Groundwater age distributions suggest relatively continuous recharge during the timeframes observed in all four semi-arid confined regional aquifer systems.

Figure 1: Conceptual model of the flow of water and distribution of ages in a groundwater system in an arid region, from Ferguson et al., 2020. The conceptual model highlights some of the many complexities in groundwater age distribution in an aquifer, including distance from the area of recharge, depth, flow path, and anthropogenic impacts.

RESEARCH QUESTIONS
This study aims to determine if groundwaters are 'fossil' due to:
1. Simply being part of a large or long subsurface flow system with relatively continuous recharge, or:
2. Paleo-recharge rates were substantially higher than today and modern recharge is negligible.

METHODS
1. Groundwater 'age' distributions from four large semi-arid basins with well-constrained hydrogeologic datasets were compiled.
2. Extracted sample distance along inferred flow paths from area of recharge & sample age.
3. Compared results to other studies examining aquifer response times.

DISCUSSION
• Strong linear correlations are observed in groundwater 'age' versus distance from the area of recharge in all four aquifer systems that were examined.
• Extension of trendlines shows flow paths where the origin is not 0; this agrees with previous research, suggesting that modern recharge is significantly reduced.
• In other instances, trendlines intercept near or above the origin. This results would suggest that there is a modern recharge component in these aquifers.
• In general, all compiled studies were lacking methodology to adequately characterize intermediate-aged groundwater (100 – 1,000 years).
• Figure 2: Plots of groundwater 'age' (kya) vs. distance from the area of recharge (km) in the A) Nubian Sandstone Aquifer (81Kr data from Ram et al., 2020), B) Great Artesian Basin (36Cl data from Torgersen et al., 1991), C) Continental Intermediate Aquifer (36Cl data from Edmunds et al., 1997), and D) North China Plain (36Cl data from Wei et al., 2015). The black ovals highlight a region moving northwestward away from areas of modern recharge toward the center of the basin, where tritium becomes non-detect and radiocarbon values suggest groundwater ages on the order of several thousand years.

FUTURE WORK
After thoroughly characterizing groundwater age distribution across the Tucson Basin transect, results will be compared to paleoclimate records to analyze whether palaeoclimatic signals are also captured in groundwater age distributions.