Oxygen and hafnium isotope geochemistry of zircon, quartz, and garnet from the near-trench Crawfish Inlet and Krestof Plutons, Baranof Island, Alaska

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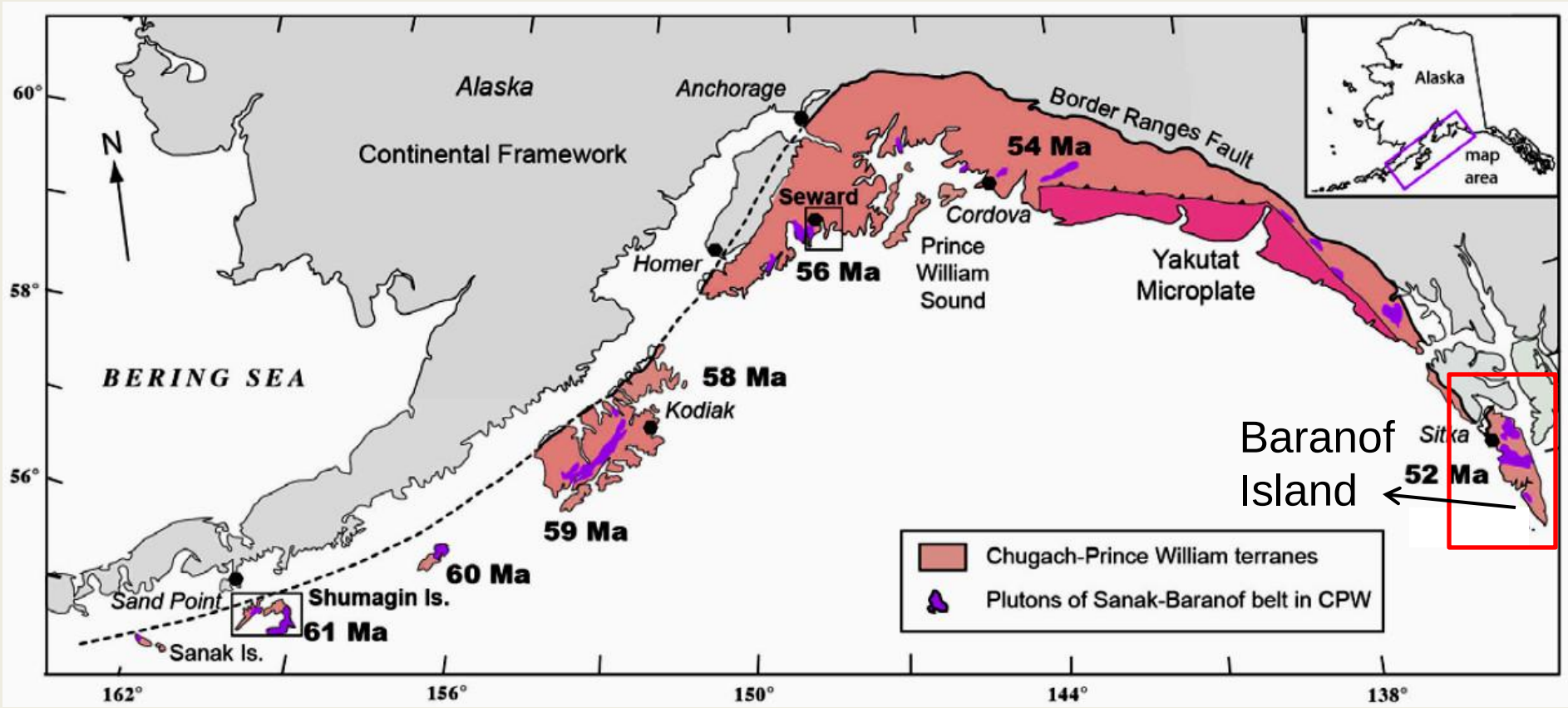
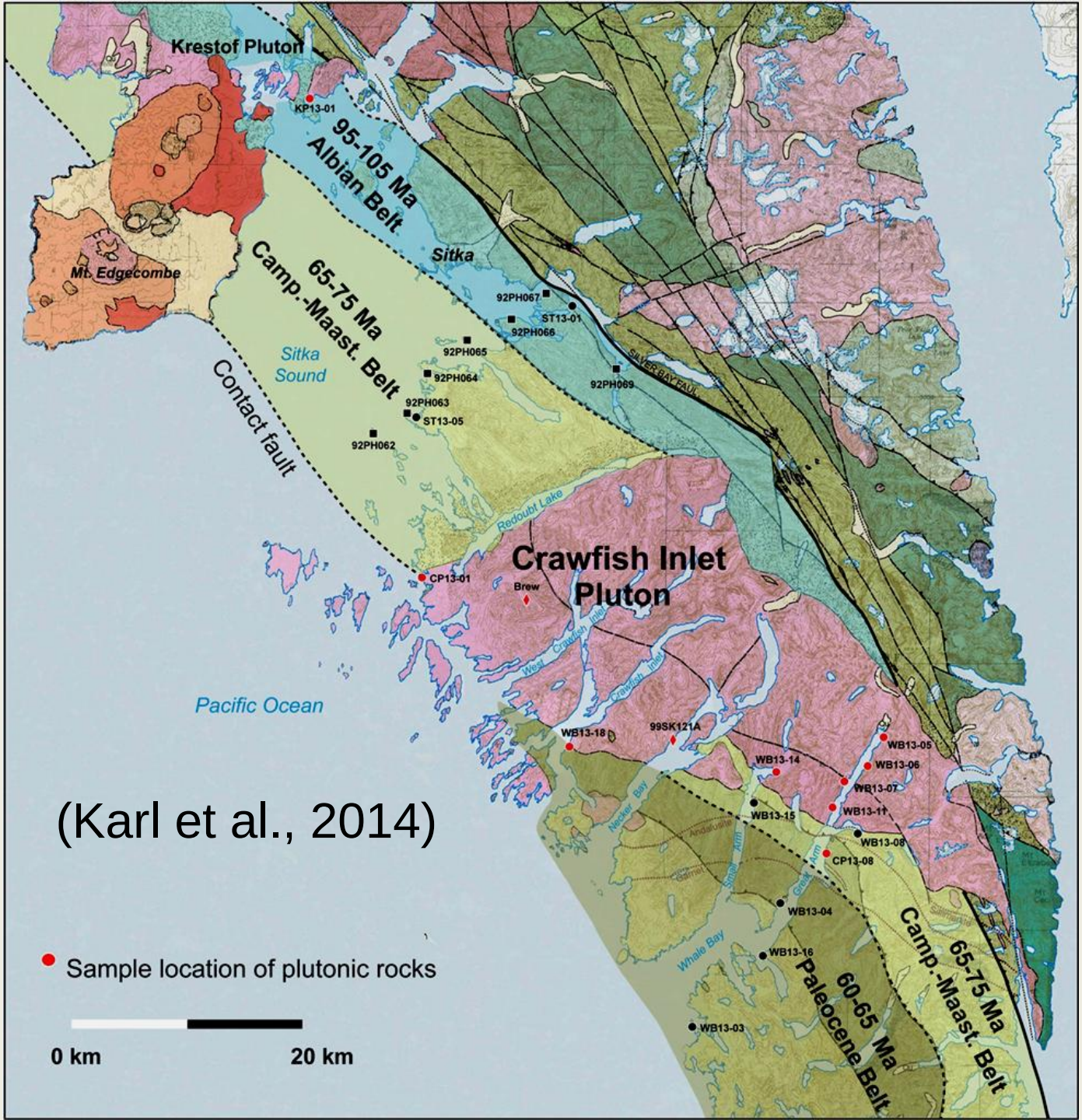
PREVIOUS STUDIES



Farris and Patterson (2009) and Bradley et al. (2003)

Davidson and Garver, 2013

http://www.keckgeology.org/keckwp/wp-content/uploads/26thSymVol_Alaska_Davidson.pdf


Krestof Pluton
KP13-01
95-105 Ma
Albian Belt
Sitka
Mt. Edgecombe
65-75 Ma
Camp.-Maast. Belt
Sitka
Sound
Contact fault
92PH067
ST13-01
92PH066
92PH065
92PH064
92PH063
ST13-05
92PH062
92PH069
SILVER BAY FAULT
Redoubt Lake
CP13-01
Brew
Crawfish Inlet
Pluton
West Crawfish Inlet
Crawfish Inlet
Pacific Ocean
WB13-18
99SK121A
WB13-05
WB13-14
WB13-06
WB13-07
WB13-11
WB13-15
WB13-08
CP13-08
Necker Bay
Andrau Lake
Carmel
Small Arm
Great Arm
WB13-04
Whale Bay
WB13-16
WB13-03
60-65 Ma
Paleocene Belt
65-75 Ma
Camp.-Maast. Belt
(Karl et al., 2014)
Sample location of plutonic rocks
0 km
20 km

IN THIS STUDY

- O and Hf isotope, and U-Pb geochronology data on the Crawfish Inlet Pluton (CIP) and the Krestof Pluton (KP) from the eastern part of the Sanak-Baranof Belt on Baranof Island.

(1) Correlate O data with available εHf (zircon) and U/Pb age (zircon) data;

(2) Thermometry and inter-mineral O fractionations;

(3) Origin and evolution of the CIP and KP.

SAMPLES

Sample from the Crawfish Inlet Pluton (CIP), Krestof Pluton (KP), and Aialik Pluton (RP), Alaska				
Sample	# of samples from site	# of samples bearing:		
		Zrc	Qtz	Grt
CIP	n = 9	n = 7	n = 9	n = 2
KP	n = 1	n = 1	n = 0	n = 0
RP	n = 1	n = 1	n = 1	n = 0
Total	n = 11	n = 9	n = 10	n = 2

Tonalites to granodioriorites

Grt-Ms leucogranites

Why is this important?

Generation of granitoids along continental margins

Crawfish Inlet Pluton, Whale Bay, AK.

METHODS

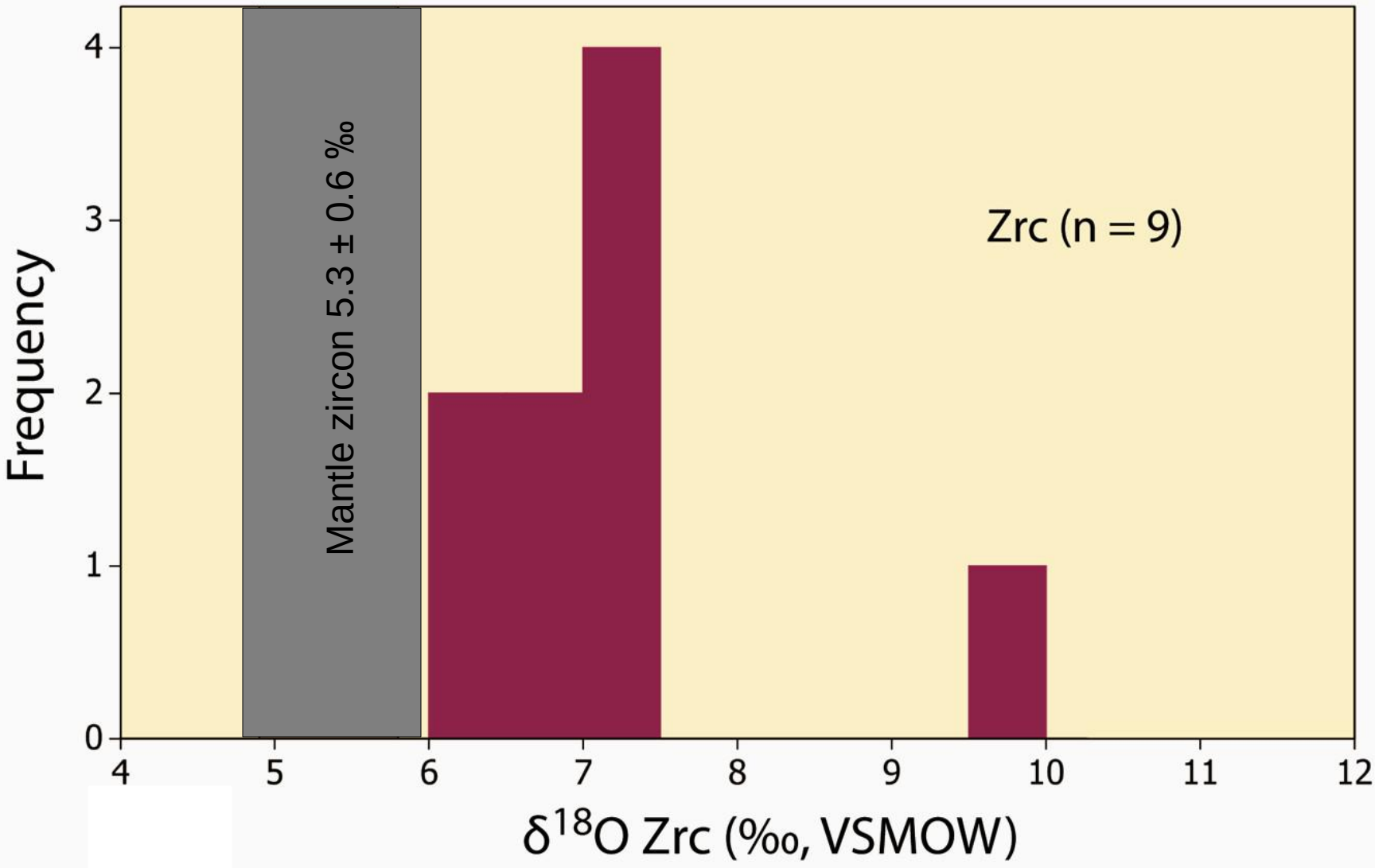
Oxygen isotope analysis

- Zircons, quartz, and garnets from the CIP and KP.
- $\delta^{18}O$ analyses by laser fluorination at the UW-Madison stable isotope laboratory.
- All samples were corrected for accuracy with UW6-2 (Valley et al., 1995).
- Origin of melt (crust vs. mantle).

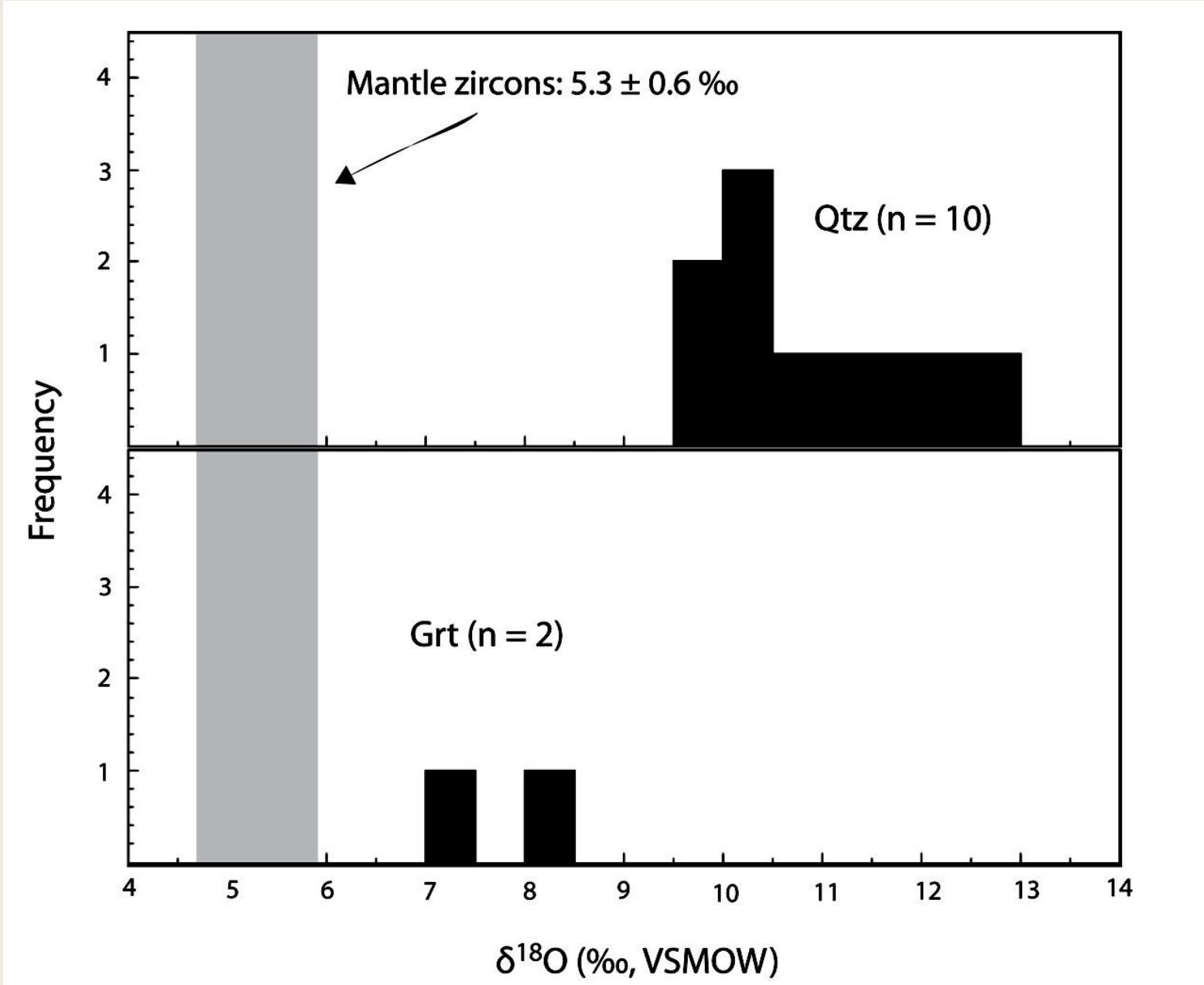
Hafnium isotope analysis and U/Pb geochronology

- U-Pb and Hf isotope data collected by LA-MC-ICPMS at the Arizona LaserChron Center.
- Crystallization ages and mantle extraction ages.

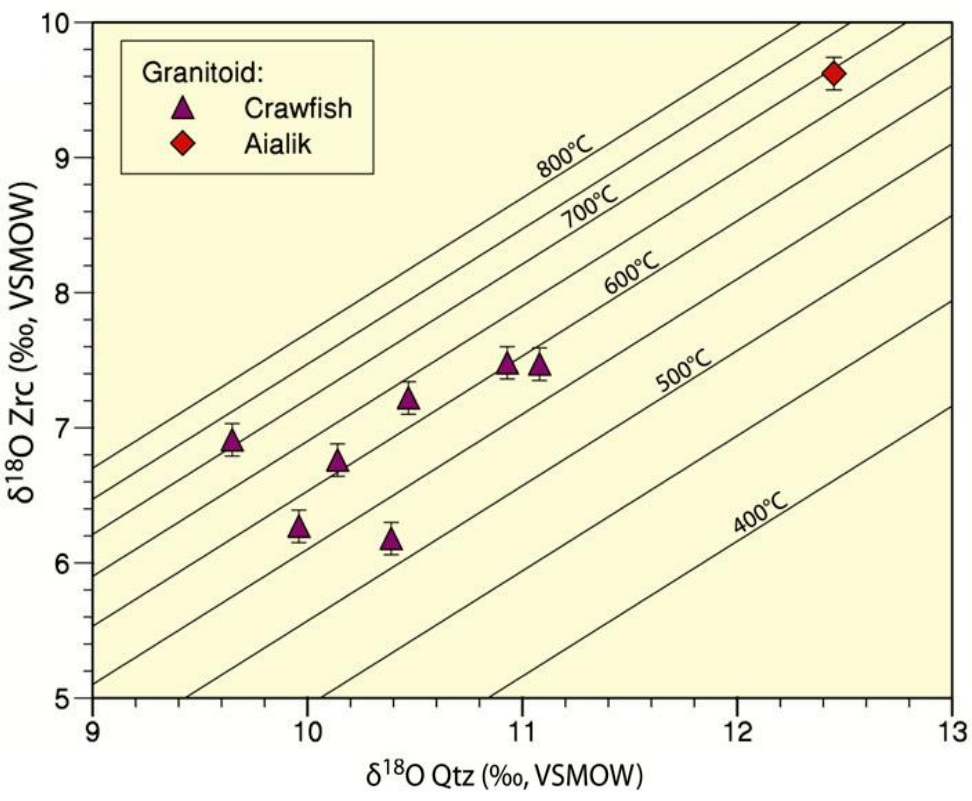
$\delta^{18}O$ (ZIRCON) FROM THE CIP, KP, AND RP



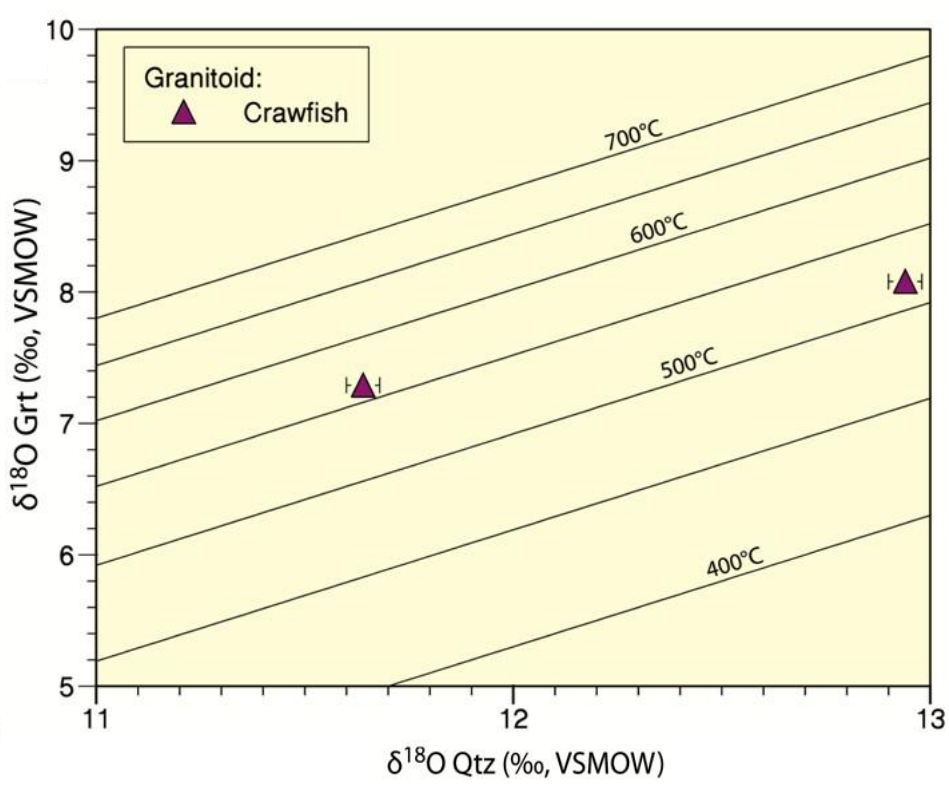
$\delta^{18}O$ (QUARTZ) AND $\delta^{18}O$ (GARNET) FROM THE CIP

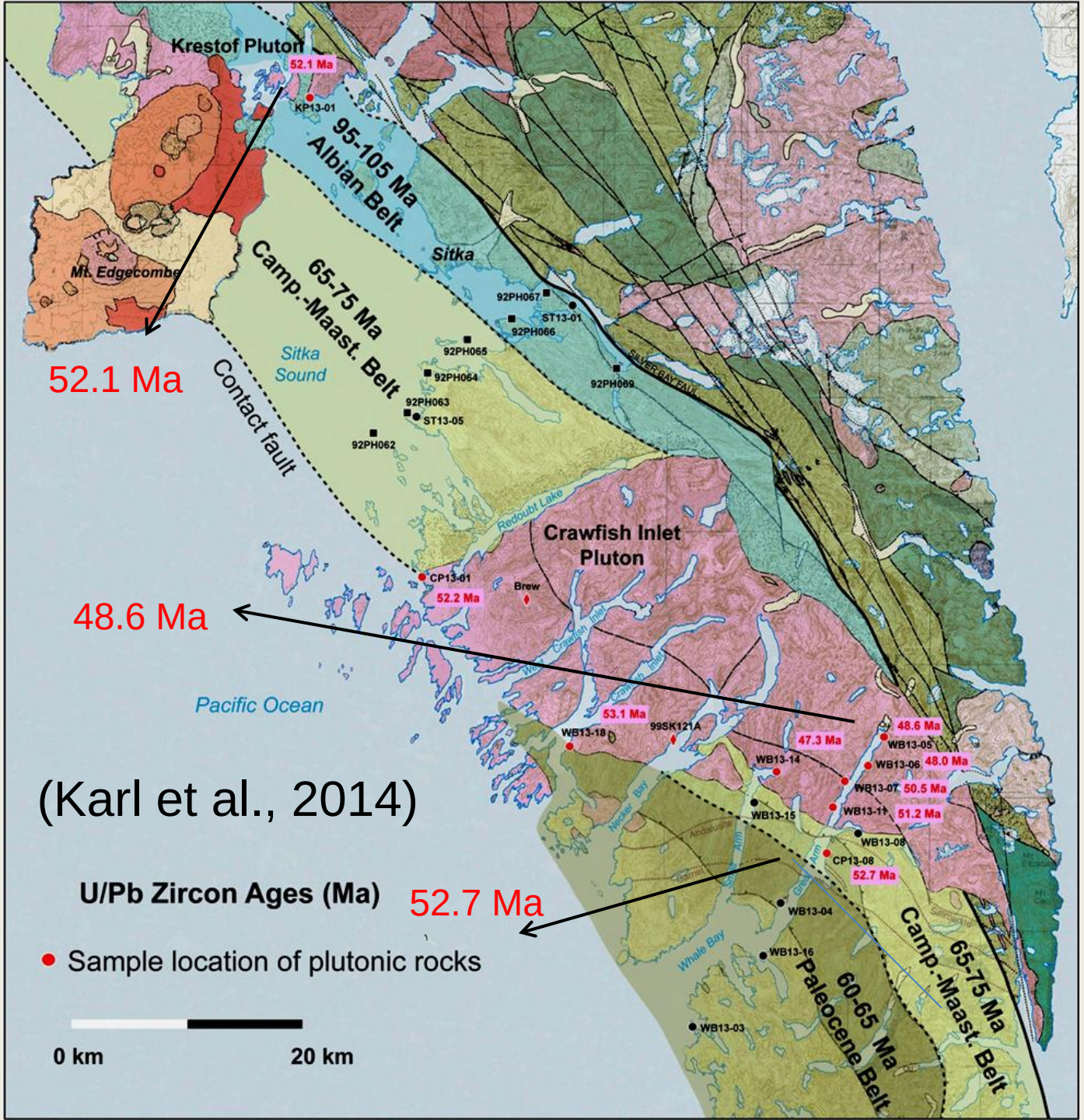


COEXISTING QUARTZ AND ZIRCON FROM THE CIP AND RP



COEXISTING QUARTZ- GARNET FROM THE CIP

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Necker Bay
Whale Bay
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(Karl et al., 2014)
U/Pb Zircon Ages (Ma)
Sample location of plutonic rocks
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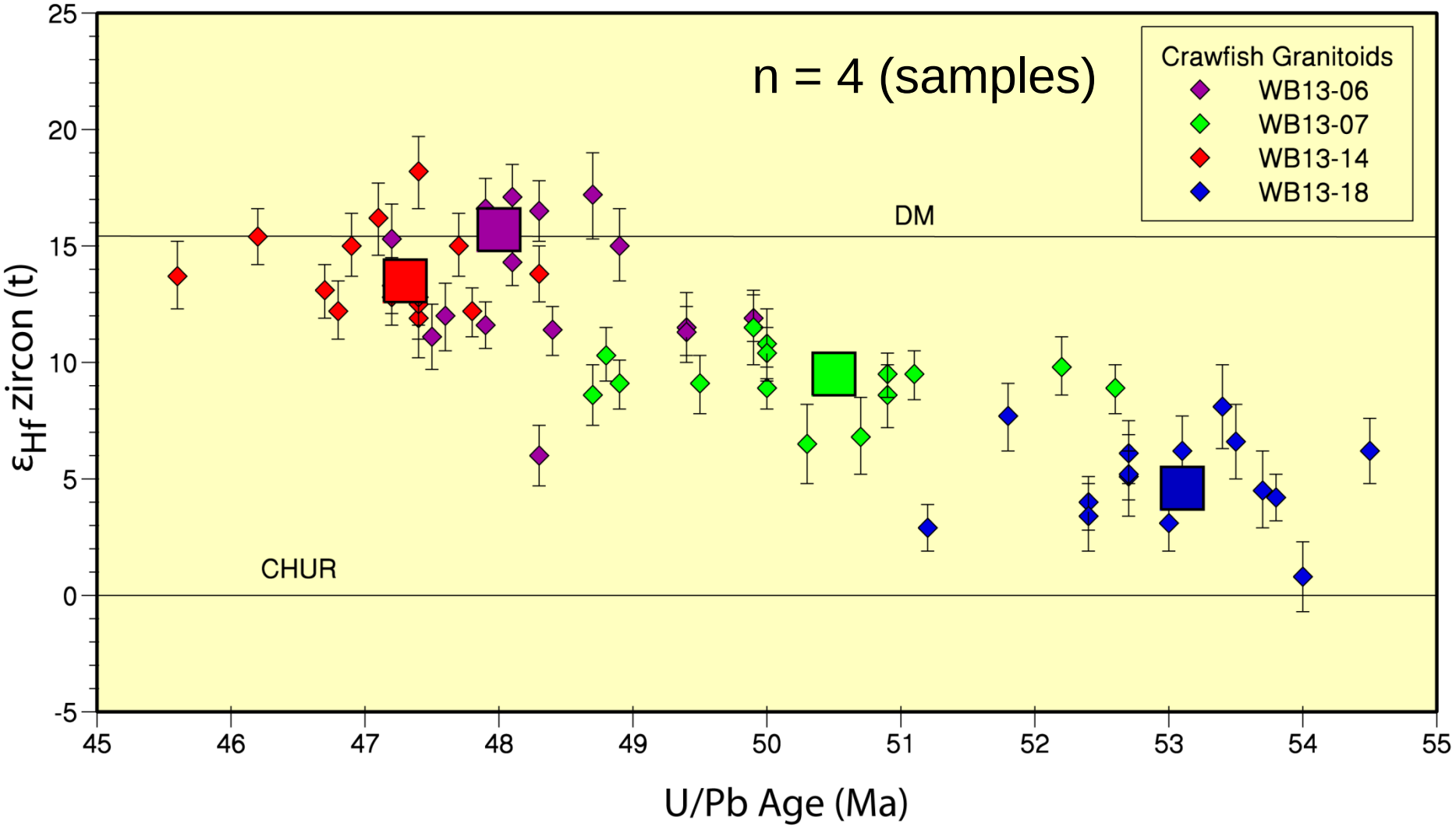
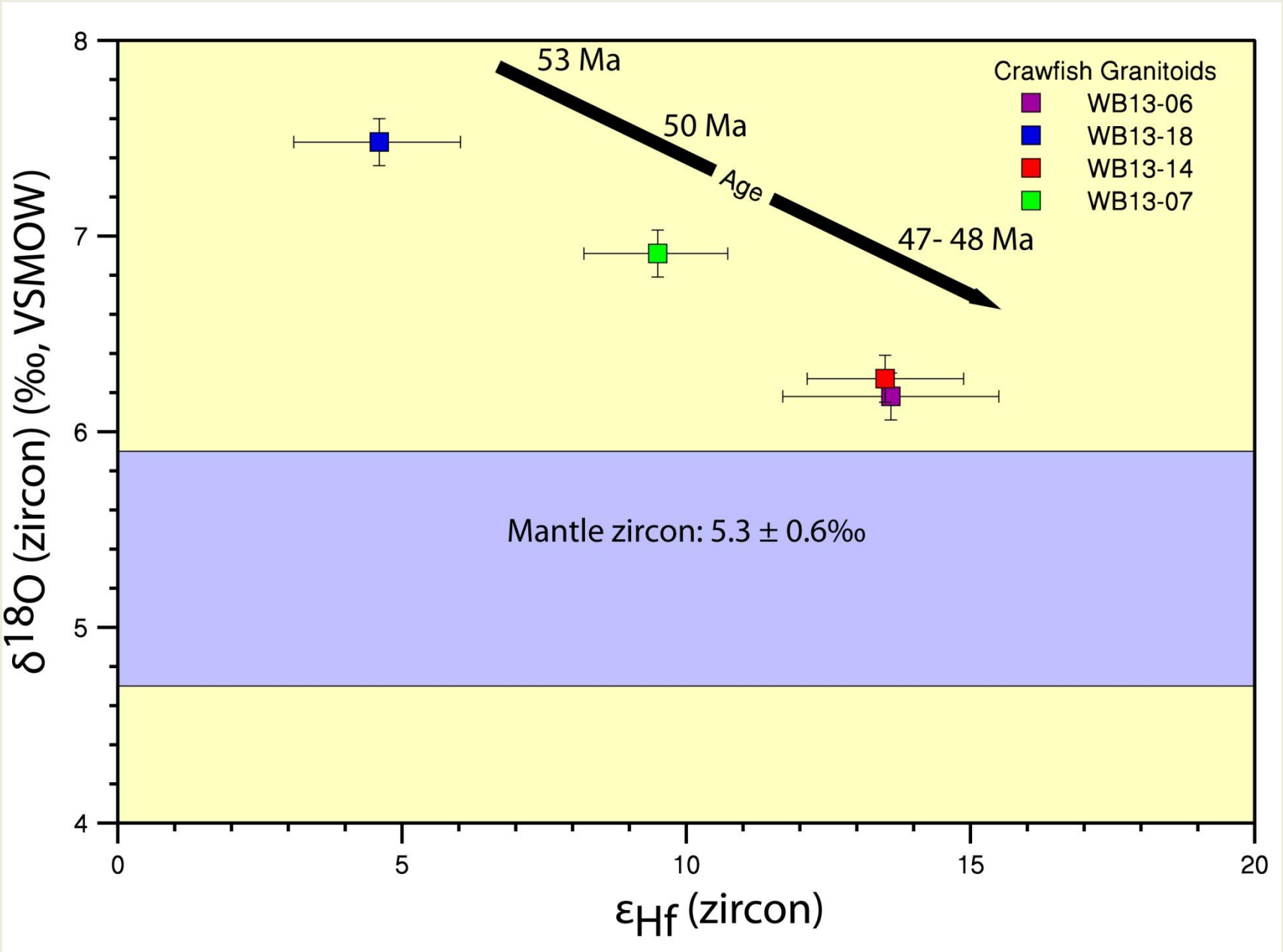
εHf vs. U/Pb age evolution for four granitoid samples from the CIP



$\delta^{18}O$ vs. εHf



SUMMARY OF RESULTS

→ $\delta^{18}O$ CIP, KP and RP (uncertainty at 2σ)

Zrc: 6 - 7.5‰, and 9.6‰

Qtz: 9.7‰, 12.5‰

Grt: 7.3 - 8.1‰

→ U/Pb ages for CIP and KP

47.3±1.2 - 53.1±0.8 Ma, 52.1±1.0 Ma for KP

→ εHf for CIP (1σ)

+18.2 ± 1.5 at 47.4 Ma to +0.8 ± 1.5 at 54.0 Ma

Discussion and Conclusion

- All zircons show evidence for the incorporation of recycled crust;
- $\delta^{18}O$ (Qtz–Zrc) and (Qtz- Grt) mineral fractionations yield temperatures lower than those considered magmatic temperatures, indicating resetting of $\delta^{18}O$ (quartz);
- U/Pb ages show evidence of multiple pulses of magmatism spanning from 53-47 Ma.

Discussion and Conclusion

- Primitive (juvenile) zircons with higher εHf values record the least evolved oxygen isotope ratios;
- Age progression shows a distinctive magmatic evolution;
- The range of $\delta^{18}O$, εHf, and U-Pb ages in the CIP, appears to indicate lesser supracrustal input with time;
- Spatial heterogeneity, age, and isotopic chemistry in the CIP, and KP raises the question on the possible source and petrogenesis.

ACKNOWLEDGEMENTS