Wetzel, K.F., and Stanley, J.R., 2021, Linking exhumation, paleo-relief, and rift formation to magmatic processes in the western Snake River Plain, Idaho, using apatite (U-Th)/He thermochronology: Geosphere, https://doi.org/10.1130/GES02453.1

Supplemental Material

TABLE S1. EXHUMATION AND EXTENSION ESTIMATES

For exhumation from the 50°C isotherm depth, extension amount for given fault dip (*SW, Owyhee Mountains*):

Fault dip angle:		40		50		60		70	
Geotherm	Exhumation[a]	km ext.	% ext.[b]	km ext.	% ext.	km ext.	% ext.	km ext.	% ext.
30	1.7	2	3.3	1.4	2.3	1	1.6	0.6	1
40	**1.3**	**1.5**	**2.5**	**1.1**	**1.8**	**0.7**	**1.2**	**0.5**	**0.8**
50	1	1.2	2	0.8	1.4	0.6	1	0.4	0.6
60	0.8	1	1.7	0.7	1.2	0.5	0.8	0.3	0.5
70	0.7	0.9	1.4	0.6	1	0.4	0.7	0.3	0.4
80	0.6	0.7	1.2	0.5	0.9	0.4	0.6	0.2	0.4
90	0.6	0.7	1.1	0.5	0.8	0.3	0.5	0.2	0.3
100	0.5	0.6	1	0.4	0.7	0.3	0.5	0.2	0.3

For exhumation from the 70°C isotherm depth, extension amount for given fault dip (*NE, Boise Mountains*):

30	2.3	2.8	4.6	2	3.3	1.3	2.2	0.8	1.4
40	**1.8**	**2.1**	**3.5**	**1.5**	**2.4**	**1**	**1.7**	**0.6**	**1.1**
50	1.4	1.7	2.8	1.2	2	0.8	1.3	0.5	0.8
60	1.2	1.4	2.3	1	1.6	0.7	1.1	0.4	0.7
70	1	1.2	2	0.8	1.4	0.6	1	0.4	0.6
80	0.9	1	1.7	0.7	1.2	0.5	0.8	0.3	0.5
90	0.8	0.9	1.5	0.6	1.1	0.4	0.7	0.3	0.5
100	0.7	0.8	1.4	0.6	1	0.4	0.7	0.2	0.4

Ext. – extension.
[a] Exhumation ~ fault throw limit.
[b] % extension calculated using WSRP approx. width of 60 km.
Bold indicates preferred values.

Table S1. Wood and Clemens (2002) estimated that 10% extension is needed in the WSRP to account for basin volume. Using our AHe data and a variety of geothermal gradients and fault dip angles, we constructed this table to evaluate the possible amounts of footwall exhumation and extension that could be accommodated on basin-bounding faults.

In the Owyhee transects, the oldest cooling dates of 40-50 Ma are at the range front. These dates suggest that these rocks have not spent time in the PRZ since well prior to WSRP rifting, limiting post-Miocene cooling to <50 °C. In the Boise Mountain front, the youngest cooling date (~30 Ma) is at the bottom of the transect. While this date still predates WSRP formation substantially, this pattern could mean that the base of the transect was exhumed from the top of the AHe partial retention zone (PRZ) during WSRP activity. We therefore allow up to 70°C of cooling on the Boise Mountains side.

We used moderate to steep normal fault dip angles (40º-70º) and our calculated range of fault throw to evaluate extension magnitudes. The highest preferred fault throws on each side of the WSRP (with 40°C/km geothermal gradient) is 1.8 km on the Boise Mountains side and 1.3 km on the Owyhee Mountains side. With a dip of 40º, these throws yield 2.1 km (3.5%) and 1.5 km (2.5%) of extension respectively, or a total of about 6% of the WSRP 60 km width. Lower magnitudes of fault throw and/or steeper faulting angles would yield even lower magnitudes of extension.