**Figure S1.** Calculated maximum depositional ages for samples MDZ1, MDZ2, MDZ3, MDZ5, MDZ9 using the Y2σ(n) method after Dickinson and Gehrels (2009a).

**Table S1.** Outcrop facies descriptions for each unit of the Monos Formation.

**Table S2.** Thin-section descriptions for each unit of the Monos Formation.

**Table S3.** Point-count data for eleven samples from the Monos Formation. Qm – monocrystalline quartz; Qp – polycrystalline quartz; Qpc – microcrystalline quartz (chert); CF-PM – cherty-feldspathic pseudomatrix; P – plagioclase feldspar; K – potassium feldspar; Lss – sandstone sedimentary lithic fragment; Lsu – undifferentiated sedimentary lithic fragment; Lsl – limestone sedimentary lithic fragment; Lvmi – microlitic volcanic lithic fragment; Lvv – vitric volcanic lithic fragment; Lvu – undifferentiated volcanic lithic fragment; Ech – echinoderm fossil fragment; Bry – bryozoan fossil fragment; Mol – mollusc fossil fragment; Biou – undifferentiated bioclast; CalR – recrystallized calcite; CalC – calcite cement; Biot – biotite; FeOx – iron-oxide mineral; Dm – dense/opaque/accessory mineral; Amph – amphibole.

**Table S4.** Detrital zircon U-Pb data from the Monos Formation. Best age—207Pb/206Pb ages for grains older than 1.0 Ga, 206Pb/238U ages for grains younger than 1.2 Ga.