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Basin dynamics of strike-slip basins in the Archean Superior and Slave cratons

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Strike-slip basins are first order indicators of horizontal crustal movement and hence, are sound indicators of plate tectonics. Archean basin dynamics are significant in deciphering Early Earth tectonics that exerts control on sedimentation and volcanism. Diverse strike-slip basin dynamics are indicated by en-échelon folds, pluton emplacement, sedimentation patterns, facies distribution and their architecture or stacking. Recognition of classical pull-apart structures has yet to be identified but divergent fault-wedge basins are common. Superior craton strike-slip basins of the oceanic arc variety include Timmins, Duparquet, Granada, and Kirkland Lake basins in the Abitibi Subprovince, and the Stormy Lake and High Lake basins in the Wabigoon Subprovince. Slave craton strike-slip basins of the continental arc variety include Jackson Lake, Beaulieu Rapids, and Keskarrah-Point Lake. Timing of strike-slip events varies considerably but ranges between ca. 2700 to 2600 Ma depending on craton and evolutionary stage. These basins display a constant association with (1) uplifted synorogenic turbiditic flysch deposits and (2) porphyry stock intrusions. Both features correlate with basin bounding unconformities and faults.

The sedimentary and volcanic basin lithofacies vary, but tectonic influence on sedimentation is evident and volcanic flows show tectonic control (e.g. emplacement along basin faults). Basin geometry, structural configuration, unconformities, and distribution of lithofacies support tectonic influence on sedimentation, and is corroborated by (1) vertical and lateral lithofacies changes, (2) cyclic repetition of depositional units, (3) fining-upward and/or coarsening then fining-upward sequences, (4) basin margin and intrabasinal unconformities, (5) coarse detritus at basin margins and basin central shallow-water deposits, (6) a thick stratigraphic sequence compared to basin size, and (7) basin margin faults. The following lithofacies display basin diversity: (1) mafic volcanic, (2) felsic volcanic, (3) pyroclastic, (4) volcaniclastic, (5) conglomerate-sandstone, (6) sandstone-argillite (± conglomerate), and (7) argillite-sandstone (± tuffaceous sandstone). The mafic-felsic volcanic deposits range from tholeiitic, calc-alkaline to alkaline and represent effusive lava flows. The pyroclastic lithofacies are related to subaerial surge and airfall processes, whereby the volcaniclastic lithofacies indicate reworked volcanic debris. The conglomerate-sandstone lithofacies is interpreted as alluvial fan, fan delta or proximal braided stream deposits, and the sandstone-argillite lithofacies is consistent with sandy flood- or braidplain deposits. A shallow-water lacustrine setting is inferred for the Superior argillite-sandstone lithofacies. In the Slave strike-slip basins, the sandstone-argillite and argillite-sandstone lithofacies are shallow marine deposits controlled by tides and waves. They indicate that these basins with high-energy coastal fan-deltas had direct sea access. Volcanic flows influenced sedimentation as fluvial discharge was rerouted. Pyroclastic material caused mass wasting processes and formation of hyperconcentrated flood-flow deposits. Volcanism may account for congestion of sedimentary dispersal patterns. Tectonism is the prevalent long-term factor in restricted strike-slip basins, but the hot-humid Archean climate and lack of vegetation are additional factors controlling sedimentation.