# Integrating Digital Tools into Post-Pandemic Geologic Fieldwork to effectively broaden content delivery and assist in overall understanding of various geologic phenomena: Summer 2022 Geologic Field Mapping

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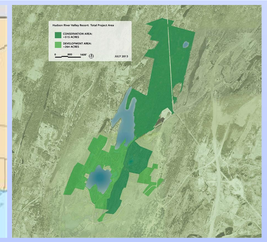
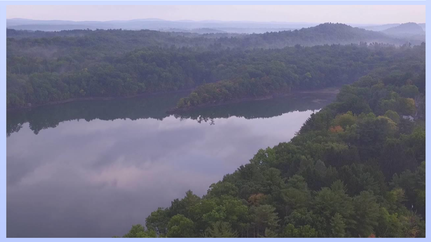
## Summary

**In the summer of 2020, a case study titled "Integrating Digital Tools in Remote Learning to Enhance the Delivery Methods of Technical Content in Undergraduate Geosciences" was virtually presented at the GSA annual meeting, Montreal, Canada. The primary objective concerning the usage of digital tools was to highlight the abrupt COVID-19 induced transition to remote learning, the subsequent impact on geologic fieldwork, and the deployment of new digital tools as an adaptation to the unprecedented change in the learning environment. Here, authors discuss integrating such digital tools and lessons learned from geologic fieldwork conducted during the pandemic into the post-pandemic geologic field investigation. The Summer 2022 Geologic Field Mapping Course in Rosendale, NY, involved lower to mid Paleozoic complexly folded siliciclastic and carbonates and was conducted to pre-pandemic standards. Students from both the City University of New York (CUNY) York College and CUNY Queens College had the opportunity to camp in the field for the entire duration of the course, largely due to easing of social distancing. Digital tools carried over from the 2020-2021 pandemic era included the employment of a 5G Internet Hotspot, a miniprojector, and the use of various remote software such as DPlot, Sedlog, ArcPro GIS, and Google Earth. The outcomes of this recently concluded field mapping exercises demonstrates that integrating lessons learned and utilization of digital tools not only optimize geologic fieldwork, rather, it also enhances the efficiency of statistically analyzing data, making real time decisions in the field, and correlating various findings to previously published academic literature. Access to 5G Internet Hotspot in remote setting became very effective in terms allowing students to gather peer-reviewed geologic information and minimize knowledge gap, if any.**

## The Experimental Study Site

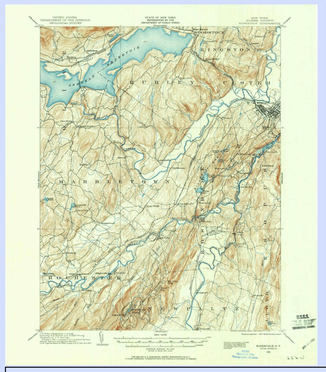



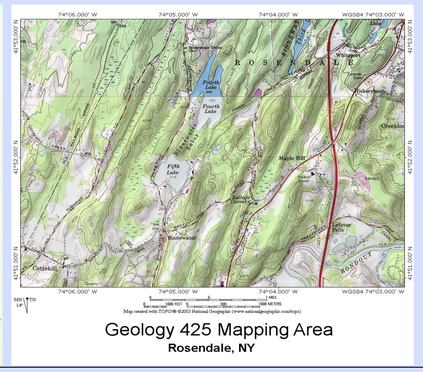


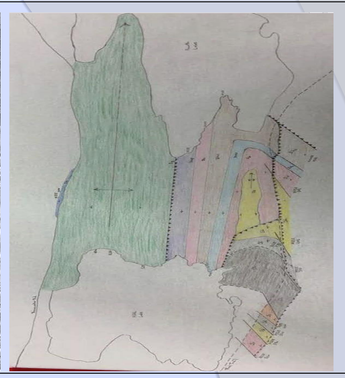
Figures 1-9 – Study Site Location and Fieldwork Images, Ulster County, NY

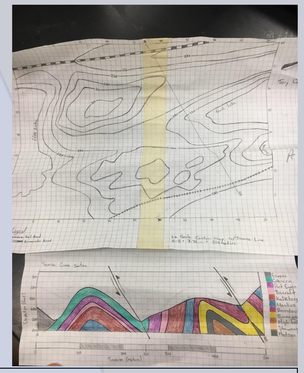
Post COVID-19 pandemic geologic fieldwork entailed a two full week camping experience for the students. The North-South Lake campground, which lacked electricity, phone and internet signal, posed a challenge for students to have proper internet access. A T-Mobile Franklin T9-Series Internet Hotspot (provided by the York College IT Department) coupled with a vehicle power invertor provided constant access for students to search references in the field. Figures 1-9 illustrates some of the field activities.

## Traditional Mapping Techniques





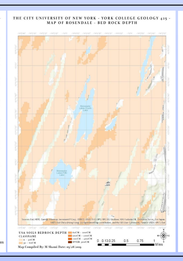



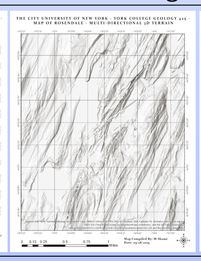


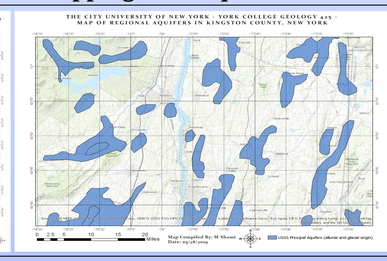
Figures. 10-14 – Traditional map layouts utilized in the field **without** the integration of digital tools

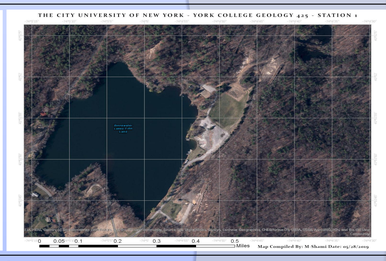
When the Hudson Valley was inundated millions of years ago (Budnik et al, 2010), conditions were ideal for various sedimentary deposits in Rosendale. Abrupt paleo-fluctuations of sea levels facilitated the deposition of formations and members that exhibit unique sedimentary characteristics (Werner et al, 2007) hence making this geologic location ideal for undergraduate training. The diversity of rock types ranged from limestones and dolostones to shales, sandstone, and conglomerate (Epstein, 1992). Structurally, this location is ideal for undergraduate training due to the presence of cement mines excavated along the contact line of the Whiteport and Rosendale members (Hoar, 1967). This feature enables student to measure and observe the strike, dip, and depositional transition between formations. Extensive deformation induced faulting, folding and presence of an angular unconformity (Kindle, 1913) create a challenge for students to map this area. However, with the assistance of the topography and various digital tools, students managed to identify formations and delineate structures as well as conduct analysis in real time.

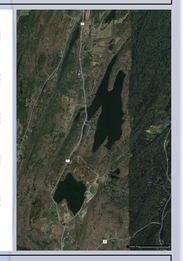
## Digital Mapping Techniques



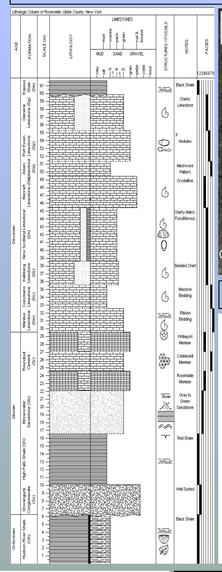


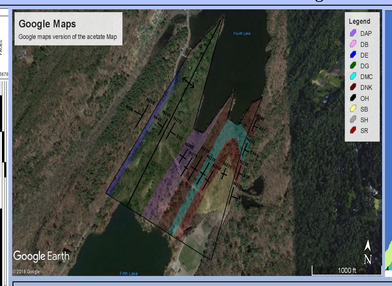


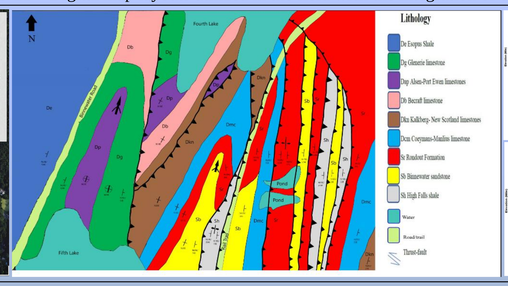


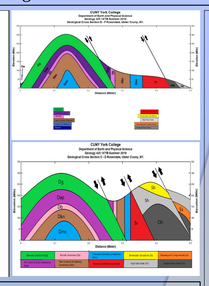


Figures. 15-21 – Digital map layouts utilized in the field **with** the integration of digital tools

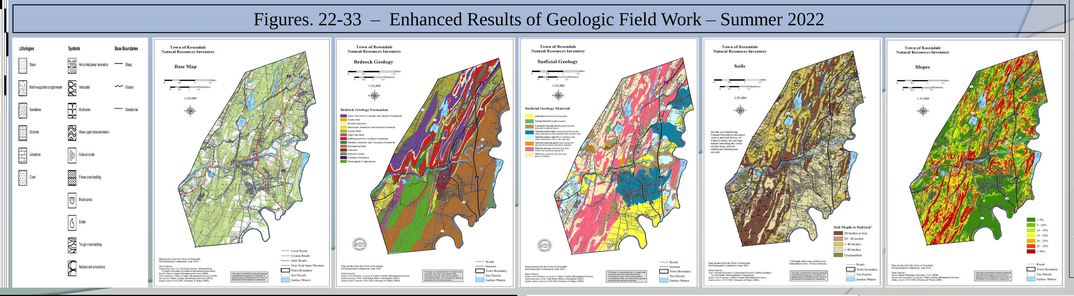








Figures. 22-33 – Enhanced Results of Geologic Field Work – Summer 2022

## References

Budnik, R., Walker, J., & Menking, K. (2010). *Chapter 3: The Geology and Topography of Dutchess County Natural Resource Inventory of Dutchess County, NY I Geology and Topography of Dutchess County, NY*. https://www.dutchessny.gov/Departments/Planning/Docs/nrichapthree.pdf

Burmeister, K. C., & Marshak, S. (2003). Examples of along-strike changes in fold-thrust belt architecture; structural geology of the Rosendale natural cement region, Ulster County, New York. *New York State Geological Association field trip guidebook, Vol. 75*, p.238-266.

Bursztyn, N., Sajjadi, P., Riegel, H., Huang, J., Wallgrün, J. O., Zhao, J., Masters, B., & Klippel, A. (2022). Virtual strike and dip – advancing inclusive and accessible field geology. *Geoscience Communication*, *5*(1), 29–53. https://doi.org/10.5194/gc-5-29-2022

Demicco, Robert V., & Smith, J. (2009). Sedimentologic Observation and Stratigraphic Interpretation of the Lower Devonian (Lochkovian) Manlius Formation along the Mohawk River Valley in Upstate New York. *The Journal of Geology*, *117*(5), 543–551. https://doi.org/10.1086/603528

Epstein, J. (1992). Stratigraphy of Silurian Rocks in Shawangunk Mountain, Southeastern New York, Including a Historical Review of Nomenclature [Review of *Stratigraphy of Silurian Rocks in Shawangunk Mountain, Southeastern New York, Including a Historical Review of Nomenclature*]. *U.S. Geological Survey Bulletin*, 1–46. Google. https://pubs.usgs.gov/bul/1839l/report.pdf

Hoar, F. G., & Bowen, Z. P. (1967). Brachiopoda and Stratigraphy of the Rondout Formation in the Rosendale Quadrangle, Southeastern New York. *Journal of Paleontology*, *41*(1), 1–36. http://www.jstor.org/stable/1301901

Kindle, E. M. (1913). The Unconformity at the Base of the Onondaga Limestone in New York and its Equivalent West of Buffalo. *The Journal of Geology*, *21*(4), 301–319. http://www.jstor.org/stable/30058382

Werner, D., & Burmeister, K. C. (2007). An overview of the history and economic geology of the natural cement industry at Rosendale, Ulster County, New York. *Journal of ASTM International*, *4*(6), 1-14.