

Table DR1. Oxygen isotope compositions of authigenic K-feldspar and quartz in the Mt. Simon Sandstone.
 Very well-developed = >5 vol%; well-developed = 2-5%; moderately developed = <2%

Sample ID and Depth	Sample Description	$\delta^{18}\text{O}$ Ksp (‰)	Average (‰) \pm Standard Deviation (‰)	$\delta^{18}\text{O}$ Qtz (‰)	Average (‰) \pm Standard Deviation (‰)
CMS-1 Outcrop	1 m above the contact with Middle Proterozoic granite/gneiss; high porosity (~20%); poorly sorted subarkose; K-feldspar overgrowths well developed; moderate quartz overgrowths	24.1 23.8 24.4 20.5 23.5	23.3 ± 1.4		
CMS-3 Outcrop	6 m above the contact with a Middle Proterozoic tonalite; high porosity (~20%); well sorted fine-grained arkosic arenite; K-feldspar overgrowths very well developed	20.1 23.1 22.7 26.4 24.6 25.6	23.8 ± 2.1		
C12996 (UPH-3) 655 m	Coarse grained, well-sorted quartz arenite and subarkose; ~15% porosity; moderate K-feldspar overgrowths; well developed quartz overgrowths	26.2 20.2 26.2 18.5 22.2 20.1 19.5 17.2 22.2 23.3	21.6 ± 2.9	26.2 26.2 29.3 29.7 26.2	27.5 ± 1.6
C3707 457 m	Fine-grained, well sorted subarkose with small clay veinlets (up to 2 mm in width); high porosity (~30%); K-feldspar overgrowths well developed; moderately developed quartz overgrowths	22.5 19.9 23.2 26.5 23.6 20.4 18.2	22.0 ± 2.8		
C675 1315 m	Medium-grained, moderately sorted subarkose and quartz arenite micro-interbedding; 10% porosity; K-feldspar overgrowths well developed; moderate quartz overgrowths	20.0 20.1 23.3 17.3 18.3 20.4	19.9 ± 2.1		
C437 889 m – Ksp 872 m – Qtz	Fine-grained, moderately sorted subarkose; 15% porosity; K-feldspar and quartz moderately developed	26.5 21.2 22.9 22.0 17.4	22.0 ± 3.3		
C7466 794 m	Moderately sorted, very fine, medium grained quartz arenite; 15% porosity; K-feldspar and quartz overgrowths moderately developed	19.5 22.4 18.8 16.8 16.0	18.7 ± 2.5		

C3904 1003 m	Fine-grained; well sorted subarkose; 10% porosity; K-feldspar overgrowths well developed, moderate quartz overgrowths	23.5 20.5 19.7 17.5 15.2 18.2 18.9	19.1 ± 2.6		
BR-1 1188 m – Ksp 1136 m – Qtz	Coarse-grained quartz arenite with small amount of K-feldspar; 10% porosity; very well developed quartz overgrowths; moderate K-feldspar overgrowths	19.2 17.2 18.0 16.1 13.6 18.9 16.0	17.0 ± 2.0	22.7 24.1 23.0 26.2 20.4 22.0 25.5 22.2	23.3 ± 1.8
C8948 1569 m – Ksp 1571 m – Qtz	Medium- to fine-grained subarkose; 8% porosity; K-feldspar overgrowths well developed; moderate quartz overgrowths	12.7 13.8 14.9 13.5 13.1	13.6 ± 0.9	21.5 20.0 25.2 21.6 19.7	21.6 ± 2.0
C4831 2581 m	Medium-grained, poorly-moderately sorted quartz arenite and subarkose; 2% porosity; moderate K-feldspar and quartz overgrowths	17.7 18.0 16.3 14.6 17.7	16.9 ± 1.4		