U-Pb Zircon Geochronologic Investigation of Granitoids and Sandstones in the Jerome Canyon and Chino Valley North 7 ½′ Quadrangles, Prescott Area, Central Arizona

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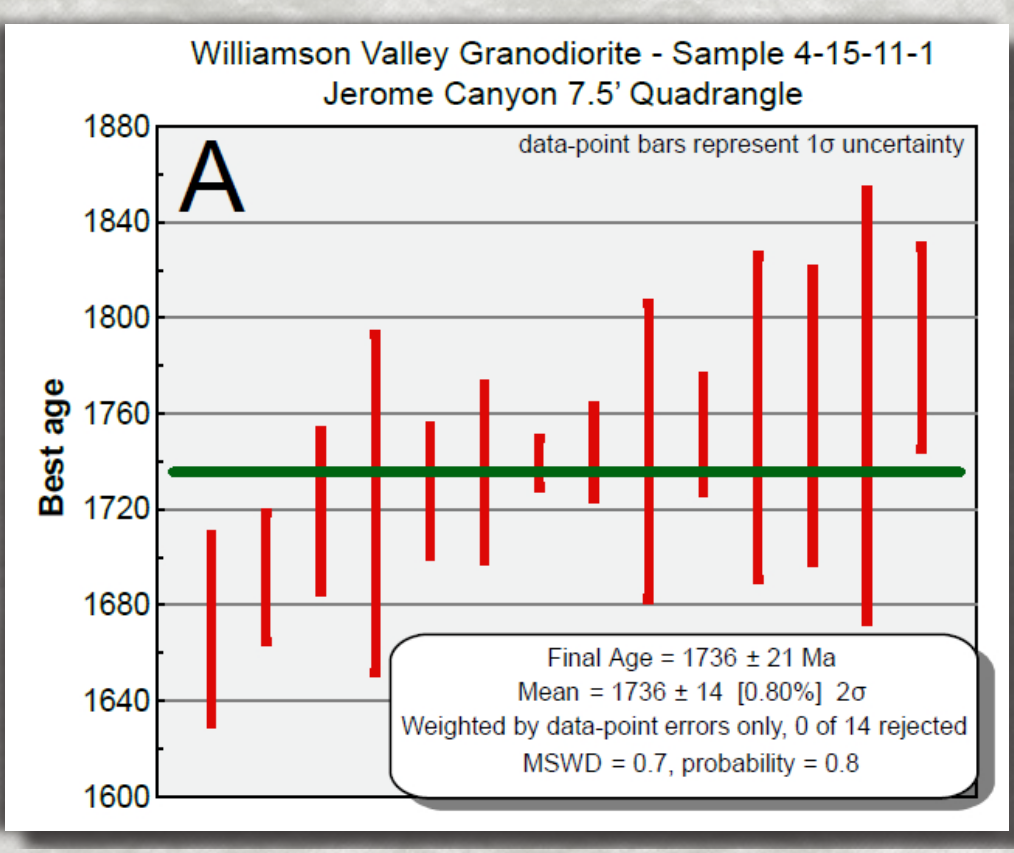

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The Prescott area is within the Yavapai geologic province which consists of rocks of Paleoproterozoic age, with typical igneous-rock ages of ~1700 Ma. Three 7 ½' quadrangles in this area have been mapped under the Arizona STATEMAP program (Chino Valley North, Paulden, and Wineglass Ranch), three more are drafted but not yet released pending incorporation of geochronologic, geochemical, and other data (Jerome Canyon, Chino Valley South, and Prescott Valley North), and two more will be mapped in 2012 (Fig. 1; Sullivan Buttes, Prescott Valley South). Rocks mapped during these mapping projects were sampled for U-Pb geochronologic study. U-Pb geochronologic analyses of single zircon grains, reported here, were done by LA-ICP-MS at the Arizona Laserchron Center at the University of Arizona. LaserChron Center facilities support was provided by NSF-EAR 1032156. This is a brief overview of new U-Pb geochronologic studies associated with the recent STATEMAP mapping.

The Chino Valley North 7 ½' Quadrangle (Gootee et al., 2010) includes a folded sequence of Paleoproterozoic quartzite mapped previously by Krieger (1965). Detrital zircon grains from quartzite samples from the base and top of the sequence yielded age spectra dominated by ~1.7 Ga zircons, with a scattering of older grains as old as 3.4 Ga (Fig. 2). This "tail" of old dates is similar to that apparent in detrital-zircon age spectra from some other Paleoproterozoic quartzites in the Southwest (e.g., Jones et al., 2009). The youngest three grains from the sample collected at the base of the sequence are 1689 ± 41Ma, 1690 ± 33 Ma, and 1704 ± 27 Ma (mean = 1694.4 Ma; 1σ uncertainty; n = 92), while the three youngest grains at the top of the sequence are 1626 ± 44 Ma, 1634 ± 24 Ma, and 1636.8 ± 61 Ma (mean = 1632.2 Ma; n = 91). The 62 Ma difference in the averages of the three youngest zircon dates from each sample is considered statistically significant based on comparison to Mesozoic sandstone units on the Colorado Plateau where the youngest individual grain dates were compared to biostratigraphically determined ages (Dickinson and Gehrels, 2009). Furthermore, deformation of the Del Rio Quartzite must have occurred after ~1632 Ma, but before deposition of flat-lying Paleozoic strata (Gootee et al., 2010), suggesting that "Yavapai" deformation continued after 1632 Ma.

The nearby Jerome Canyon 7 ½' Quadrangle includes a belt of metabasaltic rocks, metasiltstone, and fine-grain metasandstone (Krieger et al., 1965; Spencer and Young, *in press*). The belt in intruded by the 1736 ± 21 Ma Williamson Valley Granodiorite of DeWitt et al. (2008) and the 1680 ± 16 Ma Mint Wash Granodiorite of DeWitt et al. (2008) (Figs. 3, 4). A sample of the metasandstone was analyzed for detrital zircon U-Pb dates (n=75). The three youngest detrital-zircon U-Pb dates that overlap at the 1σ level are 1704.4 ± 9.5 Ma, 1720.0 ± 14.6 Ma, and 1720.7 ± 24.6 Ma (mean = 1715.0 Ma; 1σ uncertainty). (The youngest date, 704 Ma, was discarded because it did not overlap at the 1σ level with the next youngest date, following methodology of Dickinson and Gehrels, 2009). Another five zircon sand grains are dated at 1722 to 1724 Ma. The Williamson Valley Granodiorite, which intrudes the metasandstone, is thus likely younger than its 1736 ± 21 (1σ) Ma date, although it is not necessarily younger at the 2σ uncertainty level.

Detrital zircons from the fine-grained metasandstone include abundant ages typical of the Yavapai Province, but 18 of 75 dated grains are within the narrow age range of 2479 ± 7 Ma (Fig. 5). This narrow range of ages for about 25% of the grains suggests a single igneous source of the ~2479 Ma grains that is ~750 Ma older than typical dated igneous rocks in the Yavapai Province in Arizona. Zircon grains of this same narrow age range were recognized in the Vishnu Schist by Shufeldt et al. (2010).

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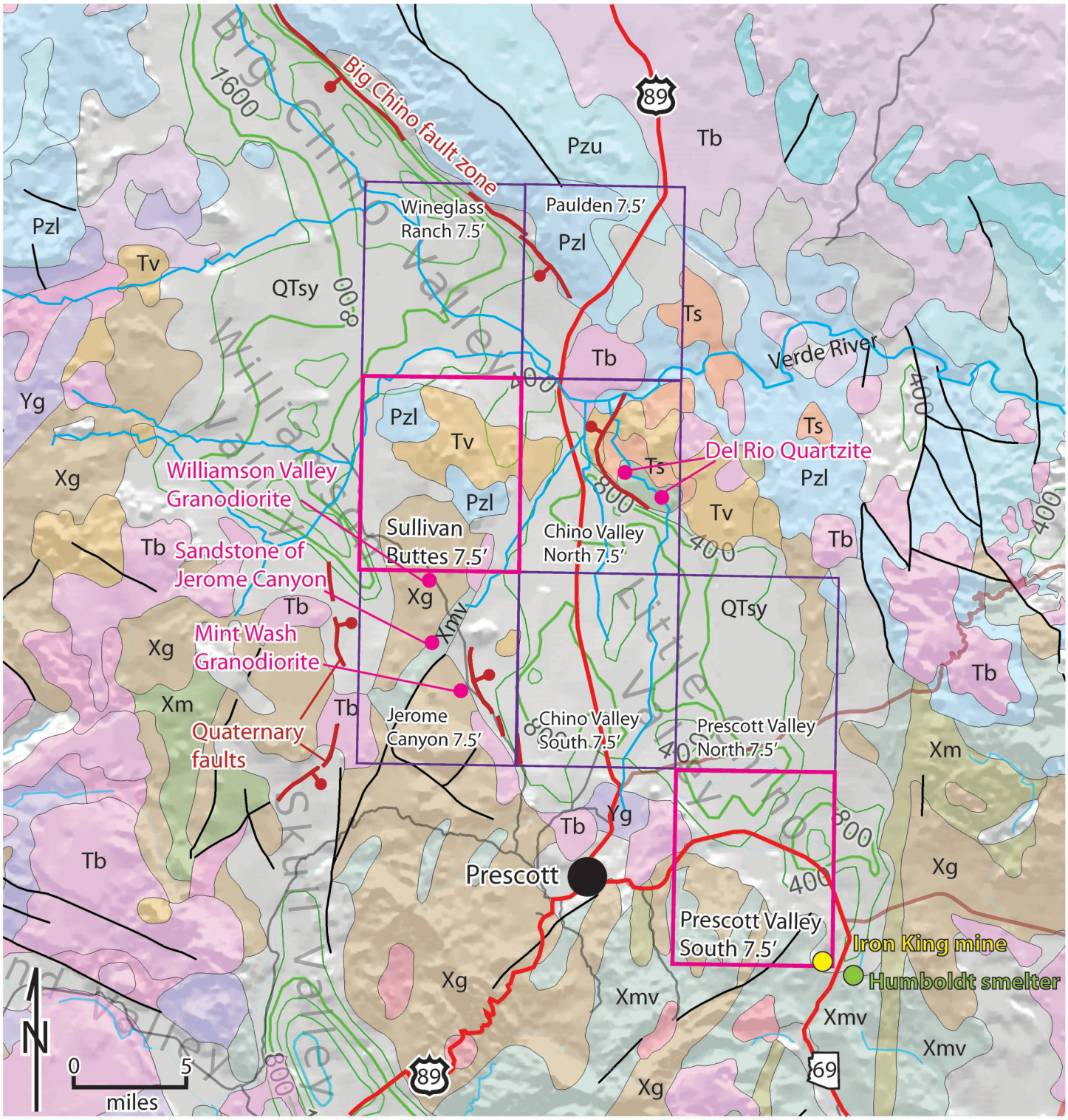


QTsy - Quaternary to upper Tertiary sedimentary units
Tb - Middle Tertiary basalt
Tv - Middle Tertiary volcanic rocks, undivided
Ts - Middle Tertiary sedimentary rocks
Pzsu - Upper Paleozoic sedimentary rocks
Pzsl - Lower Paleozoic sedimentary rocks
Yg - Middle Proterozoic granitic rocks
Xg - Lower Proterozoic granitic rocks
Xmv - Lower Proterozoic metavolcanic rocks
Xm - Lower Proterozoic metamorphic rocks, undivided

Depth to bedrock contours are in feet

Figure 1

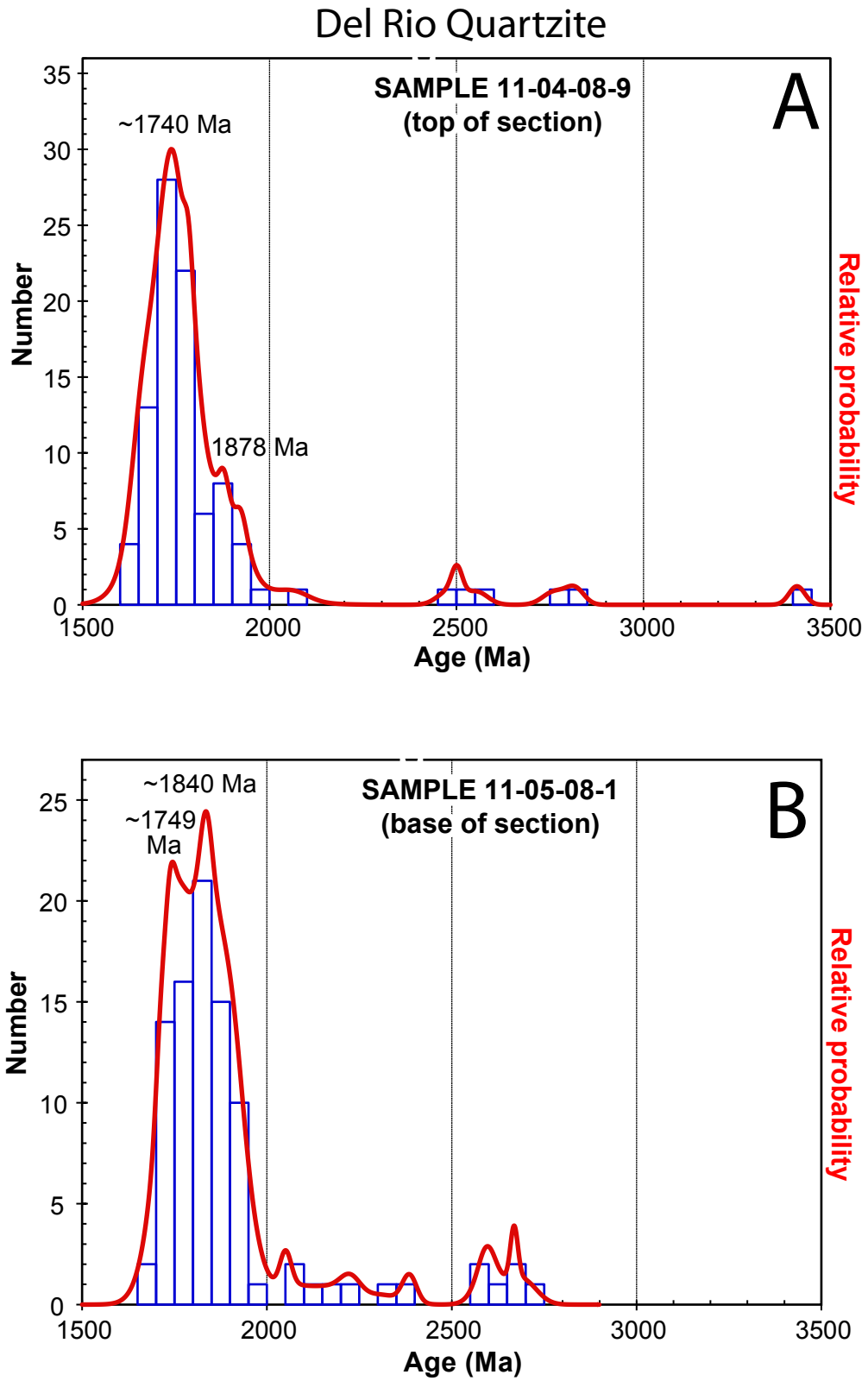

Del Rio Quartzite
SAMPLE 11-04-08-9
(top of section)
A
~1740 Ma
1878 Ma
Number
Relative probability
Age (Ma)
SAMPLE 11-05-08-1
(base of section)
B
~1840 Ma
~1749 Ma
Number
Relative probability
Age (Ma)

Figure 2

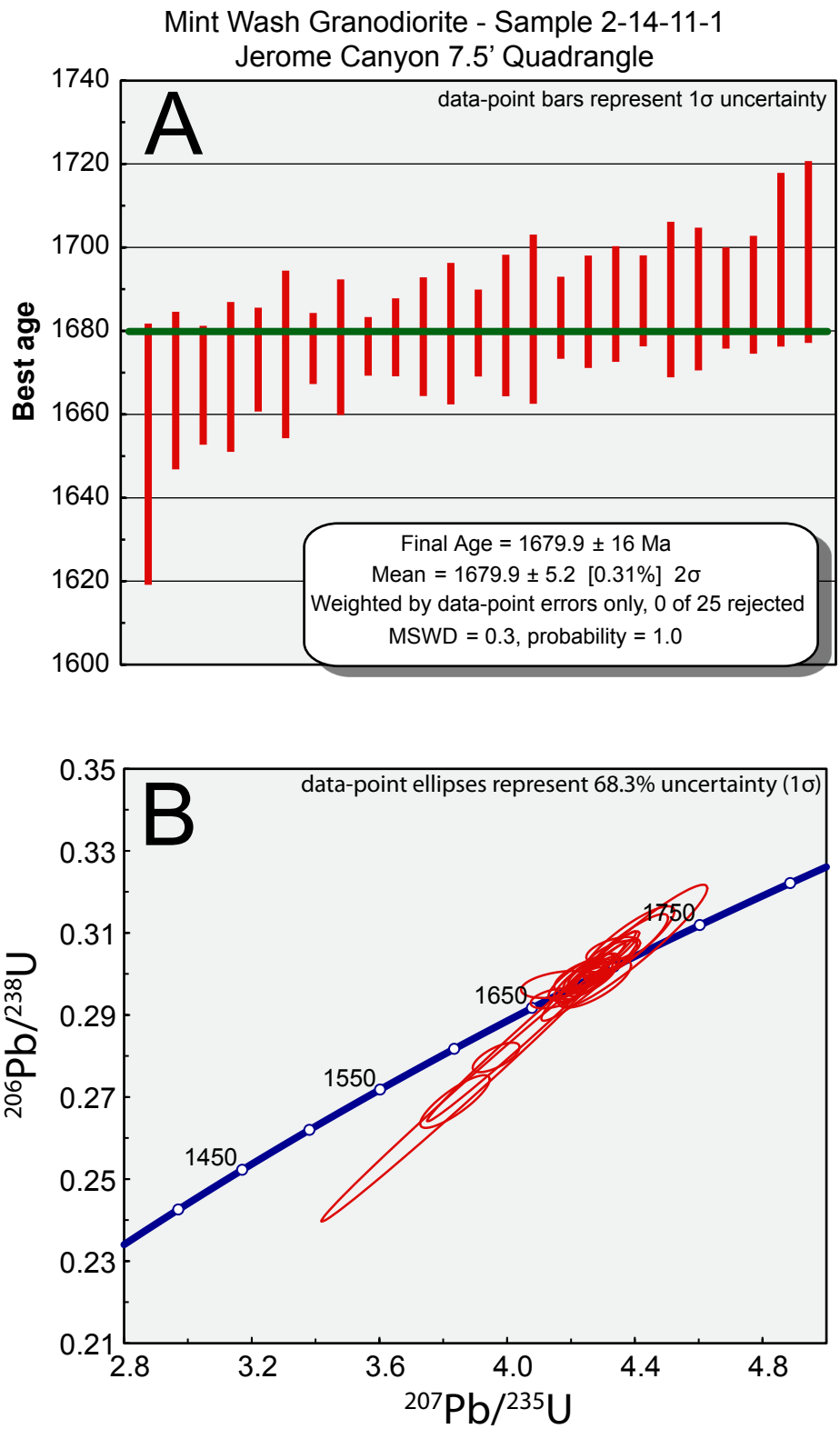

Mint Wash Granodiorite - Sample 2-14-11-1
Jerome Canyon 7.5' Quadrangle
A
data-point bars represent 1σ uncertainty
Best age
1740
1720
1700
1680
1660
1640
1620
1600
Final Age = 1679.9 ± 16 Ma
Mean = 1679.9 ± 5.2 [0.31%] 2σ
Weighted by data-point errors only, 0 of 25 rejected
MSWD = 0.3, probability = 1.0
B
data-point ellipses represent 68.3% uncertainty (1σ)
1450
1550
1650
1750
0.35
0.33
0.31
0.29
0.27
0.25
0.23
0.21
2.8
3.2
3.6
4.0
4.4
4.8
206Pb/238U
207Pb/235U

Figure 3

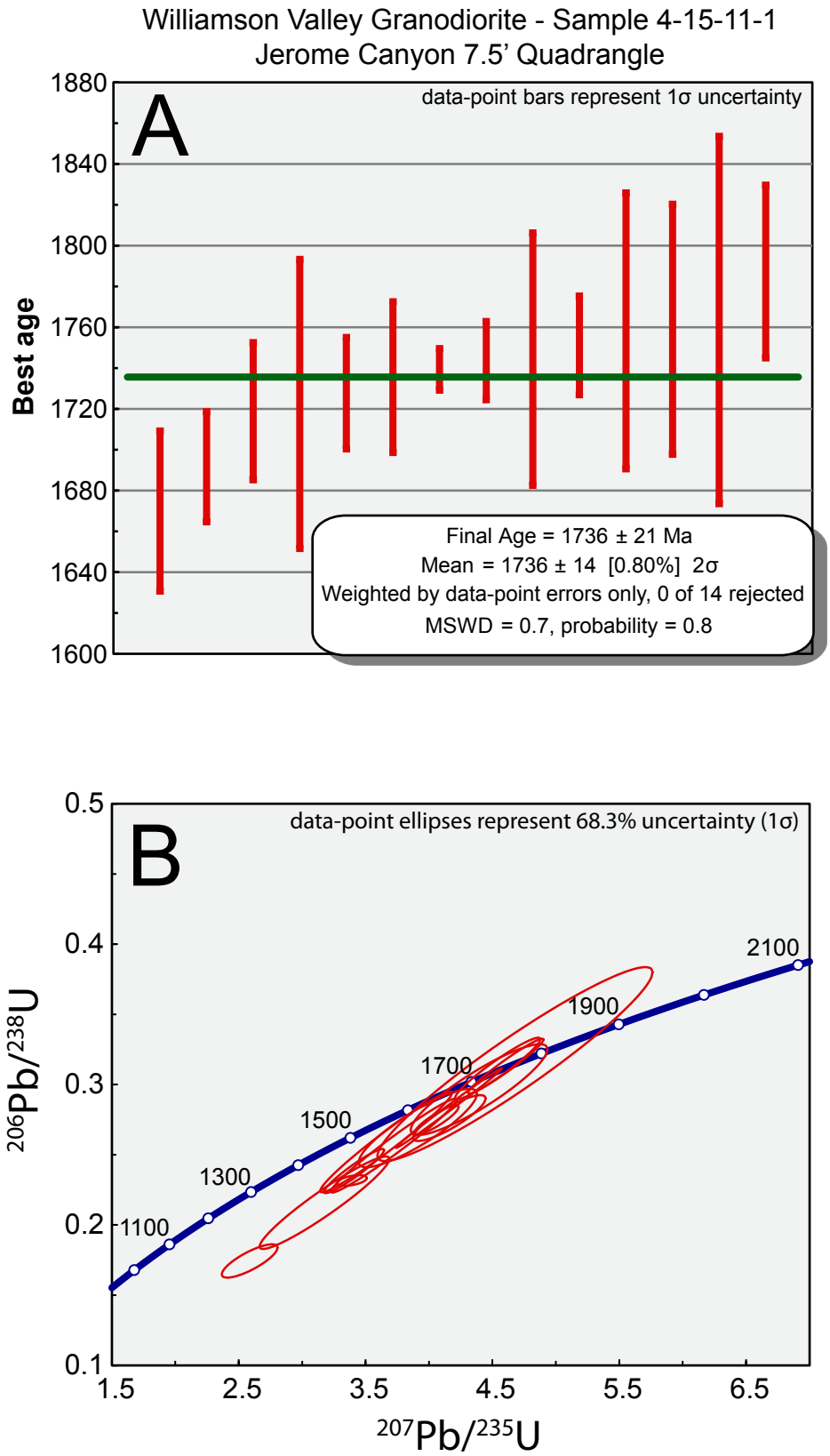
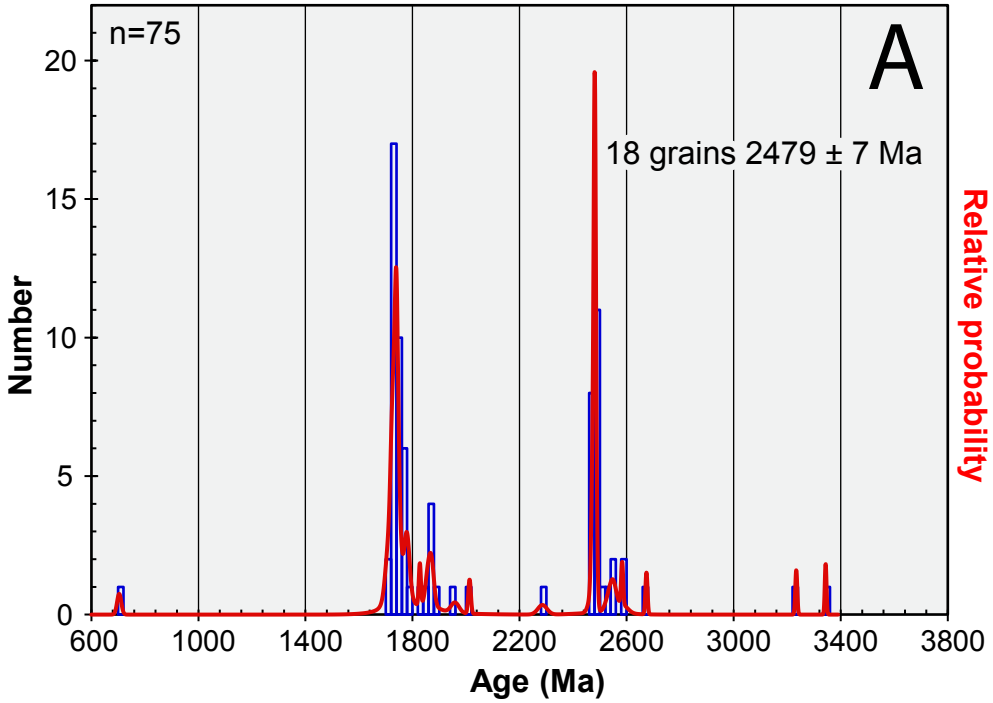

Williamson Valley Granodiorite - Sample 4-15-11-1
Jerome Canyon 7.5' Quadrangle
A
data-point bars represent 1σ uncertainty
Best age
1880
1840
1800
1760
1720
1680
1640
1600
Final Age = 1736 ± 21 Ma
Mean = 1736 ± 14 [0.80%] 2σ
Weighted by data-point errors only, 0 of 14 rejected
MSWD = 0.7, probability = 0.8
B
data-point ellipses represent 68.3% uncertainty (1σ)
0.5
0.4
0.3
0.2
0.1
1.5
2.5
3.5
4.5
5.5
6.5
1100
1300
1500
1700
1900
2100
206Pb/238U
207Pb/235U

Figure 4

SAMPLE 2-15-11-3
Fine-grain sandstone from Jerome Canyon,
Jerome Canyon 7.5' Quadrangle, Prescott area



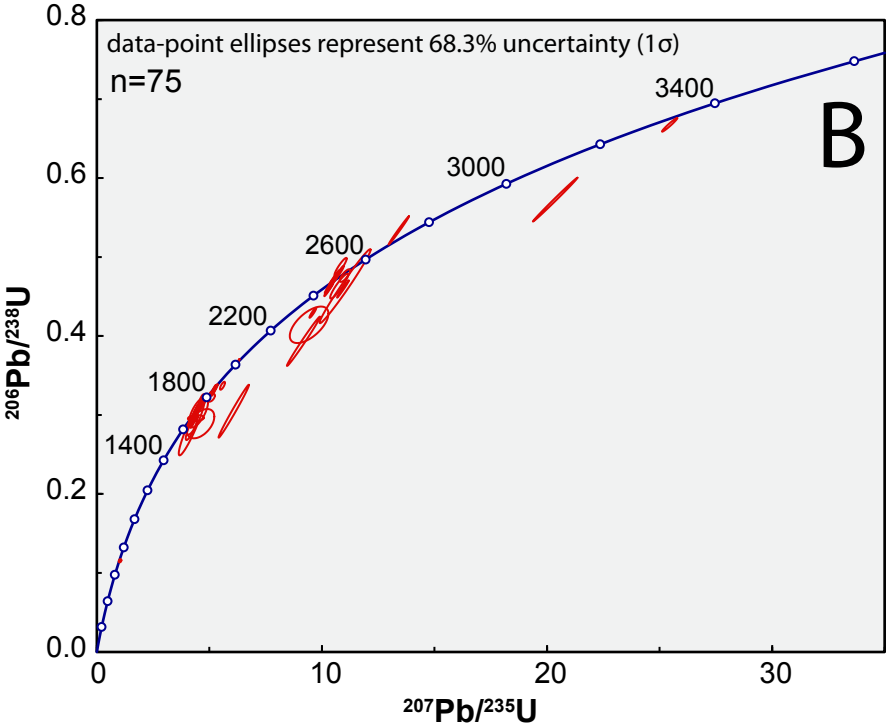


Figure 5

Unit	Sample no.	tech	Date	Station no.	UTMN	UTME	collector	NAD	Zone	Latitude	Longitude
Del Rio Quartzite, top of section	11-4-08-9	U-Pb	detrital	JES-09-034	3854343	369872	JES	NAD83	12		
Del Rio Quartzite, base of section	11-5-08-1	U-Pb	detrital	JES-09-043	3853280	371597	JES	NAD83	12		
Xs - medium to fine grain sandstone north of Prescott	2-15-11-3	U-Pb	detrital	JES-11-193	3841678	355968	JES	NAD83	12	34.707008	-112.5727449
Xmw - Mint Wash granodiorite of DeWitt - Sample of fresh granite from road cut NW of Prescott	2-14-11-1	U-Pb	1680 +/- 16 Ma	JES-11-133	3838927	357075	JES	NAD83	12	34.6823635	-112.5601973
Xwv - Williamson Valley Granodiorite of DeWitt (N of Prescott)	4-15-11-1	U-Pb	1736 +/- 21 Ma	JES-11-481	3845623	356867	JES	NAD83	12	34.7426983	-112.5636002