

# A Specialized Desolvating Nebulizer System for Isotope Ratio Measurements with Multicollector ICP-MS

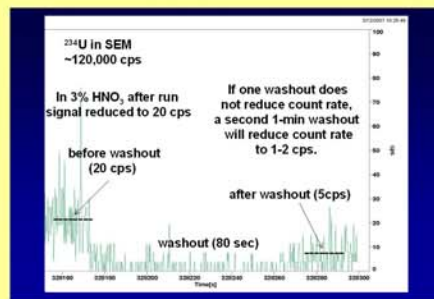
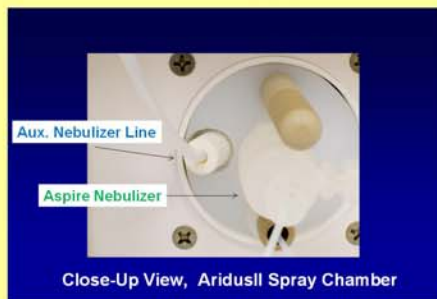
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**Abstract:**

Multicollector ICP-MS instruments are devices usually dedicated for high-precision isotope ratio measurements. When low abundance isotopes are to be measured, the highest interference-free signal is desired. Also, rapid and complete analyte washout is required for best sample throughput and elimination of signal spikes.

This paper will describe a specialized sample introduction system that can provide signal enhancement, interference reduction (e.g. hydride interferences) and faster analyte washout. This introduction system features a heated PFA spray chamber, an inert desolvating membrane, nitrogen gas addition, and a new auxiliary nebulizer for improved washout.

Data will be presented with this nebulizer system and multicollector ICP-MS for U-Th dating studies.



**Instrumentation**

**Multicollector ICP-MS:**

Thermo Finnigan Neptune

**Desolvating Nebulizer:**

CETAC AridusII & QuickWash Accessory

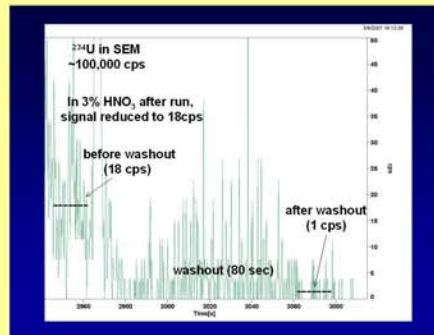
**Operating Conditions**

Thermo Finnigan Neptune MC-ICP-MS

ICP Power: 1200 W  
Aux. Gas Flow: 1 L/min  
Nebulizer Gas Flow: 0.8 L/min

**CETAC AridusII**

Sample Uptake Rate: 100 µL/min  
Ar Sweep Gas: 10.5 L/min  
N<sub>2</sub> Addition Gas: 6 mL/min  
Spray Chamber Temp: 105°C  
Membrane Oven Temp: 160°C



**Results:**

The above stalagmite was dated in the late 1970s by U-Th alpha dating, with a reported value of 125,000 years.

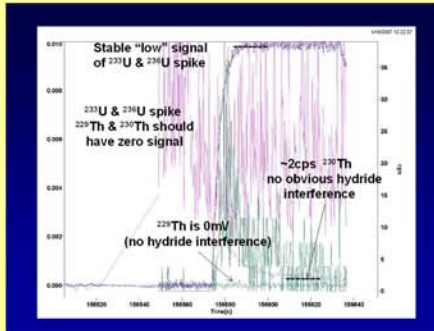
More accurate U-series dating by thermal ionization mass spectrometry (TIMS) revealed the stalagmite top to have an age of 440 +130/-60 ka (1 ka = 1000 years)

Use of MC-ICP-MS with the AridusII has significantly narrowed the absolute 2σ error: 440 +37/-29 ka.



**CETAC AridusII Advantages**

- > Signal is 8-10 times greater using the AridusII (100µL/min) than the standard 50 µL/min nebulizer giving an overall effective signal increase of 4-5 times.
- > No detectable hydrides (U-series analyses).
- > Smaller samples are now routine (for U-series, use ≤ 100 mg).
- > Measurement times are significantly reduced by 5-10 times.
- > Sample chemistry time reduced because of smaller samples.



**Acknowledgement**

CETAC would like to thank Dr. Yemane Asmerom and Dr. Victor Polyak of the University of New Mexico for the AridusII data with the Neptune MC-ICP-MS.



The Aridus II makes static runs on U-series samples routine & significantly reduces errors and measurement times

<sup>230</sup> Th/ <sup>232</sup> Th	1-σ % error	length of analyses	<sup>232</sup> Th amount of sample	Instrument
0.024367	0.4481	2.5 hours	1800	~1/2 TIMS
0.024252	0.12398	0.2 hours	98,125	~1/8 MC-ICPMS*

\* - dilute solution, Thermo Neptune MC-ICPMS / Aridus II

U-series Age (yr)	δ <sup>234</sup> U ‰	length of analyses	amount of sample	Instrument
40,384 ± 417	1047 ± 4	4.0 hours	~1/2	TIMS
40,558 ± 257	1048 ± 3	0.5 hours	~1/8	MC-ICPMS/Aridus II

Typical <sup>232</sup>U or <sup>232</sup>Th spike count rates:

- 5000 cps using TIMS
- 40,000 cps using MC-ICPMS without Aridus II
- 300,000 cps using MC-ICPMS with Aridus II

**Application**

Dating Study of a Stalagmite

**Sample Location:**

Ogle Cave in Carlsbad Caverns National Park, New Mexico USA

**Sample Size:**

TIMS: 0.236g  
MC-ICP-MS/AridusII: 0.078g

