Plasma Laboratory

Geochemistry @ University of Maryland

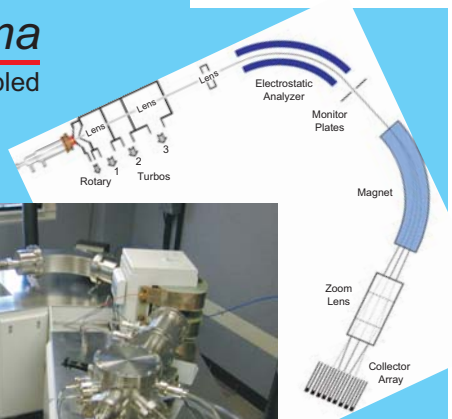
Elemental & isotopic analyses of solids & liquids

(www.geol.umd.edu/plasma-lab)

Multi-collector ICP-MS

Nu Plasma

Inductively Coupled Plasma - Mass Spectrometer

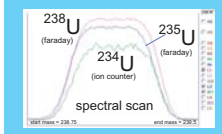


12-faraday collectors

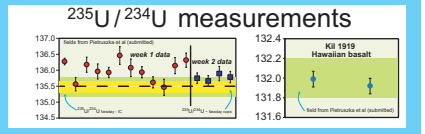
High precision isotope analyses:

applications:
- -cosmochemistry
- -environmental chemistry
- -geochemistry
- -geochronolgy

$^{7}Li/^{6}Li$	± 1‰ [all given @ ±2σ]
$^{98}Ru/^{101}Ru$	± 0.16 ‰
$^{99}Ru/^{101}Ru$	± 0.1 ‰
$^{198}Pt/^{195}Pt$	± 0.1 ‰
$^{230}Th/^{232}Th$	± 2‰
$^{234,235}U/^{238}U$	± 2‰



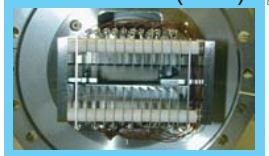
$^{235}U/^{234}U$ measurements



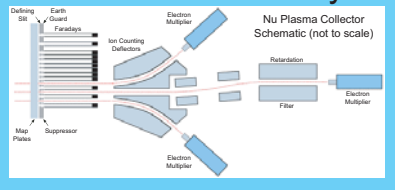
Innovative Collector Assembly:

- 12 faraday cups in a fixed assembly
- 17% mass dispersion (e.g., simultaneous ^{6}Li - ^{7}Li)
- zoom optics to separate out masses
- multi-multiplier for simultaneous ion counting

Zoom Lens ("L1")



Collector Assembly



Laser Ablation Systems

2 Deep UV lasers: excimer & Nd:YAG

- DUV wavelength couples effectively with most materials
- for in situ analyses of solids & liquids
- for use in: cosmochemistry, environmental chemistry, geochemistry and geochronolgy

ArF excimer laser system

λ = 193 nm E = 6.43 eV

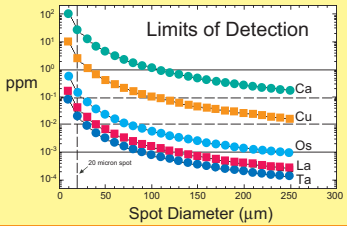
$\lambda = c\,\nu^{-1}$, $E = h\,\nu = h\,c\,/\,\lambda$

spot sizes 4 to 400 µm

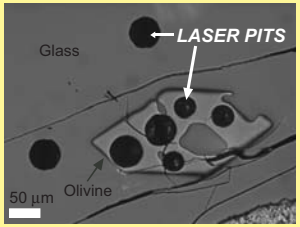
thickness of ablated layer (50-100 nm) depending on beam's energy density

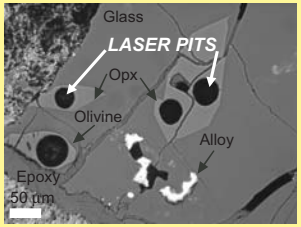
Solid state Nd:YAG laser
5th harmonic of Nd:YAG
λ = 213 nm, E = 5.83 eV

select spot sizes from 5 to 160 microns



Element detection limits are a function of spot size, mass of the isotope, and the element's 1st ionization potential (ip). Ca, La, and Ta have similar 1st ip, while Os and Ta have similar masses.



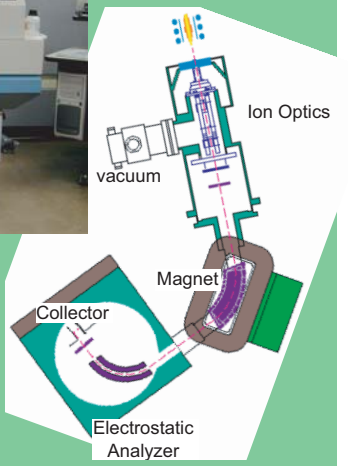


Laser Spots in Experimental Charges

Sattari, Brenan, Horn & McDonough - Economic Geology 2002, 97:385-398

Single-collector ICP-MS

Element 2

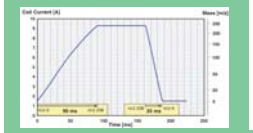


Inductively Coupled Plasma - Mass Spectrometer with a single electron multiplier detector

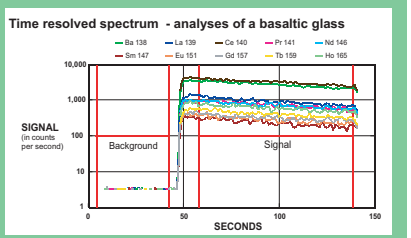
Rapid scanning & high sensitivity:

- abundance determinations for most elements, excepting noble gases, from Li to U
- solution analyses of waters, sludges, airborne particulates, dissolved rocks and metals, etc.
- *in situ* laser ablation analyses of solids or liquids (including fluid inclusions)
- low detection limits: e.g., U in solution has a detection limit of <1 ppq (i.e., $1*10^{-15}$g/g)
- high resolving power to avoid interfering iosbars

Fast scanning magnet - needed for time resolved analyses



***In situ* analyses via laser ablation**



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