North American Commission on Stratigraphic Nomenclature (NACSN)

78th Annual Meeting

Monday, October 16, 2023 (1:00-5:00 pm, Eastern Daylight Time)

Hybrid meeting held in conjunction with Geological Society of America Annual Meeting (GSA Connects 2023) Pittsburgh, Pennsylvania, U.S.A.

Westin Pittsburgh Hotel, Fayette Room

AGENDA

1. Call to Order of the 78th Annual Meeting (Chair R. M. "Matt" Joeckel)

The meeting was called to order by Chair Matt Joeckel at 1:06 PM EDT. Nine commissioners were present in the room at the beginning of the meeting; 19 commissioners were present online; also online were one commissioner-in-waiting, two commissioners whose terms began at the end of the meeting, and one guest. Chair Joeckel noted that the meeting will follow the GSA code of conduct.

2. Roll Call (Joeckel)

- Refer to separate document (* indicates new commissioner)

For the **American Association of Petroleum Geologists** (3)

Katherine A. Giles [2022-2025] Present (came in after meeting started)

Doug Sprinkel [2020-2023] Present

Richard Denne [2021-2024] **Vice Chair, 2022-2023** Present

For the **Association of American State Geologists** (3)

Clint Kromhout* (replacing David LePain) [2023-2025] Present

David Dockery [2021-2024] Present

R.M. (Matt Joeckel) [2021-2024] **Chair 2022-2023** Present

For the **Geological Society of America** (3)

Frank Ettensohn [2022-2025] Present

Jim Lehane [2021-2024] Present

Gordon C. Baird [2020-2023] Present

For the **U.S. Geological Survey** (3)

Lucy Edwards [2022-2025] Present

Julie Herrick [2020-2023] Present

Nancy Stamm [2021-2024] Present

For the **Geological Survey of Canada** (3)

Lynn Dafoe [2022-2025] Present

Robert MacNaughton [2020-2023] Present

Jim Haggart [2021-2024] Absent

For the **Canadian Society of Petroleum Geologists** (2)

John-Paul Zonneveld [2020-2023] Present

Brian R. Pratt [2021-2024] Present

For the **Geological Association of Canada** (2)

Frank Brunton [2022-2025] Absent

John W. Johnston [2020-2023] Present

For the **SEPM/Society for Sedimentary Geology** (2)

Howard Harper [2022-2025] Absent

Marie-Pierre Aubry [2021-2024] Present

For the **Servicio Geológico Mexicano** (1)

Rosario Isabel López-Palomino [2021-2024] Absent

Juan Carlos Salinas Prieto [2022-2025] Absent

For the **Asociación Mexicana de Geólogos Petroleros** (1)

Martin Martinez Medrano [2022-2025] Absent

For the **Sociedad Geológica Mexicana** (1)

Ruben Alfonso López Doncel [2022-2025] Present

For the **Instituto de Geología de la Universidad Nacional Autónoma de Mexico** (1)

Fernando Núñez Useche [2022-2025] Present

Commissioners-in-Waiting (need to amend Articles to integrate new Commissioners)

For the **Instituto de Geología y Paleontología/Servicio Geológico de Cuba (Cuba)**

Luis Ramón Bernal Rodríguez [2022-2025] Absent

For the **Colegio de Geólogos (Bolivia)**

Wilfredo Ramos Collorana [2022-2025] Absent

For the **Asociación Colombiana de Geólogos y Geofísicos del Petróleo (Colombia)**

Luis Ignacio Quiroz [2022-2025] Absent

For the **Colegio de Geólogos de Costa Rica (Costa Rican Association of Geologists)**

Gerardo Soto Bonilla [2022-2025] Absent

For the **Sociedad Geológica del Perú (Peru)**

Gerardo Pozo Calle [2022-2025] Absent

For the **La Asociación de Geólogos del Paraguay (Paraguay)**

Nestor Salinas Franco [2022-2025] Absent

For the **Sociedad Uruguaya de Geología (Uruguay)**

Valeria Mesa [2022-2025] Present

Commissioners-at-Large (9)

Jon J. Smith [2023-2025] Present

Carlton E. Brett [2022-2025] Present

Mike Easton [2021-2024] Present

Ismael Ferrusquía-Villafranca [2022-2025] Absent

Richard H. Fluegeman [2022-2025] Present

Ed Landing [2021-2024] Present

Norman P. Lasca [2021-2024] Present

Randall C. Orndorff [2021-2024] Present

Janet L. Slate [2020-2023] **Chair 2021-2022, Past Chair 2022-2023** present

Guests

Guest Stéphanie Larmagnat, Geological Survey of Canada Present

Jonathan Arthur, Executive Director, American Geological Institute Present (at 4:00)

Guy "Harley" Means, State Geologist, Director of the Florida Geological Survey Present (at 4:00)

Alex Zagorevski, Geological Survey of Canada [2024-2027] Present

Jeremy Workman, USGS, [2024-2027] Present

Ralph Haugerud, USGS, Present

Marianto Castro Mora, Present

3. Approval of the Agenda (Joeckel)

- Are there any corrections or additions to this agenda? The agenda was approved unanimously

4. Introduction of New Commissioners and Guests (Joeckel) New commissioner Clint Kromhout was introduced by Chair Joeckel

[* indicates new commissioner]

For the **Association of American State Geologists**

Clint Kromhout* (Florida Geological Survey) will be assuming the last two years of the term formerly held by David LePain [2022-2025]*

5. Approval of Minutes of the 77th Annual Meeting: Denver, Colorado, Tuesday, October 10, 2022 (Joeckel)

- Refer to separate document.
- Corrections or additions to minutes of 77th Annual Meeting?

Guests Alejandro Angulo and Katrina Sauer (both USGS) were added to the minutes.
Approval moved by Carlton Brett, seconded by Jon Smith, passed unanimously.

6. In Memoriam of Past Commissioners (Joeckel)

- John A. Van Couvering (1931–2023): Passed away on 22 May 2023. Served as NACSN Commissioner-at-Large during 2005 –2016; also served on Chronostratigraphic Subcommittee for the 1983 North American Stratigraphic Code and its 2005 revision. Founder and first editor of *Stratigraphy*, as well as long-time Editor of Micropaleontology. Retired from American Museum of Natural History.

- Any additional memorials?

7. Recognition of Awards Received by Commissioners (Joeckel)

- Brian Pratt (University of Saskatchewan): was awarded the Geological Association of Canada's Middleton Medal for Sedimentology in 2022. It is awarded biannually.

- *Any additional awards?* Carlton Brett was awarded The Paleontological Society Medal (their most prestigious honor) at their 2023 annual meeting on 10/15/2023.

8. Report of the Chair (Joeckel)

Thank you all for your patience with me over the past year. I have tried to achieve something of value on behalf of the Commission. Some salient developments during 2022–2023. I draw your attention to these developments:

8.1. Reinstatement of NACSN as a Member Society of AGI: Discussions with Executive Director of AGI Jonathan Arthur during late spring and summer 2023 led to the reinstatement of NACSN as a member society during July. NACSN is now listed as such on the AGI website [https://www.americangeosciences.org/member-societies]. In the future, the Chair of NACSN will need to participate in certain AGI meetings and circulate relevant materials. Likewise, the Commission at large will need to vote on particular measures.

8.2. Redevelopment of a NACSN website: The discussions with AGI have led to that organization hosting a new version of the NACSN website. Chris Keane of AGI graciously assisted Chair Joeckel in building the new website during August through early October; that site is now pointed to the

permanent url: https://nacsn.americangeosciences.org. The site is a 'work in progress" that will require yearly attention. An ad hoc website committee should be appointed.

8.3. Spanish and French translations of the North American Stratigraphic Code: A Spanish translation of North American Code and a draft of a French translation is completed.

8.4 Conclusion of online discussion about Chemostratigraphy proposal occurred during this term, culminating in the very recent publication of Report 15. NORTH AMERICAN COMMISSION ON STRATIGRAPHIC NOMENCLATURE Report 15 - Revised Articles 2, 61 and 62 of the North American Stratigraphic Code to Formalize Chemostratigraphic Units (Scott et al.) was published on 9/15/2023 in the journal Stratigraphy. Ed Landing suggested that commissioners send copies to editors of their association's journals, ensuring reviewers are aware of the nomenclature. Mike Easton enquired as to why "Report 15 is not Open Access? In the past the NACSN articles were all Open Access".

8.5. Possible hydostratigraphy proposal: Discussions with Jonathan Arthur and others during the late summer and early fall have led to the inclusion of a presentation by that individual at the present meeting. Interest in codifying hydrostratigraphic units has existed for four decades, yet prior attempts to formalize matters were never concluded. NACSN discussions of this topic began at least as early as the 39th Annual Meeting in 1984. There are mentions of such activity in multiple meeting minutes published as Notes in

8.6. Decision not to scan NACSN archives: Discussions with Norm Lasca during the previous year made it clear that there are, at present, too many barriers (person-hour costs, logistics, etc.) to scanning the archives and making them available online.

Additionally, I convey to you a few concerns, which others may share:

8.7. Cost of annual meetings relative to lack of organizational finances: Program billing, internet access, and other costs for the past two meetings have totaled approximately $350 each. Is the present way of dealing with such expenses sustainable? Is there an alternative?

8.8: Does NACSN need a written Code of Conduct? Or is it sufficient to indicate at the beginning of the meeting that the GSA code of conduct will be used?

8.9: Should the responsibilities of Chair and Vice Chair be codified in some way, relative to the informal list of duties compiled by Jim Haggart.

9.0. Need to attract younger commissioners (see #14 re: Junior Stratigrapher Commissioner-at-Large), especially given ongoing changes in academia and the workplace.

9.1. How does NACSN remain relevant and promote its work?

I extend my very special thanks to Randy Orndorff for his guidance and support over the past year. I also thank Lucy Edwards, Carl Brett, Nancy Stamm, Janet Slate, Julie Herrick. And David Soller. I have greatly appreciated the generous support for NACSN provided by Jon Arthur and Chris Keane of AGI. Thanks to all of NACSN for your patience with me.

9. Report of the Vice Chair (Vice Chair Richard Denne) Discussion of the "paper" summary of NACSN every 3 years; last one was Note 70 (2014-17 summary) published in Stratigraphy in April, 2020, so the article for 2017-2020 is now due. Question whether this should also be submitted to GSA Today and SEPM's Sedimentary Record. Jim Haggart agreed to spearhead the effort.

10. Update on Spanish Translation of North American Stratigraphic Code (Joeckel)

- On 12 September 2023, Commissioner Fernando Núñez Useche informed Chair Joeckel that the manuscript containing the Spanish-language translation of the North American Stratigraphic Code was ready for publication in *Boletín de la Sociedad Geológica Mexicana*, requesting letters of support from the Chair and Vice Chair of NACSN.
- Chair Joeckel and Vice Chair Denne sent the requested letters to Dr. Antoni Camprubí Cano (Editor-in-Chief) on 19 September.
- Additional comments? To be published in 2024; Vice-chair Denne discussed release of the copyright with Stratigraphy editor Jean Self-Trail. Jon Smith noted to add versions on the website.

11. Update on French translation of North American Stratigraphic Code (Commissioner Aubry and Stephanie Larmagnat, Geological Survey of Canada)

- Thus far, *ad hoc* review committee includes Lucy Edwards; additional volunteers are needed. There was a discussion between Lucy Edwards and Marie-Pierre Aubry on reviewing, and a comment by Mike Easton that translations can improve the English version. Lucy Edwards and Brian Pratt volunteered to serve on the French version ad hoc committee; suggestion to also ask Manuel Duguet [from online chat: "manuel.duguet@ontario.ca He was born and received his university training in France, and is fluent in both English and French. So classical French rather than French-Canadian. He did the French translation for Note 67-Report 12, so he is familiar with the Code and NACSN"].
- Review committee will address stylistic, editorial and scientific problems that have been noted in the course of the translation.
- Commissioner Marie-Pierre Aubry and Guest Stéphanie Larmagnat (Geological Survey of Canada) will present their first draft of the French translation of the Code, formatted as the English text, and inserted in it for ready online posting. Stéphanie Larmagnat shared (via screen) the current version with English and French versions side by side.
  Marie-Pierre Aubry and Stéphanie Larmagnat will meet in November to unify their translations (terminology, style, etc.). Their comments on the English version will hopefully be done during the winter.

12. Update on Inclusion of Chemostratigraphy in the North American Stratigraphic Code (Joeckel).

- Published online 15 September 2023: NORTH AMERICAN COMMISSION ON STRATIGRAPHIC NOMENCLATURE Report 15 - Revised Articles 2, 61 and 62 of the North American Stratigraphic Code to Formalize Chemostratigraphic Units, by Robert W. Scott, Carlton E. Brett, Richard H. Fluegeman, Jr., Brian R. Pratt, and Ed Landing. Stratigraphy Volume 20, No. 3, pp. 233-–236.

- This recent publication follows: NORTH AMERICAN COMMISSION ON STRATIGRAPHIC NOMENCLATURE Note 71 – Application for addition of chemostratigraphic units to the North American Stratigraphic Code: A case for formalizing chemostratigraphic units. *Stratigraphy*, Volume 17, No. 2, pp. 135–139 - online 09 Jun 2020.

  Extensive discussion of this note occurred by email during the fall and early winter of 2022, following the 77th annual meeting (2022). There was no further discussion on these items.

13. Reports from other Commissioners or organizations

- NACSN Archives? Norm Lasca reported that the archives were up to date to 2022. He encouraged everyone to copy him on all correspondence, and that someone else needs to take over the archives by the next meeting (the archives will remain at the U. of Milwaukee).
- Others? No further discussion.

14. Discussion of Unresolved Agenda Items from the 2022 Annual Meeting

- Formalizing Biochron in the Code (Discussed in 2022 by Commissioner Marie-Pierre Aubry).
- Formalizing Subseries in the Code (Discussed in 2022 by Commissioner Marie-Pierre Aubry). [Incorporated in 2021 edition]
- Possible Junior Stratigrapher Commissioner-at-Large (discussed in 2022 by Commissioners Janet Slate and Jim Haggart).

Discussion began with Lynn Dafoe providing a short history on junior commissioner discussion.
Lucy Edwards: encouraged everyone to make sure fill-ins are appointed if they were to miss a meeting
Norm Lasca: Organizations should look at appointing younger commissioners.
Marie-Pierre Aubry: support for junior-at-large commissioners.
Lynn Dafoe: amendment to encourage alternates?
Jon Smith: also early career
Carlton Brett: develop avenues for younger at-large commissioners.
Richard Fluegeman: should go through the organizations, not at large
Lynn Dafoe: what about student observers?
Lucy Edwards: "NACSN meetings are open to anyone. I also attended when I was young as an observer"
Chair Joeckel: (1) do we need bylaws on appointing fill-ins (alternates)? (2) how do we involve young professionals? As commissioners in training? (3) student observers. Need for agenda item for next year's meeting.
Janet Slate: need to write an amendment before we meet.
Online chat: Current phrasing "A Commissioner may designate an alternate to act in his or her stead at meetings the Commissioner is unable to attend."
Jim Lehane: suggested to change in bylaws from "may" to "should" designate an alternate.
Lynn Dafoe: need committee to move forward.
Lynn Dafoe, Randy Orndorff, Carlton Brett, Fernando Núñez, Marie-Pierre Aubry, and Jim Lehane volunteered to serve on a committee on revising bylaws and to encourage student engagement with Rob MacNaughton as ex officio member.

- Discussion on Inclusion of Central and South American Stratigraphers in NACSN (discussed in 2022 by Commissioner Fernando Núñez).

Rob MacNaughton started discussion by stating that articles were revised in 2020 to be more inclusive, will provide background to the committee.
Lucy Edwards: what was approved is in the meeting notes.
Fernando Núñez: should have commissioners from Ecuador and Chile.
Norm Lasca: commissioners-in-waiting need to be regularly appointed.
Lynn Dafoe: there was discussion in 2021 meeting on new positions.
Janet Slate: thought amendment was to be discussed at this meeting.
Richard Fluegeman: should go ahead and appoint now as at-large and then determine what organizations should be added from South America.
David Dockery: what about quorum?
There was no further discussion and no action was taken on this item.

- Other items?

15. VOTE on adoption of new logo for NACSN (Joeckel). David Dockery moved, Carlton Brett seconded, unanimously approved after short discussion (logo is attached to the end of the minutes). The logo is based on stratigraphic section from the Pennsylvanian of Kansas in honor of R. C. Moore, the first chair of the NACSN.

16. VOTE on adoption of NORTH AMERICAN COMMISSION ON STRATIGRAPHIC NOMENCLATURE NOTE 72: Application for Revisions to the North American Stratigraphic Code to Address Culturally Offensive or Inappropriate Unit Names and to Encourage the Use of Indigenous Place Names, by Robert B. MacNaughton, Lynn T. Dafoe, and James W. Haggart. *Stratigraphy* 19(3): 187-200. Published online 15 September 2022. https://www.micropress.org/microaccess/stratigraphy/issue-384/article-2299, https://doi.org/10.29041/strat.19.3.03

- *As per Article 21 of the NACSN Bylaws, this content may be voted upon since more* than a year has passed since its publication; it can be approved by a two-thirds majority.

- Text of email communication from Rob MacNaughton dated 21 September 2023:

"NACSN Note 72, which proposed revisions to the Code, was published on Sept 17, 2022. Since more than one year has now passed since publication, I understand that these revisions can be voted on at the 2023 Annual Meeting. I attach a copy of Note 72 for possible circulation with the agenda.

The authors of the note have received very little feedback regarding the proposed revisions. The one substantive suggestion came from the USGS Geologic Names Committee. Regarding the proposed revisions to Article 7, Remark (a) (p. 190 in the English portion of the note), they suggested that an example be provided to illustrate the inappropriate use of an Indigenous place name. We take their point but, rather than provide an example, we have added text suggesting that inappropriate usage may best be avoided by discussion with local communities. The attached Word document provides the current text of Article 7, Remark (a), with the revisions proposed in Note 27 (red, italic text) and the suggested additional revision (red, bold, italic text)." [Note that the red text in the following bullet are as they were in the agenda of the meeting and were not added during writing of the minutes.]

- Remarks (from a separate document): (a) **Appropriate geographic terms.**—Geographic names derived from permanent natural or artificial features at or near which the unit is present are preferable to those derived from impermanent features such as farms, schools, stores, churches, crossroads, and small communities. Appropriate names may be selected from those shown on topographic, state, provincial, county, forest service, hydrographic, *Indigenous government or organization,* or comparable maps, particularly those showing names approved by a national board for geographic names *or a similarly authoritative body*. *Where more than one published name is available for a geographic feature, it is appropriate to consider both common usage and the availability of an Indigenous name when formalizing a unit. Particular care should be taken, however, to avoid inappropriate usage of culturally important sites or their traditional names when naming geological units****; discussions with local Indigenous communities may play an important role in avoiding inappropriate usage of such names****.* The generic part of a geographic name, e.g., river, lake, village, should be omitted from new terms, unless required to

distinguish between two otherwise identical names (e.g., Redstone Formation and Redstone River Formation). Two names should not be derived from the same geographic feature. A unit should not be named for the source of its components; for example, a deposit inferred to have been derived from the Keewatin glaciation center should not be designated the ‘‘Keewatin Till.’’ *Names that could be deemed culturally offensive or similarly inappropriate by present-day standards should be avoided, even if they otherwise conform to the principles just stated.*

During discussion Ed Landing asked what if there is more than one Indigenous name?, which Brian Pratt commented on.
Robert MacNaughton: no political position is taken, main point is to remove offensive terms.
Lucy Edwards: we are ahead of the game.
Randall Orndorff: USGS is very supportive.
Robert MacNaughton: thanked committee and asked to honor Fred John Barnaby and Bobby Manuel
Motion to approve by Jim Lehane, seconded by Carlton Brett, unanimously approved.
Lucy reminded committee that Note 72, with the bold red revision, will now have to be published as Report 16.

17. Report of the Nominating Committee and Election of Officers for 2022–2023 (Commissioners Janet Slate, Rob MacNaughton, and John-Paul Zonneveld)

- See separate document with list of 2023–2024 Commissioners. Past-Chair Janet Slate introduced new commissioners Alex Zagorevski, Geological Survey of Canada [2024-2027] and Jeremy Workman, USGS, [2024-2027], and Vice-Chair nominee Randy Orndorff.

18. Appointment of ad hoc NACSN Website Committee

- Charge: Check existing material for errors and oversights. Carefully review **posted text from North American Stratigraphic Code**—determine what is missing and insert the appropriate text from the version approved in 2021.
- Compile other corrections, approved agendas, approved minutes, membership lists, additions, etc. and share them with the Chair of NACSN for approval. Be sure to include the approved minutes of the 77th Annual Meeting in 2022.
- Submit all compiled changes, thus approved to **Chris Keane** at AGI (keane@americangeosciences.org) **no later than 15 December 2023**.
- **DO NOT plan on adding or modifying content more than twice during the period October 2023 to October 2024** or in any other year. Thus, once in late 2023 and once in August or early September of 2024.

Jon Smith will chair the ad hoc NACSN Website Committee, with members Jim Lehane and Doug Sprinkel. Randy Orndorff will advise as he did the previous website. Randy also noted that there were issues with the printed code.

19. Appointment of Nominating Committee for 2023–2024 (Joeckel)

- The NACSN Bylaws state that a new committee of three (3) members in the third year of their term will be appointed.

Jim Haggart will chair the nominating committee, with members Matt Joeckel and David Dockery.

20. Election/Renewals of Commissioners-at-large (Joeckel)

- Jon J. Smith (Kansas Geological Survey) was voted in as a Commissioner-at-Large at the 77th annual meeting
- Janet Slate's term ends in 2023

Brian Pratt moved, seconded by Carlton Brett to add Janet Slate as a Commissioner-at-Large. Unanimously approved.

- Any other Commisioners at large?

Marie-Pierre Aubry suggested that we add Stéphanie Larmagnat. Brian Pratt moved, seconded by Jon Smith to add Stéphanie Larmagnat as a Commissioner-at-Large. Unanimously approved.

21. Presentation of Scrolls (Joeckel)

- Terms ending in 2023: Commissioners ~~Doug Sprinkel [2020-2023]~~, Gordon C. Baird [2020-2023], Julie Herrick [2020-2023], Robert MacNaughton [2020-2023], ~~John W. Johnston [2020-2023]~~, Janet L. Slate [2020-2023]. Commissioners Sprinkel and Johnston had their terms renewed by their organizations.
- Discussion of how to deal with scrolls now and in the future. Lucy Edwards stated that she used to send them out; Chair Joeckel will send them out to those who wish them.

RECESS UNTIL 4:00 PM IF NECESSARY

Guests Jonathan Arthur and Guy "Harley" Means joined the meeting after a 15 minute recess. Jonathan Arthur went through a PowerPoint presentation (attached to the back of these minutes) entitled "Is There a Case for a Hydrostratigraphic Code?". Main problems are nomenclatural inconsistencies, accepted nomenclature doesn't address types of data needed for conceptual models, need hydrostratigraphic code that addresses subtilities.

22. **Reconvene at 4:00 pm** for a brief presentation by Jonathan Arthur, Executive Director of AGI and former State Geologist of Florida, on hydrostratigraphy and the need for its inclusion in the North American Stratigraphic Code.

Jon Arthur submitted the following text by email on 3 October 2023:

Hydrostratigraphic Nomenclature – A Potential Role for the NACSN (Draft)

Jonathan Arthur

October 3, 2023

Water resources in the US are of paramount importance and most of these of these resources are groundwater. Discrepancies in aquifer unit names and hierarchies are cause for confusion and impact bottom-line costs when framework characterization, mapping and modeling are undertaken, especially across geopolitical boundaries. Moreover, the inconsistencies do not foster effective communication of geoscience information to policy makers and the public. Well-characterized hydrogeologic settings,

including characterization of boundary conditions, are essential for the successful design and management of water supply wellfields, waste disposal wells, monitoring system designs, various applications of managed aquifer recharge, and infrastructure or land uses that can impact water quality.

As with early challenges in lithostratigraphy, hydrostratigraphic nomenclature issues center on scale, correlation, and consistency (e.g., multiple unit and term definitions). There is no code or set of rules that defines the minimum criteria (e.g., mappability, identifiable physical or hydrologic properties) for a fundamental hydrostratigraphic unit (HSU). Only guidelines exist that have been variably implemented.

At a sub-regional scale, a hydrostratigraphic unit may be correctly identified as an aquifer; however, at a more regional scale the same unit may be a subunit within a thick and complex aquifer system. Lateral and vertical permeability changes within a region's hydrogeological framework give rise to a need for robust and specific nomenclature standards and definitions to foster consistent mapping and modeling. In many regions, currently accepted nomenclature does not include the level of detail needed for conceptual models and simulation of groundwater flow systems.

Different geologic terrains present different nomenclatural challenges. For example, characteristics of a carbonate-siliciclastic aquifer in the southeastern US differ vastly from a fractured rock aquifer in the northeastern US. Water well production from an aquiclude in one region may have the same yield as a unit in another region that is locally considered an aquifer.

As demands on water resources increase, and as they vary in response to climate change adaptation, our understanding of HSU and related frameworks will evolve. However, many legacy names are entrenched in scientific literature, rules, and laws, making implementation of more appropriate names difficult. Consistent hydrostratigraphic nomenclature and perhaps a related governance framework is needed to help advance the science in an orderly manner and meet the changing needs of geoscientists addressing local and regional water-resource issues. The North American Stratigraphic Code and the governance of NACSN could serve as an infrastructure to address this recurring need.

- Follow-up discussion.

Presentation ended by Harley Means stating that this is not just a Florida problem, as aquifers cross state boundaries.
Vice-chair Denne: how would this solve problems of different names?
Mike Easton: There also was a proposal in the GSA DNAG Volume O2 Hydrogeology, by Paul Seaber
Lucy Edwards: the big question is a hydrostatigraphic CODE vs a hydrostratigraphic section in the NASC?
Randy Orndorff: USGS had hydrostratigraphy review committee.
Carlton Brett segued into the issue of state line geology.
Ed Landing: developing guidelines for a unified stratigraphy

- Motion to form an ad hoc Hydrostratigraphic Unit Committee to prepare a formal proposal?

Nancy Stamm: suggested talk to Tom Scott who has USGS historical notes
Norm Lasca: archives has notes from NACSN
David Dockery, Jon Smith, Chair Joeckel, Ed Landing, Randy Orndorff, Jeremy Workman, Carlton Brett, and Norm Lasca volunteered to serve on the ad hoc committee.
Chair Joeckel and Jon Arthur will bring the matter up at the AASG meeting.

23. Miscellaneous business

- Remarks on new lithodemic framework by Commissioner Mike Easton; text from email from 5 October.

> "A group led mainly by staff of the Manitoba and Saskatchewan Geological Surveys has proposed a new lithodemic framework that builds on what is in the NACSN Code, but which includes also a number of items that do not mesh directly with the Code. The group is in the final stages of preparing a manuscript to reveal this proposal, likely for the Canadian Journal of Earth Sciences.
>
> At this point, it is really an information item, but nonetheless it is an activity NACSN should be aware of. I can circulate the current draft of the ms to the members in advance of the meeting."

Mike Easton brought up that the Canada survey has proposed new lithodemic framework (above).
Ed Landing: committee should encourage their organization to use the code.
Jon Arthur brought up adding new terms to GeoRef.

- Other items?

24. Adjournment of the 78th Annual Meeting (Joeckel)

- Ask for motion to adjourn and second.

Brian Pratt moved, Richard Fluegeman seconded to adjourn the meeting, and was unanimously approved.
Chair Joeckel adjourned the meeting at 4:52 PM EDT.

- Richard Denne has agreed to be Chair for 2023–2024. Approval by acclamation.
- Randy Orndorff has agreed to be Vice Chair for 2023-2024. Approval by acclamation.

25. Call to Order of the 79th Annual Meeting (2022-2023 Vice Chair and 2023-2024 Chair Richard Denne) to be held during **GSA Connects 2024, 22–25 September 2024, Anaheim, California, USA**.

At 4:54 PM EDT Chair Denne called to order the 79th Annual Meeting.

26. Remarks by Incoming Chair (Denne)

After making a few brief remarks, the meeting was put into recess at 5:00 PM EDT until it re-opens during GSA Connects 2024, 22–25 September 2024, in Anaheim, California.

Is there a Case for a Hydrostratigraphic Code?

Jonathan D. Arthur, Ph.D., P.G.



Statement of the problem

- Critically important water resources
- Water management becomes less defensible and more imprecise
- Evolving understanding
- Nomenclature inconsistency
- Guidelines and ASTM (withdrawn 2019)
- USGS guidelines not advanced beyond OFR
- Economic and scientific integrity costs



Background

- FGS Statewide purview and perspective of geoscience issues
  - 377.075 F.S.: “The Florida Geological Survey shall cooperate or coordinate with, or act as a clearinghouse for, other agencies funded by the state who contribute to the study or revision of geologic interpretations and nomenclature.“
- Early work
  - Shallow aquifer: Wyrick, 1960; Lichtler, 1960; etc.
  - Intermediate: Sproul and others, 1972; Joyner and Sutcliffe, 1976…
  - Floridan: Stringfield, 1936, Parker and others, 1955.

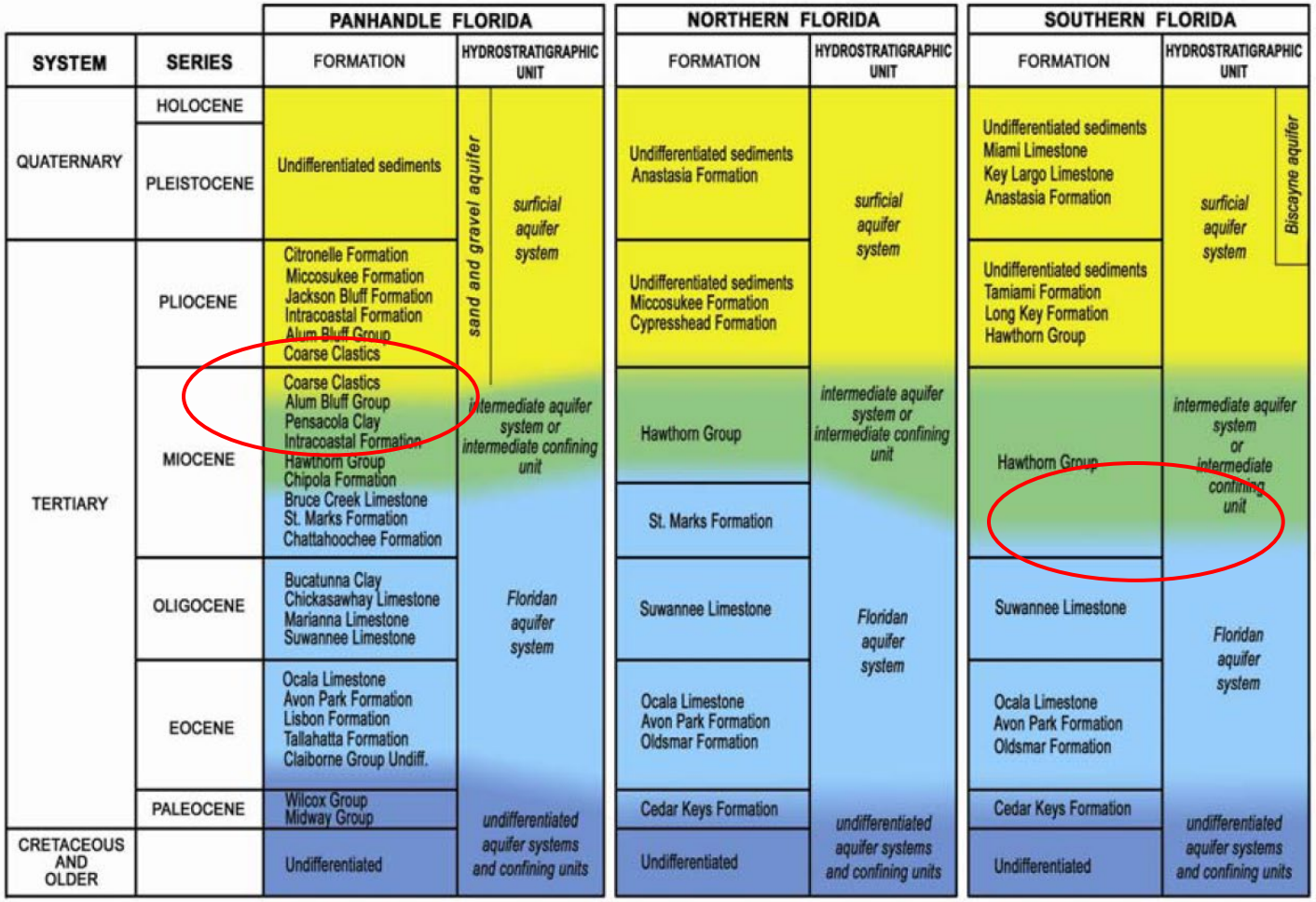


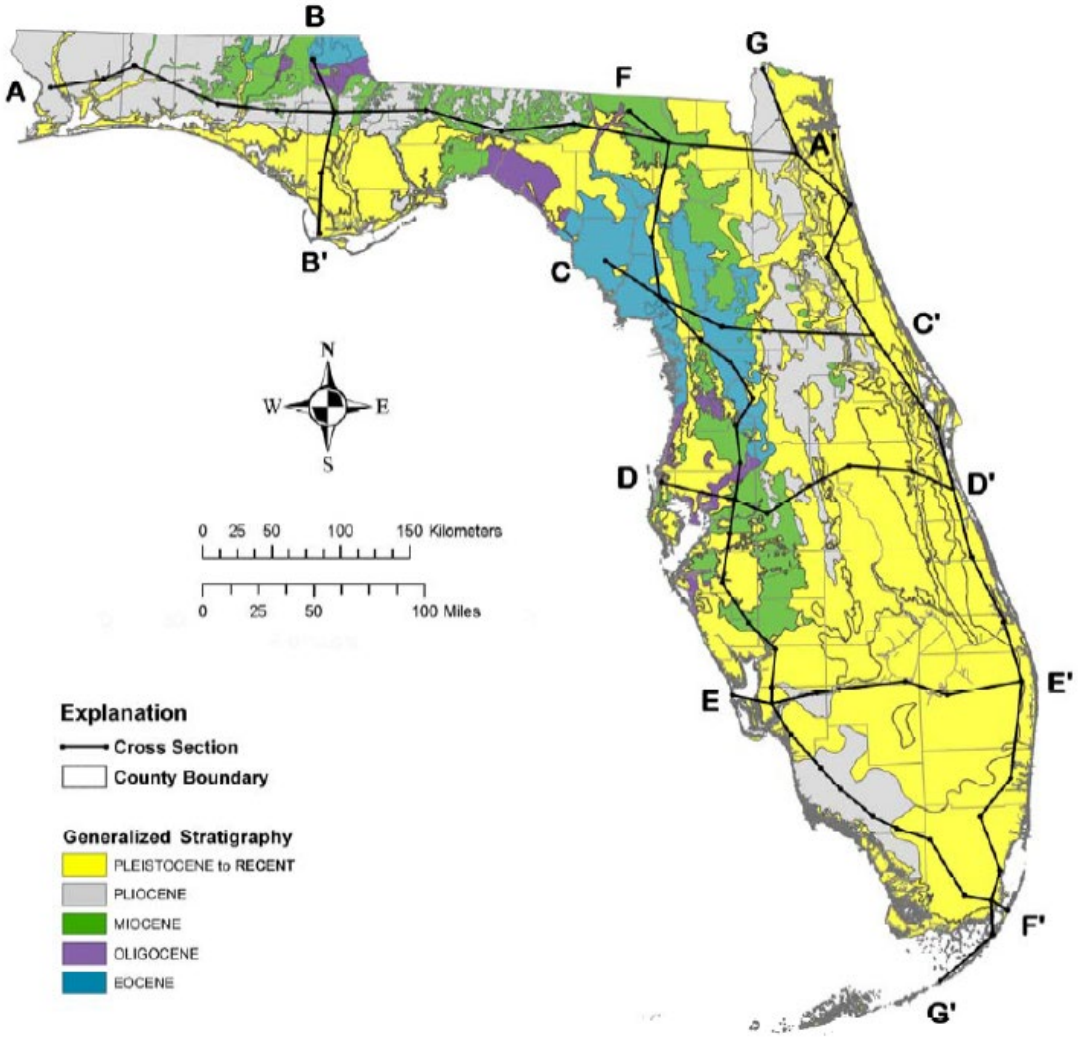
Background

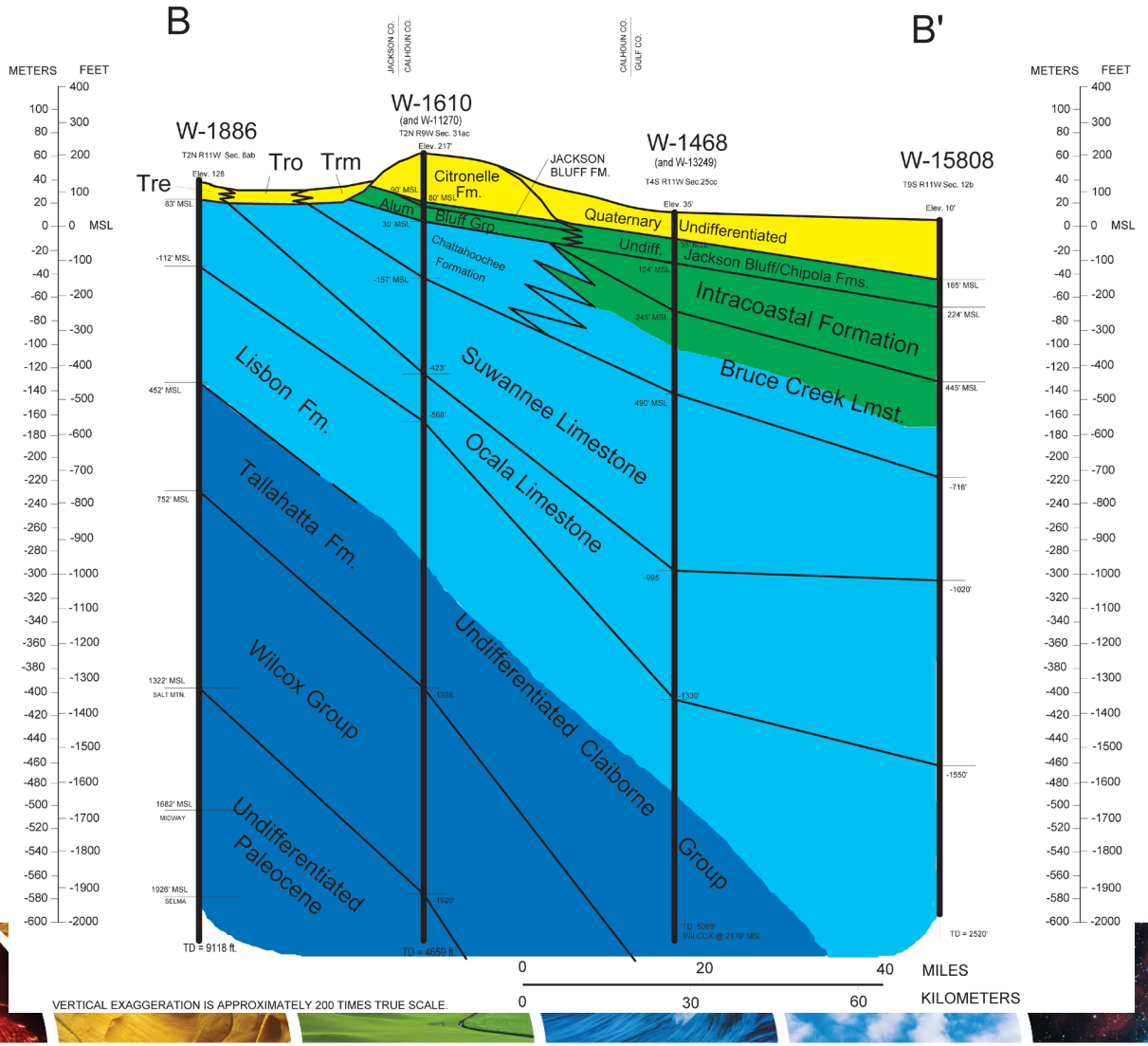
- FGS Special Publication 28 (SEGS, 1986)
- Miller, 1988
- FGS Special Publication 28 (revised); not published
  - Second Ad Hoc Committee on Florida Hydrostratigraphic Unit Definition (CFHUD II)
    - 40 members; 5 years
    - DEP/FGS, WMDs, consultants, USGS, academia
  - Addressed system level (not zones, MFCUs, etc)
  - Opinions based on regional perspectives
  - Limited progress



CFHUD II


PANHANDLE FLORIDA
NORTHERN FLORIDA
SOUTHERN FLORIDA
SYSTEM
SERIES
FORMATION
HYDROSTRATIGRAPHIC UNIT
QUATERNARY
HOLOCENE
PLEISTOCENE
Undifferentiated sediments
sand and gravel aquifer
surficial aquifer system
Undifferentiated sediments
Anastasia Formation
Undifferentiated sediments
Miami Limestone
Key Largo Limestone
Anastasia Formation
Biscayne aquifer
TERTIARY
PLIOCENE
Citronelle Formation
Miccosukee Formation
Jackson Bluff Formation
Intracoastal Formation
Alum Bluff Group
Coarse Clastics
Undifferentiated sediments
Miccosukee Formation
Cypresshead Formation
Undifferentiated sediments
Tamiami Formation
Long Key Formation
Hawthorn Group
MIOCENE
Coarse Clastics
Alum Bluff Group
Pensacola Clay
Intracoastal Formation
Hawthorn Group
Chipola Formation
Bruce Creek Limestone
St. Marks Formation
Chattahoochee Formation
intermediate aquifer system or intermediate confining unit
Hawthorn Group
St. Marks Formation
Hawthorn Group
intermediate aquifer system or intermediate confining unit
OLIGOCENE
Bucatunna Clay
Chickasawhay Limestone
Marianna Limestone
Suwannee Limestone
Floridan aquifer system
Suwannee Limestone
Suwannee Limestone
Floridan aquifer system
EOCENE
Ocala Limestone
Avon Park Formation
Lisbon Formation
Tallahatta Formation
Claiborne Group Undiff.
Ocala Limestone
Avon Park Formation
Oldsmar Formation
Ocala Limestone
Avon Park Formation
Oldsmar Formation
PALEOCENE
Wilcox Group
Midway Group
Cedar Keys Formation
Cedar Keys Formation
CRETACEOUS AND OLDER
Undifferentiated
undifferentiated aquifer systems and confining units
Undifferentiated
undifferentiated aquifer systems and confining units
Undifferentiated
undifferentiated aquifer systems and confining units


A
B
B'
F
G
A'
C
C'
D
D'
E
E'
F'
G'
N
W
E
S
0 25 50 100 150 Kilometers
0 25 50 100 Miles
Explanation
Cross Section
County Boundary
Generalized Stratigraphy
PLEISTOCENE to RECENT
PLIOCENE
MIOCENE
OLIGOCENE
EOCENE



Hydrostratigraphic units

- surficial aquifer system
- intermediate aquifer system
- Floridan aquifer system
- undifferentiated aquifer systems and confining units

Background

- Minimal existing guidelines
  - Laney and Davidson, 1986 (USGS – OFR)
  - American Society for Testing and Materials (ASTM), 2004 [withdrawn]
- Regional publications
  - Inconsistent and independent evolution
  - Central Florida Water Initiative: Expanded East-Central Florida Transient (ECFTX) Groundwater Model Convergence?



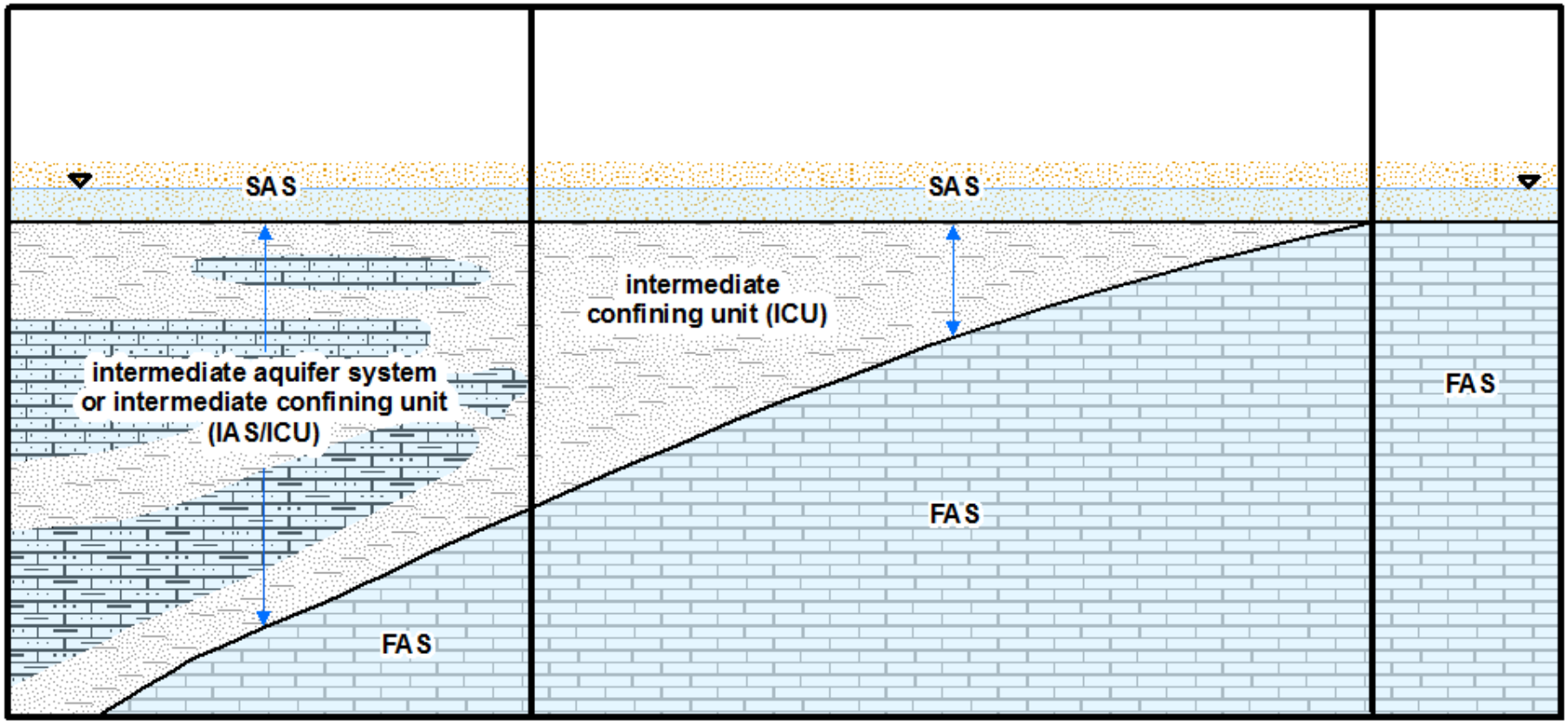
Statement of the Problem

- Current accepted nomenclature does not address level of detail needed for conceptual models
- Regional evolution of nomenclature has evolved without a framework beyond FGS SP28
- Florida needs:
  - A hydrostratigraphic “code” that addresses subtleties of a mixed siliciclastic - carbonate platform
  - Adoption of a statewide hydrostratigraphic framework
  - A path forward for proposal and adoption of new HSUs



NACSN (2005)

- The unit must have sufficient areal extent and thickness to be mappable
- The unit must have easily identifiable physical (lithologic) properties
- The fundamental unit (a formation in stratigraphy) is formally named for a locality where a type section can be observed
- Formations can be grouped according to similarities in origin or rock type into groups and subdivided into members providing that the mappability criteria are preserved


SAS
SAS
intermediate
confining unit (ICU)
intermediate aquifer system
or intermediate confining unit
(IAS/ICU)
FAS
FAS
FAS

What is in use today?

- Independently evolved nomenclature
- Drivers:
  - Regional water supply planning
  - Groundwater system conceptualization and characterization
  - Simulation of groundwater flow systems:
    - Do all model units need to be HSUs?
    - What parameters and “hydrologic contrast” are needed for distinction of an HSU?
- The view across the WMDs…

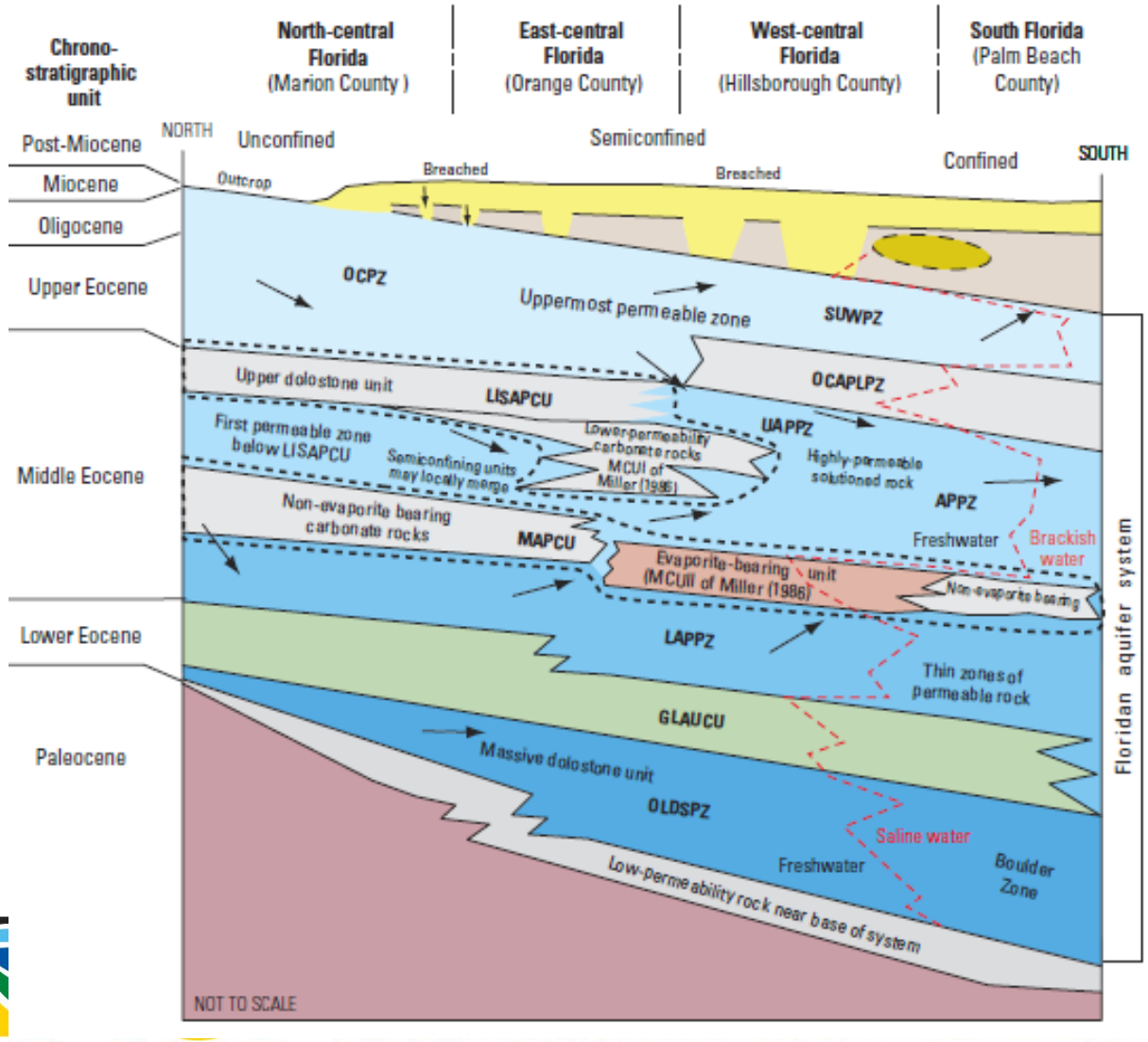


More on the challenge:

SFWMD NOMENCLATURE		TORRES et al. 2001		KNOCHENMUS 2006		SWFWMD NOMENCLATURE	
Intermediate Aquifer System	*confining unit*	Intermediate Aquifer System	*confining unit*	Intermediate Aquifer System	*confining unit*		*confining unit*
	Sandstone aquifer		Tamiami/ Peace River zone (PZ1)		Zone 1	Hawthorn Aquifer System	Peace River aquifer
	confining unit		*confining unit*		*confining unit*		*confining unit*
	Mid-Hawthorn aquifer		Upper Arcadia zone (PZ2)		Zone 2		Upper Arcadia aquifer
	confining unit		*confining unit*		*confining unit*		*confining unit*
Floridan aquifer system	Lower Hawthorn/ Tampa producing zone		Lower Arcadia zone (PZ3)		Zone 3		Lower Arcadia aquifer
	confining unit		*confining unit*		*confining unit*		*confining unit*



USGS



Zone

Higher permeability

- **SUWPZ**, Suwannee permeable zone
- **OCPZ**, Ocala permeable zone
- **APPZ**, Avon Park permeable zone
- **UAPPZ**, upper Avon Park permeable zone
- **LAPPZ**, lower Avon Park permeable zone
- **OLDSPZ**, Oldsmar permeable zone

Lower permeability

- **OCAPLPZ**, Ocala-Avon Park lower permeability zone
- **LISAPCU**, Lisbon-Avon Park composite unit
- **MAPCU**, middle Avon Park composite unit (includes evaporite units, MCUII)
- **GLAUCU**, glauconite marker unit

Other aquifers and confining units

- Surficial aquifer system
- Intermediate aquifer system
- Upper confining unit
- Lower confining unit
- Contact
- Composite unit boundary
- Freshwater-saltwater interface
- General direction of regional groundwater flow

Floridan aquifer system

- Upper Floridan aquifer: Upper zone, Lower zone
- Middle composite units (MCU): LISAPCU, MAPCU
- Lower Floridan aquifer: Upper zone, Lower zone
- Low-permeability unit



Considerations

- Hierarchy
  - System
  - Aquifer
  - Unit
  - Zone
  - Other
- Scale
  - Statewide
  - Regional
  - Sub-regional
  - Local
- Naming conventions
  - Role in groundwater flow system
  - Relation to lithostratigraphy
  - Existing usage (e.g., FAS cited in 373.0465 F.S.)
  - Geographic attributes



Considerations

- Rules or guidelines?
  - 3D mappable – thickness and extent
  - Characterized boundary conditions
  - Extent defined by several wells defining **AND** constraining limits
  - Extent based on at least “X” number of boreholes with lithologic **AND** hydrogeological **AND** geophysical data
  - Consistent hydrogeologic attributes
    - One order of magnitude consistency in T, Kv, Kh?
- Other considerations
  - HSU does not always need to correspond to a single model layer?
  - Model layers should align with HSU framework



Florida's possible path forward

- ✓ Review current HSU usage per agency
- Establish rules/guidelines
- Establish draft baseline HSU statewide framework
- WMD input; formal adoption and implementation
- Template for proposal of future names
- Florida HSU ad hoc committee
  - One representative from each WMD
  - One representative from DEP-FGS
  - One representative from DEP
  - One representative from USGS
  - Consulting and academia representation
- Committee adopted HSU's implemented statewide



It’s not just a Florida problem…

