

Use of the CETAC Aridus II™ Desolvating Nebulizer System with Multi-Collector ICP-MS

Multi-collector (MC) ICP-MS instruments are highly specialized devices used for stable isotope ratio measurements. A primary application area is research in the earth sciences, particularly for U-Th dating studies. This technical note will summarize performance data with a CETAC Aridus II™ Desolvating Nebulizer System coupled to a contemporary MC-ICP-MS system. Important figures of merit include signal enhancement and hydride reduction (ThH^+ and UH^+).

Operating Conditions:

MC-ICP-MS:	Thermo Finnigan Neptune
ICP Power:	1200 W
Coolant Gas:	15 L/min
Auxiliary Gas:	0.58 L/min
Sample Gas:	1.103 L/min
Focus Lens:	-626 V
Desolvating Nebulizer System:	CETAC Aridus II™
Nebulizer:	Aspire PFA-100
Nebulizer Uptake:	Adjusted to 120 $\mu\text{L}/\text{min}$
PFA Spray Chamber Temp:	110°C
Membrane Oven Temp:	160°C
Ar Sweep Gas:	6.32 L/min
N ₂ Addition Gas:	9 mL/min

Sensitivity Enhancement:

A test solution containing 20 mg/L Th, U was monitored using a standard fixed low-flow nebulizer (ESI PFA-50) and quartz concentric spray chamber. This was compared with the Aridus II™ system using the conditions listed above. Overall sensitivity enhancement with the Aridus II™ is a factor of 4 to 5, correcting for differences in sample uptake rate. See Figure 1. Note: The ESI PFA-50 self-aspiration uptake was measured to be 70 $\mu\text{L}/\text{min}$.

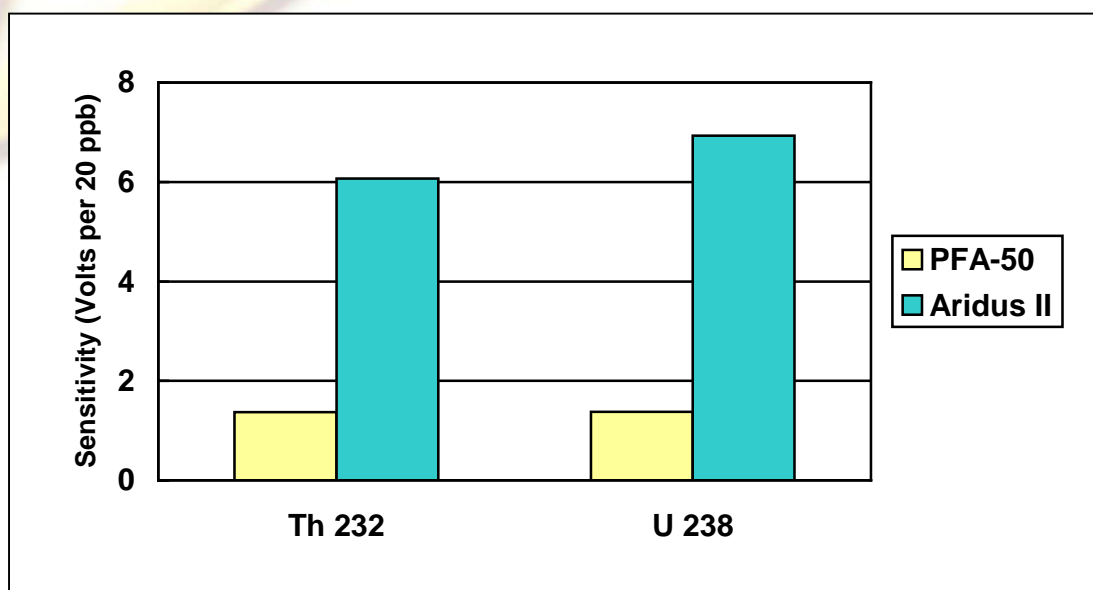


Figure 1. Sensitivity enhancement for Th and U with the Aridus II™



Aridus II™ Desolvating Nebulizer System

Hydride Reduction:

The use of U-Th isotope ratios for dating studies can be compromised by the presence of hydride interferences in the mass spectrum. These hydrides are largely caused by the injection of water vapor from a standard nebulizer/spray chamber setup. The PTFE membrane desolvator of the Aridus II™ system can greatly reduce hydride levels, as the countercurrent flow of Ar sweep gas removes much of the water vapor before it reaches the ICP-MS. Some important hydride interferences in U-Th dating studies include: $^{229}\text{ThH}^+$ on $^{230}\text{Th}^+$, $^{233}\text{UH}^+$ on $^{234}\text{U}^+$, $^{235}\text{UH}^+$ on $^{236}\text{U}^+$.

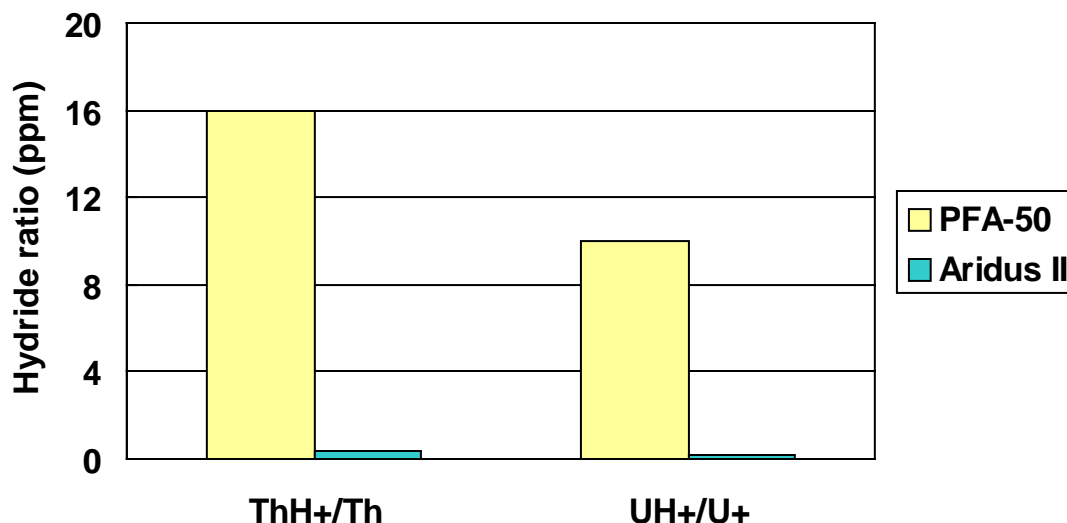
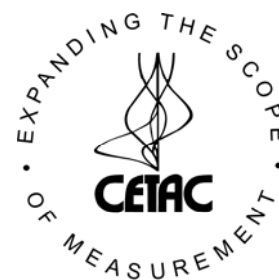


Figure 2 compares the hydride levels with the Aridus II™ via monitoring of $^{232}\text{ThH}^+$ and $^{238}\text{UH}^+$ versus the ESI PFA-50 nebulizer with no desolvation. Hydride levels are described as the signal ratio MH^+/M^+ . Note that hydride levels are reduced by a factor of 40 to 50, while the net signal (Figure 1) is *still increased* by a factor of 4 to 5.



Aridus II™



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