Precision and Accuracy of Digital and Analogue Compass-Clinometers

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Structural measurements using digital compass-clinometers offer more rapid acquisition, easier backup, and convenient integration with other field data. Systematic empirical testing of eight Apple smart-phones and tablets was carried out, alongside a variety of analogue compass-clinometers (all with a 'traditional' free-swinging magnetised compass needle), and cross-checked against survey measurements based on long sight-lines (> 800m) and calibrated inclinometers. A standardised procedure was followed carefully to calibrate the digital devices prior to each test. Tests measured the dip and strike of planes and the plunge and azimuth of lineations, across a range of orientations.

While analogue compass-clinometers are able to measure orientations repeatedly and reliably with an accuracy of ±5° or better, the performance of the digital devices was highly variable and unpredictable, raising significant doubt about their suitability for geological field measurements. In some tests the Apple devices performed adequately, with an accuracy of ±5°, while in other tests, measurements showed a range of over 30°. The underlying cause(s) of the variability is unclear. Most of the spread is in the strike component (i.e. measurements from the digital compass), corroborating other results that show that digital inclinometers are able to measure dip with high accuracy. Further testing is needed using larger numbers of geologists with a wider range of different digital devices and software apps.

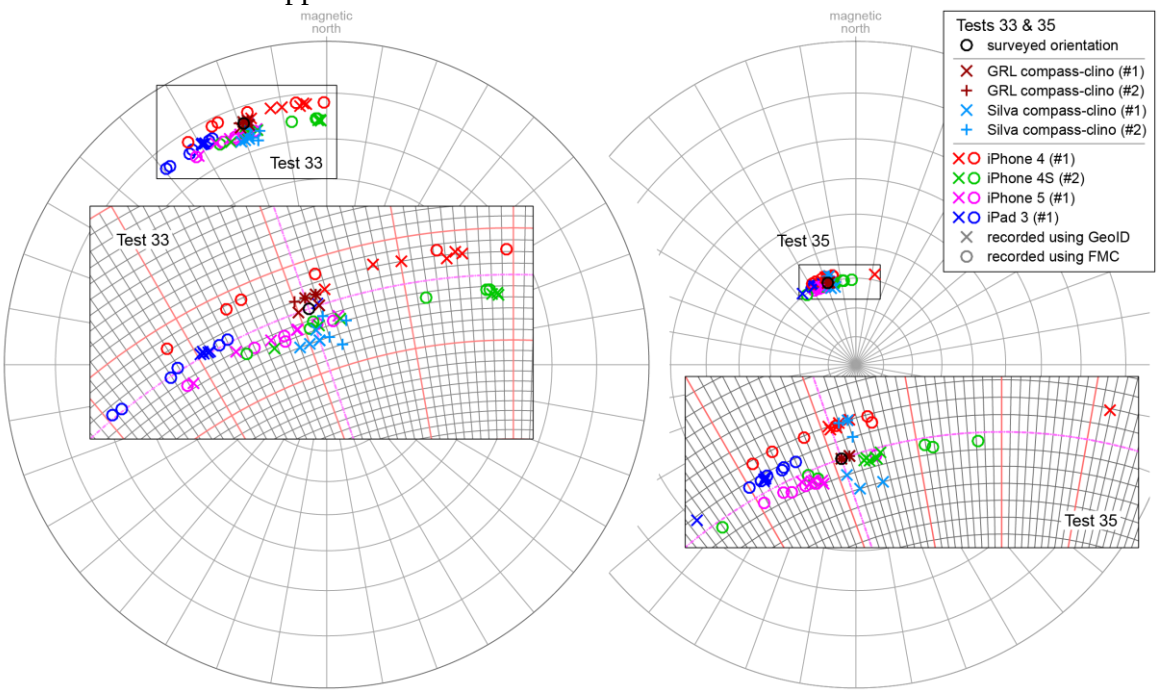

Figure: Examples of test results using a number of different analogue and digital compass-clinometers, plotted as poles to planes on a lower hemisphere equal-angle stereonet (grid on main nets is 10°; insets show a 1° net with 10° grid lines in red).