sediment mixing can be attributed to geomorphic processes and more accurately categorized empirically as "pedisediments". Under the loessial Alfisol, a second clay bulge is

typically found in the buried till subsoil, an argillic 2 or 3Bt(g)b horizon. This subsoil often has many prominent thick clay coats that has been correlated to the Yarmouth-Sangamon (polygenetic) Geosol with the upper part of the paleo-solum appearing to include the overlying silty loessial sediments (*geosol* – as defined in the *North American Stratigraphic Code* (1983:37) is a formally recognized paleosol and pedostratigraphic unit that is buried, or fossil, within a stratigraphic column). The till paleo Bt horizon, has been recorded with 40 to more than 60 percent clay (e.g., MO6-139-66-03-04, MO6-139-70-04-05 & MO6139-52-04-05). This upper till stratigraphy is underlain with other paleosols that developed when they were surface soils. Often the paleosols are stacked, and where the depositional units are thinner a composite of pedologically overprinted or merged soils can appear to be one continuous soil profile, rather than the multiple (previously separate) paleo soil-sediment packages. These polygenetic features along with diagenetic changes obscure field identifications of individual paleosols and their associated lithostratigraphic unit and require close attention to details and a conception of the bigger picture, or profile model.

Beneath the paleosols, substrata sediments in C, or transitional B-C, horizons commonly have over 30% clay with fine silty or fine loamy, whole-earth textures and this material has been interpreted to be subglacial lodgement placements. Each till unit, usually in the lower part of the sediment package, can include coarser strata with silty to sandy textures. These are interpreted as more to flow tills (e.g., proglacial deposits) or supra- or sub-glacial melt-out till. These sequences of textural discontinuities within a till unit may relate to summer ice melts that moves sediments away from the glacier then get subsequently buried by the clayier lodgement till when during colder times the glacier advances. Many of these coarser strata deposits occur as discontinuous pocket or lens vs. a more extensive outwash plain, like surface and the duration of their exposures appear to have been relatively short-timed, because no individual or independent paleosols have been detected within these coarser sediment beds.

For field identifications of the individual stratigraphic units, the applied methodology utilizes soil development and weathering sequences and a solum's attributes (solum: a set of related pedogenic horizons, e.g., A, E, and B horizons). We try to vertically track/record pedogenic developments and relationships that include processes of eluviation/illuviation, leaching/enrichments. Its can also be important to differentiate between diagnostics subsoils features for e.g., argillic, cambic, or calcic subsoils and lower nondiagnostic horizons that have only some of the attributes or are more transitional in nature (e.g., a few clay films on a prism face). The relatively unmodified or substrata horizons indicate your below the solum and approaching (sooner or later) the end of one depositional unit and the beginning of another soil-sediment package. If the lithostratigraphic unit is not too thin, the upper leached profiles will have lower horizons with secondary carbonate accumulations, e.g., B(t)k horizons, and then unleached C-like horizons in the lowest part. Below the tills' subsoils, an often repeated sequential pattern includes oblique angled fractures and joint faces that have allow downward movement of air and water, and soil constituents. In this part of the profile, carbonates and clay and manganese coats can infiltrated, or intrude, into C/B or BC horizons and sometimes structural aggregates form at the joint's interface in a otherwise structureless, massive matrix (C or C/B). Below the solum, unaltered till material will be slight to strongly effervescent and the basal part of the unit's profile is often dense and lacking a jointed system (e.g., Cd horizon).

The till units' differentiating characteristics include lithology and substrata clay mineralogy and texture. The Fulton deposits typically have the highest amount of clay in the substratum and the Macon the highest percentage of smectitic clays. Their profiles typically have fine over fine silty, whole-earth textures and fine-earth textures of clay, silty clay, and silty clay loam. The intervening Columbia Member generally has less clay and a little higher sand content with fine-loamy substrata and more clay loam textures. The McCredie members contain the higher ratio/percentage of crystalline (igneous and metamorphic) clasts from northern sources (e.g., Canada). Whereas, the earlier Atlanta and Moberly glacial intrusions, across a more residual Missouri landscape, apparently picked up and incorporated more sedimentary rock (local examples, cherts, limestone, sandstone, and shale with lignite or coal). These two formations are also low or devoid (respectively) of expandable clay minerals (Rovey and Kean 1996). The Moberly formation with its lignite or

coal masses has an illitic, shale-clay textural feel that can be detected in the field and often has an unoxidized (greenish black) matrix in the substratum. The basal Atlanta Formation or its associated reworked diamicton is usually a relatively thin till unit, e.g., a few to several feet. Only remnants of this earliest till deposit are encountered. Apparently scattered remains across an erosional landscape along with pre-glacial soil materials. Within the lower Atlanta till, residual/colluvial materials can be found as mix. Below the till stratigraphy, the pre-glacial residual soil regolith is referred to as the Whippoorwill formation and it too has associated paleosols.

Evidently, there were interglacial intervals of sufficient time length and conducive climate/temperatures to develop soils with cambic and argillic horizons, paleo-analogues similar to the mature Holocene surface soils that developed over the last 12,000 years. Erosion of till deposits also occurred that truncated and thinned till deposits and, in areas, removed a till deposits.

The preliminary soil-geomorphic research work contributed by Guccione and Tandarich during their mapping activities (during the 1980s) as soil scientist for the Callaway County soil survey is the foundation of today's understandings of Missouri's till stratigraphy. Guccione's study led her to introduce the term "McCredie formation" for the pre-Illinoian till sequence and during Tandarich's field studies he was able to recognized three separate tills (utilizing clay mineralogy and textures). He designated the oldest as the Moberly formation and the upper two tills as the Columbia and Fulton members of the McCredie formation (Rovey and Kean 1996:19). The missing upper, Macon till appears to be more northernly restrictive, not occurring very far south of the I-70 Interstate corridor; the deeper, remnant Atlanta may not have been seen or undivided from Whippoorwill material. Unfortunately, this research work and their initial findings for Missouri tills was not continued by other soil professionals until Dr. Rovey began his investigations, sometime prior to 1994.

At this point, I would like to take the opportunity to acknowledge and share that a great deal of the work for the surficial materials mapping project is being done by soil scientists LeAnn Bullard and Amber Marshaus and their professional contributions are both needed and much appreciated. Also I want to thank DGLS's Mike Siemens for his' significant contributions to the project work, its publication processes. He has proved to be the best field coordinator we've had and his insightful/knowledge related to the geologic materials have proven to be most beneficial. Wyn Kelley provides the overall leadership and has contributed to all aspects of the SM project.

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