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Tectonic Provinces of East Antarctica

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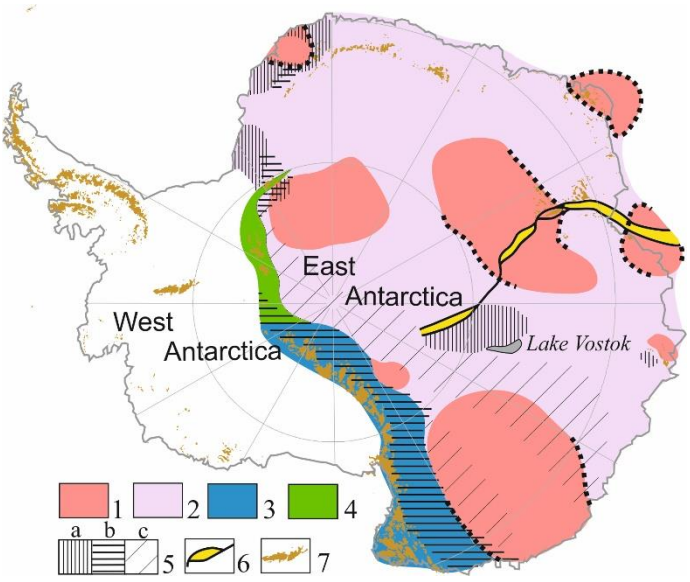

Tectonic provinces of East Antarctica (EA) that can be recognized in peripheral bedrock outcrops and/or by correlation with conjugate Gondwana continents are extrapolated beneath the vast ice sheet using geophysical methods, mainly the magnetic data, and radar-derived bedrock topography. Near-coastal bedrock exposures consist predominantly of Precambrian crystalline basement partly affected by Early Paleozoic (EPz) tectonic activation coeval with the orogeny and intraplate deformation at the elevated Pacific-faced edge of EA. The EPz fold basement is overlain by extensive Paleozoic-Mesozoic (Pz-Mz) platform cover. Limited subaerial occurrences of Neoproterozoic (NP) to Mz platform and/or rift-related units are scattered elsewhere in peripheral EA

The overall tectonic pattern of EA Precambrian basement is defined by Archean-Paleoproterozoic (A-PP) cratons incorporated in the network of Mesoproterozoic (MP) orogenic belts. Both types of tectonic structures are mapped in the outcrops and predicted by magnetic evidence in much of the sub-ice interior of EA. Here the cratons are recognized by low-amplitude mosaic and/or high-amplitude long-wavelength pattern, and the MP belts can be traced by elongated high-amplitude anomalies. Most prominent boundaries between these types of magnetic field are shown in Fig. 1 by thick dotted black lines.

Figure 1: Tectonic sketch of EA. 1- A-PP cratons; 2 - MP orogens; 3 - EPz orogen; 4 - EPz intraplate fold zone; 5 - platform covers and/or rift units: a-NP-EPz, b-Pz-Mz, c-undivided; 6 - major rift system; 7 - bedrock outcrops

Magnetic evidence is less helpful in recognizing subglacial platform covers and/or rift units whose existence in central EA has nevertheless been speculated on the basis of general considerations. Recently this supposition received material confirmation from the deep borehole at Vostok Station [1]. The basal layer of the ice sheet above subglacial Lake Vostok contains small (mm-sized) debris which includes clasts of sandstones and siltstones. Detrital zircon and monazite grains found in these clasts were dated by SHRIMP-II method revealing ages from 0.6 to 2.0 billion years (Ga) with two distinct clusters within 0.8 - 1.2 Ga and 1.6 - 1.8 Ga intervals. This suggested the presence in the vicinity of Lake Vostok of post-0.6 Ga terrigenous strata sourced from the nearby A-PP cratons and/or MP orogens. Refraction seismic velocities of 5.4-5.5 km/s measured at the bedrock surface to the west of Lake Vostok are consistent with existence there of highly lithified sedimentary units.

A major rift developing since Late Paleozoic is inferred to intersect the entire EA from the coast to the near-Pole segment of the EPz fold belt. Many other linear bedrock depressions are believed to result from ice erosion which probably amplified the precursor tectonic lineaments.

References

[1] Leitchenkov et al (2016) Phil. Trans. A374: doi: 10.1098/rsta.2014.0303