United States Department of Agriculture

NRCS

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February 13, 2009

Micheal Golden, Director
Soil Survey Division
Natural Resources Conservation Service
1400 Independence Ave SW
Washington, D.C. 20250

Dear Mike:

Attached is a status report from the Gypsum Soils Task Force. This task force is a National Cooperative Soil Survey (NCSS) consortium initiated in May 2007 to examine the morphology, classification, geomorphology, laboratory analyses, and interpretations associated with gypsum soils. We are investigating soils with both high gypsum content (gypseous soils) and soils with low to intermediate gypsum content (gypsiferous soils). A comparison of the original task force charges (Attachment A) for each working group with performance to date indicates (in general) significant progress in addressing the charges.

A primary goal of the Gypsum Soils Task Force is a response to the classification, soil landscape, and interpretive needs of field soil scientists and an attempt to build nationwide consistency in describing gypsum soil morphology. Proposed terminology related to gypsum morphology, including kinds and shape of gypsum concentrations, pedon void and surface features, and kinds of horizon and surface fragments, were included in NASIS 6.0. Several proposals on soil morphology and taxonomy were reviewed during the 2008 NCSS Regional Conferences and will be presented as recommendations at the 2009 NCSS National Conference in May 2009. Interpretation subrules related to gypsum soils have been completed and incorporated in national standard interpretations. Laboratory analyses on gypsum soils, coordinated through the National Soil Survey Laboratory (NSSL) and three universities, continue to explore laboratory techniques for particle-size determination on gypsum soils. Laboratory results from these four laboratories also investigate internal quality control and external quality assurance on gypsum laboratory analyses – how reproducible (precise) and accurate are the results?

Composition of Task Force co-chairs and team members has changed due to retirements and reassignments. Tom Reedy (NSSC) worked zealously to provide a comprehensive series of recommendations on gypsum soil morphology and classification prior to his retirement. Dr. Juan Herrero provided an international perspective on gypsum soils during his sabbatical year at Texas Tech University prior to his return to Spain. We appreciate their contributions and participation.

The proposals on soil morphology and taxonomy reviewed during the 2008 NCSS Regional Conferences received overall support as written with only minor proposed changes. The Soil Survey Standards Subcommittee on Taxonomy for the West Regional Cooperative Soil Survey (WRCSS) Conference proposed a minor terminology change for the three new particle-size classes (replace "crystalline" with "gypseous") and addition of a statement in four of six strongly contrasting particle-size classes for a minimum gypsum difference of 15% between both parts to ensure that they are contrasting. The WRCSS Conference Research Needs Committee commented that "research is needed in areas surrounding laboratory characterization methods, soil geomorphology and ecosystem functions". This committee further expressed the need for a task force on the ecology of gypsiferous landscapes. The North Central Regional Work Planning Conference supported adoption of the gypsum morphology and taxonomy proposals without comment. The Taxonomy Committee of the Northeast Regional Cooperative Soil Survey Conference voted to take "no opinion" on the gypsum proposals as they do not impact their region. The Southern Regional Cooperative Soil Survey Conference did not address these gypsum proposals. In response to this support, we anticipate that the taxonomy proposals will be incorporated in Keys to Soil Taxonomy, 11th edition.

The 2009 NCSS National Conference draft agenda cites several items related to gypsum, including two field trips and a Gypsum Task Force Forum. These items will facilitate field and forum discussions leading to final task force reports and recommendations for future work.

Please advise us should you have any questions or comments.

Sincerely,

Susan Casby-Horton
Soil Scientist-Retired, Cross Plains, TX

Thomas Reinsch
Soil Scientist, NSSC, Lincoln, NE

cc: Maxine Levin, SSHQ, Washington, DC
Jon Hempel, Chair, SBAAG, NGDC, Morgantown, WV
Larry West, National Leader, Soil Survey Research and Laboratory, NSSC, Lincoln, NE
Karl Hipple, National Leader, Soil Survey Interpretations, Lincoln, NE
Craig Ditzler, National Leader, Soil Survey Standards, Lincoln, NE
Joe Chiaretti, SS, NSSC, Lincoln, NE
Nelson Rolong, SS, Rosenberg, TX
Cathy Seybold, SS, NSSC, Lincoln, NE
Juan Herrero, CSIC-EEAD, Zaragoza, Spain
Phil Schoeneberger, Research SS, NSSC, Lincoln, NE
Doug Wysocki, Research SS, NSSC, Lincoln, NE
Lynn Loomis, MLRA 42 SSPL, Marfa, TX
Richard Ferguson, Analytical Chemist, NSSL, Lincoln, NE
Curtis Monger, New Mexico State Univ., Las Cruces, NM
Wayne Hudnall, Texas Tech Univ., Lubbock, TX
David Weindorf, Louisiana State Univ., Baton Rouge, LA
Dennis Williamson, Leader, MLRA Region 9/SSS, Temple, TX
Ken Scheffe, SSS, Albuquerque, NM
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Gypsum Soils Task Force
Status Report
February 13, 2009

Task Force Co-chairs: Susan Casby-Horton (NRCS-retired, Cross Plains, TX) and Thomas Reinsch (NSSC, Lincoln, NE)

1. Thomas Reinsch (NSSC) and Wayne Hudnall (Texas Tech University) developed a joint technical session, entitled Characterization and Interpretation of Soils and Geologic Formations with Carbonates, Gypsum, and Other Soluble Salts, at the 2008 Joint GSA-ASA-CSSA-SSSA-GCAGS Annual Meeting. Task force members were either presenters or co-authors for nine of the ten oral presentations in this session. Susan Casby-Horton presented "Gypsum Soil Morphology and Interpretations: An Interim Report from the NCSS Gypsum Soils Task Force".

2. Thomas Reinsch presented "National Gypsum Study Task Force Update" at the 2008 NCSS West Regional Conference in June 2008.

3. Continue to investigate the need and possibility for translation of Dr. Juan Herrero's publication "Morfologia y Genesis de Suelos sobre Yesos" (Morphology and Genesis of Soils Overlaying Gypsum), authored in Spanish and published in 1991 by the National Agriculture and Food Research and Technology Institute, Spain – including translation and publication costs.

Morphology/Classification Working Group

Chair: Nelson Rolong (NRCS, Rosenberg, TX)
Note: Tom Reedy (NSSC, Lincoln, NE), previous co-chair, retired following submittal of all proposals.

1. Submitted morphology and taxonomic classification proposals for review and comment at the 2008 NCSS Regional Conferences, as follows:

Introduction to Morphology and Classification Proposals
by Joe Chiaretti, Soil Data Quality Specialist
NRCS, Reno, Nevada

The concept of separate taxonomic and descriptive standards for high-gypsum soils has merit. Soil characterization data from the National Soil Survey Laboratory indicates that about 40 percent gypsum content is a valid separation between high-gypsum soils and lower content gypsum soils, based on measured 1500 kPa water content. This critical value was used in these proposals to establish a new mineralogy class for soils that have their physical and chemical properties dominated by the presence of gypsum.

The Gypsum Morphology & Classification Workgroup is proposing new terms in lieu of texture for use in soil horizons with 40 percent or more gypsum (mentioned below under Morphology Proposals). There is also a proposal on new substitutes for particle-size class for high-gypsum soils and another on revising the gypsic mineralogy class into two classes, gypsic and hypergypsic (mentioned below under Soil Taxonomy Proposals). These three separate proposals for high-gypsum soils– new terms in lieu of texture, new substitutes for particle-size class, and the hypergypsic mineralogy class; are intended to parallel and support each other. These new standards for high-gypsum soils will add clarity to pedon descriptions, validity to taxonomic classifications, and consistency to data population.

MORPHOLOGY PROPOSAL

For soils with ≥ 40% gypsum – Two classes proposed for terms in lieu of texture:
For materials that contain 40 percent or more by weight gypsum, a variety of particle-size distributions, of either gypsum particles or a combination of gypsum particles and aluminosilicates, occur. Therefore, it is conceivable that a variety of in-lieu-of terms for texture can be proposed. The Gypsum Morphology & Classification Workgroup is proposing two new classes for use in soil horizons with 40 percent or more gypsum.

Rationale for two classes: These soils have extremely limited use potential. Gypsum content is the single most limiting factor for high gypsum materials. Standard engineering classification systems, such as AASHTO and Unified, and liquid limits and plasticity indices do not apply to these materials. High gypsum materials are easily mechanically pulverized, such as during road construction and subsequent trafficking. Subsidence, which is caused by gypsum dissolution, followed either by leaching or translocation and precipitation, is extremely problematic.

In light of the overriding limited use potential, (most interpretations will be driven by gypsum percentage) the morphology workgroup could neither come up with the criteria, nor were they able to justify more than two in-lieu-of texture classes for materials with 40 percent or more gypsum. Materials that are dominantly coarse retain 50 percent or more by weight fine earth on a #140 sieve (≥ 0.1 mm) and those that are dominantly fine retain < 50 percent by weight fine earth on a #140 sieve.

Coarse gypsum material – Mineral soil material with 40 percent or more by weight gypsum in the less than 20 mm fraction and dominated by fine sand or coarser particles. Coarse gypsum material has 50 percent or more (by weight) particles with diameters of 0.1 to **2**mm.

Fine gypsum material – Mineral soil material with 40 percent or more by weight gypsum in the less than 20 mm fraction and dominated by very fine sand, silt, and clay particles. Fine gypsum material has less than 50 percent (by weight) particles with diameters of 0.1 to **2**mm. It yields a smooth, soft feel by hand texturing a field sample with brief rubbing between thumb and forefinger.

SOIL TAXONOMY PROPOSALS

For soils with ≥ 40% gypsum – Proposed substitutes for particle-size classes
Soils with high amounts of gypsum (≥40%) are unique in that their physical and chemical properties are dominated by the presence of gypsum. When gypsum is present in amounts totaling 40 percent or more, accurate determination of all soil separates is impractical by current standard laboratory procedures for particle-size distribution analysis. This is due to the antecedent water content of gypsum, the solubility of gypsum particles in water solutions, and the flocculating effect that the calcium ion in gypsum has on fine soil particles. Even if removing all the gypsum from high-gypsum soil samples were practical, the resulting non-gypsum fraction of the soil would not accurately represent the natural soil material.

Using the particle-size classes of Soil Taxonomy to classify high-gypsum soils is a problem since such soils disperse poorly and clay content must be estimated using the formula (Clay % =2.5(%water retained at 1500 kPa tension - % organic carbon) in the Key to Particle-Size and Substitute Classes of Mineral Soils. Soil characterization data from the National Soil Survey Laboratory indicates that about 40 percent gypsum content is a valid separation between high-gypsum soils and lower content gypsum soils based on measured 1500 kPa water contents (Figure 1 in Proceedings of Gypsum Soil Workshop dated August 23, 2007). Eswaran and Zi-Tong also document that "In high-gypsum soils, there is no apparent relationship between 1.5mPa water and clay content as exists in most other mineral soils" (Eswaran and Zi-Tong, 1991). If there is no relationship between 1500 kPa water contents and clay contents in high-gypsum materials, then using the

above formula would give poor results. High-gypsum soils are also so low in content of silicate clay, that attempting to use normal particle-size classes defined largely by clay content makes little sense.

This proposal names three new substitutes for particle-size class and their possible substitute class definitions under group "B." of the Key to the Particle-Size and Substitute Classes of Mineral Soils. "Crystalline" was coined as a formative element for these substitute class names to distinguish them from the other classes in Part B of the key to Particle-size and Substitute classes. The existing classes for fine-earth components of 10 percent or more (the ashy group, medial group, and hydrous group) are defined by andic soil properties, volcanic glass content, pararock fragment content, rock fragment content, and 15 kPa water content. They're designed for soils strongly influenced by volcanic ash which are mainly soils with high volcanic glass content (non-crystalline grains) or high amounts of short-range order minerals (poorly-crystalline materials). Connoting crystalline minerals (i.e. gypsum) in the substitute class names for high-gypsum soils makes for easy separation from these other substitute class names. As part of this proposal, an analysis was made of existing soil series to determine the number of soils in the U.S.A. meeting these new substitute classes. There are currently no series that meet the crystalline-skeletal class (but some are anticipated in New Mexico), 16 series that meet the coarse-crystalline class, and 26 series that meet the fine-crystalline class. Item 4 below is a set of substitute class criteria that would follow the existing Hydrous substitute class and precede the paragraph note on clay.

Keys to Soil Taxonomy, 10th edition:

Page 298, Key to the Particle-Size and Substitute Classes of Mineral Soils
(AFTER B.3.c)

Keys to Soil Taxonomy, 10th edition:
Page 298, Key to the Particle-Size and Substitute Classes of Mineral Soils
(AFTER B.3.c)

B.4. Have, in the fraction less than 20 mm in diameter, 40 percent or more (by weight) gypsum *and* one of the following:

a. A total of 35 percent or more (by volume) rock fragments.

Crystalline-skeletal[1]

or

b. Less than 35 percent (by volume) rock fragments and 50 percent or more (by weight) particles with diameters of 0.1 to 2 mm.

Coarse-crystalline

or

c. Less than 35 percent (by volume) rock fragments.

Fine-crystalline

[1] "Crystalline" is proposed rather than "gypseous" to avoid taxonomic overkill of the recurring "gyp" syllable at the substitute class, mineralogy class, and possibly the suborder level (i.e., coarse-gypseous, hypergypsic, thermic Typic Haplogypsids).
NOTE: The Soil Survey Standards Subcommittee on Taxonomy for the West Regional Cooperative Soil Survey (WRCSS) Conference proposed substitution of the term "gypseous" for "crystalline", and the task force supports this request. For example, "Crystalline-skeletal" will change to "Gypseous-skeletal".

Proposed Strongly Contrasting Particle-Size Classes (Keys, 10th edition, pgs. 299 - 301).

- Clayey over crystalline-skeletal (0, but anticipated)
- Clayey over coarse-crystalline (0, but anticipated)
- Clayey over fine-crystalline (1)

- Loamy over coarse-crystalline (10)
- Loamy over fine-crystalline (7)
- Loamy-skeletal over crystalline-skeletal (4)

NOTE: The Soil Survey Standards Subcommittee on Taxonomy for the West Regional Cooperative Soil Survey (WRCSS) Conference proposed substitution of the term "gypseous" for "crystalline", and the task force supports this request. Therefore, the names of the six proposed strongly contrasting classes will also change because they use the new substitute classes in the lower part of the control section. For example, "Clayey over crystalline-skeletal" will change to "Clayey over gypseous-skeletal". This subcommittee also proposed adding additional statements to four of the six new strongly contrasting classes to ensure that they are contrasting. The statements will be added to the clayey over fine-gypseous, loamy over coarse-gypseous, loamy over fine-gypseous, and loamy-skeletal over gypseous-skeletal classes. The statement will be: "*(if there is an absolute difference of 15 percent or more gypsum between the two parts of the control section)*".

Proposed Hypergypsic and Gypsic Mineralogy Classes

The rationale for the current limits of the gypsic mineralogy class is not given in *Soil Taxonomy* and is also un-documented outside our taxonomic system. Several authors have offered that the limits for the gypsic mineralogy class are set too high (Hallmark, 1985; Allen, 1990). Dr. B.L. Allen in particular states: "Considering, the effect of gypsum on both chemical and physical soil properties, it seems that the present criteria for gypsic families (>40% gypsum and carbonates of the whole soil and >35% of this fraction be composed of gypsum) is too high". In addition, having accessory carbonates as part of the criteria for the gypsic mineralogy class complicates the definition and makes little sense based on their difference in solubility of gypsum and calcium carbonate(s). Again, the rationale for including carbonates in the current criteria for gypsic mineralogy is not documented.

If gypsum is the critical mineral in the definition of the class then it should, by any standard, be a stand-alone criterion. The current criteria for gypsic mineralogy effectively sets the minimum gypsic content needed at 14 percent (40%*.35). For convenience, this proposal raises that by one percentage point to 15 percent and removes the need for accessory carbonate content totaling 40 percent gypsum plus carbonates. The change makes the definition much simpler and easier to apply. The behavior of soils meeting this revised definition is likely influenced more by the gypsum content than by the mixture of gypsum plus carbonates or by the assemblage of other minerals present.

This proposal effectively lowers the limits of the gypsic mineralogy class to capture more soils that currently may be in other mineralogy classes such as mixed. Since mineralogy classes are based on a weighted average in the particle-size control section, the revised criteria for the gypsic mineralogy class is not intended to capture all soils with 15 percent or more gypsum that do not otherwise qualify for the proposed hypergypsic mineralogy class. There are 198 series that were reviewed; 127 are Gypsids and 71 are other taxa. For the Gypsids, 19 series with mixed mineralogy and one with carbonatic mineralogy would change to gypsic mineralogy if the proposed revision is adopted. This represents a change for 28 percent of the Gypsids currently having mixed mineralogy and 20 percent of the Gypsids currently having carbonatic mineralogy. For the other taxa (not Gypsids), 9 would change from mixed to gypsic and one that would change from smectitic to gypsic mineralogy if the revision is adopted. This represents a change for 26 percent of other soil taxa with gypsum currently having mixed mineralogy and 10 percent of other taxa with gypsum having smectitic mineralogy.

Keys to Soil Taxonomy, 10th edition:
Page 301, Key to Mineralogy Classes

(to be inserted before the Amorphic class)

B. Other soil layers or horizons, in the mineralogy control section, that have a substitute class that replaces the particle-size class, other than fragmental, and that:

1. Have 40 percent or more (by weight) gypsum, either in the fine-earth fraction or in the fraction less than 20 mm in size, whichever has a higher percentage of gypsum.

Hypergypsic

Keys to Soil Taxonomy, 10th edition:
Page 302, Key to Mineralogy Classes

(Replaces the current definition)
C. Other mineral soil layers or horizons, in the mineralogy control section, in all other mineral soil orders and in Terric subgroups of Histosols and Histels that have:
1. Any particle-size class and 15 percent or more (by weight) gypsum, either in the fine-earth fraction or in the fraction less than 20 mm in size, whichever has a higher percentage of gypsum.

Gypsic

NOTE: A presentation by Lynn Loomis at the 2008 Joint GSA-ASA-CSSA-SSSA-GCAGS Annual Meeting discussed an alternate proposal for taxonomic changes related to gypsum soils. Under this proposal, all soils that contain gypsic, hypergypsic, and petrogypsic horizons and have an aridic soil moisture regime would be considered Gypsids. No soil with greater than five percent gypsum content would remain as a Torriorthent. Subgroup classes that group soils with differing limitations and potentials for use and management were proposed, along with a hypergypsic diagnostic horizon and the great group Hypergypsids. This proposal was not formally submitted for NSSC review and, therefore, was not considered at this time.

References

Eswaran, H., and G. Zi-Tong. 1991. Properties, genesis, classification, and distribution of soils with gypsum, p. 89-119. *In* W.D. Nettleton (ed.) Occurrence, characteristics, and genesis of carbonate, gypsum, and silica accumulations in soils. SSSA Spec. Pub. 26. SSSA, Madison, WI.

Hallmark, C.T. 1985. Family mineralogy of soils with free carbonates and gypsum. p. 53-60. *In* J.A. Kittrick (ed.) Mineral Classification of soils. SSSA Spec. Pub. 16. SSSA and ASA, Madison, WI.

Allen, B.L. 1990. Mineralogy of Aridisols. p. 191-196. In J.M. Kimble and W.D. Nettleton (ed.) Proceedings of the Fourth International Soil Correlation Meeting (ISCOM IV) Characterization, Classification, and Utilization of Aridisols. Part A: Papers. USDA, Soil Conservation Service, Lincoln, NE.

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2. Submitted gypsum morphology terminology for inclusion in NASIS for the following categories:

shapes of concentrations	kind of pedon void and surface features
kinds of gypsum concentrations	kind of horizon fragment and surface fragment

Terms for shapes of concentrations, redoximorphic features, and mottles

Sequence	Obsolete?	Choice ID	Choice	Label	Description
1	No	1	cylindrical	Cylindrical	Elongated, tubular bodies.
2	No	2	dendritic	Dendritic	Elongated, tubular, branched bodies.
3	No	6	irregular	Irregular	Bodies of non-repeating spacing or shape.
4	No	4	platy	Platy	Relatively thin, tabular sheets
5	No	7	reticulate	Reticulate	Crudely interlocking bodies with similar spacing.
6	No	3	spherical	Spherical	Irregular or crudely spherical bodies.

7	No	5	threadlike	Threadlike	Fine to very fine, elongated filaments, generally not dendritic.
			lenticular	Lenticular	Resembling in shape the cross section of a double convex lens.
			pendular	Pendular	Suspended bodies that occur on the undersides of objects, (e.g., pendular gypsum on the bottom of rock fragments).
			rosette-like	Rosette-like	A mineral growth with concentric aggregates resembling rose flowers.

Terms for kinds of gypsum concentrations

Sequence	Obsolete?	Choice ID	Choice	Label	Description
20	No	18	gypsum crystals, unspecified	Gypsum crystals	A generic choice that has no implication of crystal type (selenite, satin spar, etc.), no connotation of pedogenesis (gypsum crystal clusters), and no connotation of inherited minerals (gypsum crystals, geogenic).
21	No	19	gypsum masses	Masses of gypsum	Discrete non-cemented gypsum bodies; crystals generally not visible.
22	No	20	gypsum nests ***(delete)*** gypsum crystal clusters	Nests of gypsum ***(delete)*** Gypsum crystal clusters	A pocket-like cluster of gypsum crystals within a soil matrix or groundmass. Generally assumed to be pedogenic accumulations.
			gypsum, finely disseminated	Finely disseminated gypsum	Very small gypsum bodies diffused within the soil layer and commonly not visible; may cause the soil to appear as though lightly dusted with whitish powder. Generally detected with the use of National Soil Survey Lab field kits; a positive reaction to soluble sulfates (SO4--) in the presence of calcium (Ca++).
			selenite crystals	Selenite crystals	The clear, colorless variety of gypsum (occasionally brownish in color due to impurities) occurring in distinct, transparent to somewhat opaque, monoclinic crystals or in large crystalline masses with one primary cleavage plane and two poor cleavages that give fragments a skewed, angular look.
			satin spar crystals	Satin spar crystals	A white, translucent, fibrous variety of gypsum, characterized by a silky luster; fibrous crystal aggregate includes fine, parallel threads that reflect light, resembling satin.
			gypsum crystals, geogenic ***(delete)***	Geogenic gypsum crystals ***(delete)***	Angular gypsum crystals, usually larger than 2 mm, that are inherited from soil parent materials. They are usually "free floating" in the matrix of transported parent materials like alluvium or they may be present in seams or fractures of parent materials weathered in place (e.g. residuum from shale or gyprock). ***(delete)***

Term for kind of pedon void and surface features

Sequence	Obsolete?	Choice ID	Choice	Label
			Gypsum coats	Gypsum coats

Term for fragment kind and comp_surface_fragments kind

Choice	Label
gypsum crystals	Gypsum crystal fragments

3. Workgroup member Wayne Hudnall led a four-day field trip in West Texas, entitled "Characterization and Interpretation of Soils and Geologic Formations with Carbonates, Gypsum, and Other Soluble Salts", associated with the 2008 Joint GSA-ASA-CSSA-SSSA-GCAGS Annual Meeting. Several workgroup members participated in this field trip.

4. Continued to develop the ftp site (ftp://ftp-fc.sc.egov.usda.gov/NSSC/Gypsum) for publications, trip reports, working group correspondence, etc. related to gypsum soils and the Gypsum Soils Task Force.

5. Developed a prototype Munsell High Value White Page.

6. Finalize development of a NASIS minimum dataset for gypsum soils.

7. Finalize discussion (with recommendation) on use of the "y" and (proposed) "yy" horizon designations.

Interpretations Working Group

Co-Chairs: Cathy Seybold (NSSC, Lincoln NE) and Juan Herrero (CSIC-EEAD, Zaragoza, Spain)

1. Drafted one new interpretation for un-surfaced roads.

2. Completed interpretation subrules for dust, piping, subsidence (due to gypsum dissolution), and gypsum content. Most of the engineering and urban/recreation interpretations have been updated with these subrules. Modified 30 interpretations to take into account high gypsum soils (soils with > 40 percent gypsum) and surface O horizons. This is 1/3 of all the national standard interpretations. Initiated testing of several modified interpretations within the Interpretations Working Group. Internal testing is complete. Revisions proposed by users will be evaluated.

Soil Geomorphology Working Group

Co-chairs: Phil Schoeneberger (NSSC, Lincoln, NE) and Lynn Loomis (NRCS, Marfa, TX)

1. Oral presentation by Phil Schoeneberger, entitled "Pedologic and Landscape Evolution along a Traverse of Highly Gypseous Soils in a Semi-arid Bolson, New Mexico" at the 2008 Joint GSA-ASA-CSSA-SSSA-GCAGS Annual Meeting in Houston.

Laboratory Methods and Analyses Working Group

Co-chairs Richard Ferguson (NSSC, Lincoln, NE) and Curtis Monger (NMSU, Las Cruces, NM)

1. Continued inter-laboratory comparison of analytical results. Control soil samples and data were furnished by National Soil Survey Laboratory (NSSL) to Texas Tech (Wayne Hudnall, Jim Rogers), Texas A&M (Tom Hallmark), and New Mexico State University (NMSU) (Curtis Monger) and are being analyzed along with test samples for process control.

2. NSSL investigation of gypsum particle size distribution, oral presentation by Mike Pearson, Thomas Reinsch, and Rich Ferguson at the 2008 Joint GSA-ASA-CSSA-SSSA-GCAGS Annual Meeting in Houston. The standard particle size method, being conducted on the mineral fraction after gypsum removal, is not applicable to determine texture. A novel method is proposed to measure the sand size particle distribution of

whole gypseous soils in order to determine the texture class according to the taxonomic proposal. The whole, < 2 mm sample is disaggregated in ethanol by sonication, then sieved through a 300 mesh screen. The retained fraction is dried and passed through a nest of sieves to determine sand size particle distribution. Assuming insignificant amounts of clay-size gypsum particles are present in such soils, the percent total clay is re-calculated from the standard SSIR-42 method result onto a whole soil basis. Silt is determined by subtracting percent total clay and percent total sand from 100.

3. Additional NSSC investigation of gypsum particle size distribution, oral presentation by Doug Wysocki and Phil Schoeneberger at the 2008 Joint GSA-ASA-CSSA-SSSA-GCAGS Annual Meeting in Houston. This method employs a dry sieve technique to obtain a consistent measure for particle size comparison. The data obtained is not a true particle size, but the technique provides a rapid estimate based on uniform energy input that can help quantify field texture.

4. Current NMSU research is exploring ways to prevent the dissolution of gypsum while conducting textural analysis by using low viscosity oil, saturated NaCl solution, saturated gypsum solution, and a combination of a saturated Na_2SO_4-gypsum solution. Although the low viscosity oil prevented gypsum dissolution, it was unsuitable because of problems with the drying of the oil-saturated sample, disposal, and cost. The NaCl saturated solution was unsuitable because it did not prevent gypsum dissolution as a result of ion pairing. The saturated gypsum solution was successful in preventing gypsum dissolution because of the common ion effect, but problems with clay flocculation can still occur. Current experiments are evaluating the combination of Na_2SO_4 and gypsum solution for preventing gypsum dissolution but not dispersing the clay. Oral presentation (Justin Riggs, Curtis Monger, Mei Wang, and April Ulery) at the 2008 Joint GSA-ASA-CSSA-SSSA-GCAGS Annual Meeting in Houston.

5. Current Louisiana State University research is exploring use of field portable x-ray fluorescence (XRF) spectrometry as a quantification tool for gypsum content in soils of West Texas and southern New Mexico, USA. Six sites were evaluated with gypsum contents ranging from <10% to >90%. Samples collected from each site were scanned in the field using XRF and brought back to the laboratory for additional XRF scanning. Variables which might affect XRF scanning results, such as scanning time, particle size, moisture content, etc. were evaluated. Both gypsum ($CaSO_4 \cdot 2H_2O$) and calcite ($CaCO_3$) were quantified using standard lab techniques. Three datasets were compared: 1) soil characterization data (SCD), obtained from the National Soil Survey Laboratory Research Database in Lincoln, NE, 2) quantitative x-ray diffraction (QXRD), and 3) portable x-ray fluorescence (PXRF). The best correlation of gypsum XRF data (via Ca quantification minus calcite content) and lab data was between PXRF and QXRD ($R^2 = 0.92$). On average, PXRF provided results within 6% of SCD, the current lab standard for gypsum quantification. Field portable XRF shows considerable promise as a rapid, quantifiable measure of gypsum in soils. Submittal (David Weindorf, et al) currently under review for publication in Journal of Arid Environments, entitled "Evaluation of Portable X-ray Fluorescence for Gypsum Quantification in Soils".

Attachment A
Gypsum Soils Task Force
Working Group Organization and Charges
Provided via Email Message from David Hammer on May 29, 2007 (with minor modification)

Task Force Co-chairs: Thomas Reinsch (NSSC, Lincoln, NE) and Susan Casby-Horton (NRCS, Temple, TX)

Although not included in the original task force organization and charges, co-chairs expect to:
1. Identify issues related to gypsum soils and revise working group charges, as appropriate.
2. Coordinate progress and timelines among the four working groups, including participation in teleconferences, and report activity.
3. Communicate the progress and needs of the Gypsum Soils Task Force to National Headquarters, NSSC, State Soil Scientists, field soil scientists, and NCSS cooperators.
4. Identify funding needs and opportunities, if needed.
5. Coordinate both field testing of working group proposals and recommendations and technology transfer of information on gypsum soils to field soil scientists.

Morphology/Classification Working Group
Co-chairs: Tom Reedy (NSSC, Lincoln, NE) and Nelson Rolong (NRCS, Presidio County, TX)

Team members:
Wayne Hudnall (Texas Tech University, Lubbock, TX)
Tom Hallmark (Texas A&M University, College Station, TX)
Bob Dobos (NSSC, Lincoln, NE)
Greg Cates (MLRA Project Leader, Las Cruces, NM)
Tom Hahn (NRCS, Lakewood, CO)
Doug Malo (South Dakota State University, Brookings, SD)
Steve Park (NRCS, Lakewood, CO)

Charges -- Morphology
Munsell color page development.
Textural modifier criteria – gypsiferous?
Terms-used-in-lieu-of criteria – gypseous material?
Pedon morphology and naming conventions
Surface morphology
Geogenic vs. pedogenic discussion
Horizon nomenclature – Need to clarify for field application.
For gypsum soil materials (and other kinds of material) that are not technically bound by a cementing agent and do not slake in water: Should we continue to describe them as "cemented rupture resistance class" or propose a different term to replace "cemented" (e.g. unslaked rupture resistance class, air-dried, submerged, moist)?

Charges – Taxonomy
Petrogypsic horizon – is there a need for a *haplic* petrogypsids (strongly "cemented" or less "cemented" in all subhorizons)?
Mineralogy class: revise gypsic criteria? Is there an interpretive need to add hypergypsic?
Substitute classes for mineral soils.
Sandy-gypseous?
Loamy-gypseous?
Floury-gypseous?
Strongly contrasting particle-size classes.

Interpretations Working Group
Co-chairs Cathy Seybold (NSSC, Lincoln, NE) and Juan Herrero (Texas Tech University, Lubbock, TX)

Team members:
Bob Dobos (NSSC, Lincoln, NE)
Ken Scheffe (NRCS, Albuquerque, NM)
Kent Cooley (NRCS, Rapid City, SD)
Steve Park (NRCS, Lakewood, CO)

We anticipate the morphology and geomorphology groups will closely coordinate. Ideally, a system that can associate the pedon morphological features with the geomorphic surface is desirable, but may not be achievable due to the highly mobile, dynamic nature of gypsum.

Charges
Identify national standard interpretations that need modifications due to presence of gypsum (outline proposed modifications).
Develop interpretive statements for modifications outlined in charge #1.
Conduct literature reviews to obtain information for development of interpretive criteria and breaks (based on interpretive statements developed in charge #2)
After completion of the first three charges, develop rules in NASIS and modify the national standard interpretations relating to the presence of gypsum in soil.

Potential hazards of soils containing gypsum:
Dissolution induced subsidence
Piping (and karst development)
Corrosion
Agronomic problems
Heaving (presence of soluble sulfates, Al, Ca, and water)

Other related hazards:
Piping due to Na and clay
Clay materials with ESP values of > 15% are considered highly susceptible to piping
Low density soils (collapse settlement or hydrocompaction) in Arid soils
Collapsing soils are characterized by low moisture content (less than 15%), high porosity (>40%), and low bulk density
Especially troublesome in soils with large amounts of silt
Corrosion problems with soils high in sulfates (e.g., Na and Mg) other than calcium sulfate or in combination

Soil Geomorphology Working Group
Co-chairs: Phil Schoeneberger (NSSC, Lincoln, NE) and Lynn Loomis (NRCS, Marfa, TX)

Team members:
Wayne Hudnall (Texas Tech University, Lubbock, TX)
Susan Casby-Horton (NRCS, Temple, TX)
Gordon Michaud (NRCS, Las Cruces, NM)
Bill Johnson (NRCS, Phoenix, AZ)

Charges
Investigate and document occurrences of gypsum on geomorphic surfaces.
Investigate relationships of forms of gypsum on landforms/geomorphic surfaces.
Investigate pedogenic and geomorphic transport processes of gypsum.

Identify and document relationships of gypsum dissolution and ground subsidence to gypsum origins, forms and locations in landforms.
Investigate relationships of gypsum to other salts and metals.
Identify and compare existing occurrence models of gypsum with patterns and processes in current soil survey areas.

Laboratory Methods and Analyses Working Group
Co-chairs Richard Ferguson (NSSC, Lincoln, NE) and Curtis Monger (NMSU, Las Cruces, NM)

Team members:
Wayne Hudnall (Texas Tech University, Lubbock, TX)
Tom Hallmark (Texas A&M, College Station, TX)
Thomas Reinsch (NSSC, Lincoln, NE)

Charges
Compare analytical results of gypsum analyses among cooperating soil survey laboratories (SSL, Texas Tech, Texas A&M, New Mexico State).
Identify needed new analyses for chemical, physical and mineralogical properties of soils with gypsum.
Develop and test new analytical methods for chemical, physical and mineralogical properties of soils with gypsum.