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Lessons in modern digital field geology: Open source software, 3D techniques, and the new world of digital mapping

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Although many geologists refuse to admit it, it is time to put paper-based geologic mapping into the historical archives and move to the full potential of digital mapping techniques. For our group, flat map digital geologic mapping is now a routine operation in both research and instruction. Several software options are available, and basic proficiency with the software can be learned in a few hours of instruction and practice. The first practical field GIS software, ArcPad, remains a viable, stable option on Windows-based systems. However, the vendor seems to be moving away from ArcPad in favor of mobile software solutions that are difficult to implement without GIS specialists. Thus, we have pursued a second software option based on the open source program QGIS. Our QGIS system uses the same shapefile-centric data structure as our ArcPad system, including similar pop-up data entry forms and generic graphics for easy data management in the field. The advantage of QGIS is that the same software runs on virtually all common platforms except iOS, although the Android version remains unstable as of this writing. A third software option we are experimenting with for flat map-based field work is Fieldmove, a derivative of the 3D-capable program Move developed by Midland Valley. Our initial experiments with Fieldmove are positive, particularly with the new, inexpensive (<300Euros) Windows tablets. However, the lack of flexibility in data structure makes for cumbersome workflows when trying to interface our existing shapefile-centric data structures to Move. Nonetheless, in spring 2014 we will experiment with full-3D immersion in the field using the full Move software package in combination with ground based LiDAR and photogrammetry. One new workflow suggested by our initial experiments is that field geologists should consider using photogrammetry software to capture 3D visualizations of key outcrops. This process is now straightforward in several software packages, and it affords a previously unheard of potential for communicating the complexity of key exposures. For example, in studies of metamorphic structures we often search for days to find “Rosetta Stone” outcrops that display key geometric relationships. While conventional photographs rarely can capture the essence of the field exposure, capturing a true 3D representation of the exposure with multiple photos from many orientations can solve this communication problem. As spatial databases evolve these 3D models should be readily importable into the database.