

# SHRIMP II

Reliable, Productive Ion Microprobe



***The Window into the Early Earth***

# SHRIMP II<sup>e</sup>

The **SHRIMP II<sup>e</sup>** is the industry leading SIMS instrument for advanced geochronology. Building on the strong performance of the **SHRIMP II**, the **SHRIMP II<sup>e</sup>** is enhanced by;

- Advanced electronics, coupled by a fibre-optic control system for low noise and high reliability;
- Advanced electrometers, with computer-selectable feedback resistors and capacitance mode to optimise gain and settling time;
- Advanced intelligent vacuum control system, for safe control of routine and fault conditions;
- Enhanced magnet control system for highly stable operation and rapid field switching at high and low fields;
- Enhanced high voltage power supplies, for enhanced end to end stability and throughput;
- Enhanced software, for ease of user operation, remote operation, automation and system parameter logging;
- Enhanced analysis of light isotopes, with a sophisticated multicollector, which can be reconfigured under computer control, without breaking vacuum.

**SHRIMP II<sup>e</sup>** is designed for in situ measurement of elemental and isotopic compositions of micron-scale areas on the surface of solid samples, based on the principles of secondary ion mass spectrometry (SIMS). The analysis of geological samples is complicated by the presence of complex isobaric interferences that require high mass resolving power to separate the isotopic species of interest. The high mass resolution of **SHRIMP II<sup>e</sup>** is achieved by the use of a large double-focusing mass spectrometer with energy and mass refocusing.

The unique design allows operation with wide slits, allowing high sensitivity measurements of isotopic compositions of trace elements at high mass resolution. This facilitates accurate analysis of the isotopic composition of trace elements

at concentrations of even a few parts per million. For most elements, routine detection limits of a few parts per billion are readily achieved.

This high sensitivity permits analysis of very small amounts of sample; a typical spot is 25 microns in diameter and less than 3 microns deep. The high quality reflected light imaging system in **SHRIMP II<sup>e</sup>** allows micron-scale placement of probe spots into specific target areas.

## Applications

**SHRIMP II<sup>e</sup>** is designed to facilitate micron scale surface analysis for geochronology, stable isotope analysis, determination of isotope anomalies and trace element analysis, in grain mounts or thin sections. Typical applications include;

### Geochronology

- Accurate ages of igneous rocks
- Accurate ages of mineral deposits
- Magma provenance from inherited zircon cores
- Metamorphic ages from overgrowths
- Sediment provenance and correlation
- Deposition ages from diagenic overgrowths

### Stable Isotopes

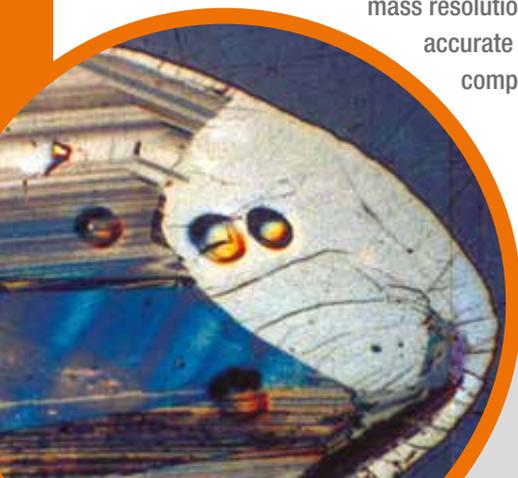
- Sulphur isotopes in massive sulphide deposits
- Sulphur isotopes in sulphide inclusions
- Oxygen isotope ratios in biogenic and inorganic minerals

### Isotope Anomalies

- Anomalies in refractory meteoritic minerals
- Solar wind isotope analysis in lunar materials

### Trace Elements

- Rare earth elements in protolith cores and metamorphic overgrowths
- Depth profiling of surface films and diffusion profiles
- Isotope imaging by rastered sample
- Forensic analysis of glass samples



Zircon grain from the world's oldest-known rock, the Acasta Gneiss, showing the very shallow pits and virtually no sample damage.

## Features

- Fine spatial and depth resolution; the sharply defined and homogenous primary beam produces sharp spot edges and flat-bottomed pits;
- High sensitivity at high mass resolution: 5000  $M/\Delta M$  at 75% transmission with flat-topped peaks, to resolve major molecular interferences during analysis;
- Resolving power of 10000 with 50% transmission;
- 300 ppb abundance sensitivity at  $^{254}\text{UO}$ ;
- Elegantly simple Matsuda ion optics: just three main secondary optical elements – the electrostatic analyser, the quadrupole lens and the electromagnet. This design offers unrivalled ease of tuning, which in combination with the state of the art, fibre-optic networked electronics, confers stable operating conditions not only over the course of an analytical session but over many months of continuous operation;
- Easy operation: the simplicity of the design and the LabVIEW® based intuitive software enables even novice users to be trained in a matter of hours to utilise the unparalleled capabilities of this quality instrument. Self-jigging lenses and built-in serviceability ensure minimum downtime during servicing.
- Multiple Samples: hold up to four samples can be stored in the high vacuum air lock. The sample chamber can hold up to two sample mounts during analysis. Interchanging these samples is performed under computer control – quick, easy and with no loss of vacuum;

- Remote Operation.  
The **SHRIMP IIe** can be run remotely over a web link, allowing remote tuning, maintenance and analysis;

- Automation.  
The optional automation package allows measurement on user-selectable sample positions on a full set of samples under automatic control. The user can select criteria such as minimum age, and only perform detailed analysis on samples selected from initial analysis.

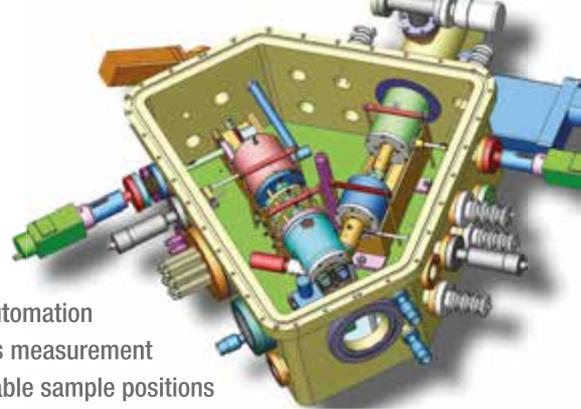
## Reliability

**SHRIMP IIe** has been designed to work, and stay working! Our engineers design reliability into every instrument. Simplicity, accessibility, robust design and careful choice of components ensure minimum downtime. For users with a heavy workload and deadlines to meet, **SHRIMP IIe** is the only choice.

## Rapid Commissioning

Every **SHRIMP IIe** is installed by a team of ASI engineers with many years experience. New users are amazed when they see just how quickly and efficiently the instrument is installed and commissioned. Within 7 days of delivery the instrument is reassembled. Typically, full operating specifications are achieved within 6 weeks.

**'Six Weeks, crates to dates!'**



# SHRIMP II

## Specifications

### Primary Ion Source

The **SHRIMP IIe** is equipped with a Duoplasmatron. Ion species ( $O^-$ ,  $O_2^-$ ,  $O^+$ ) are selectable via a Wien mass filter (resolution of approximately 30). The primary ion probe diameter can be set from less than 5 microns to 30 microns.

### Sample lock, sample changer and stage

Four 25mm (standard) or 35mm (MegaMount) samples can be stored under vacuum in the air lock, and two samples in the source chamber, for analysis. Sample mount exchange is computer controlled.

### Viewing Systems

Optical viewing is continuous during analysis using a high resolution CCD video camera and colour display. The magnification is selectable between x300 and x900, with associated field of view from 0.9 x 0.9 mm to 0.3 x 0.3 mm.

### Secondary Ion Extraction

Extraction of either positive or negative secondary ions is possible, transferred to the source slit by a quadrupole triplet lens. The secondary extraction for positive or negative secondary ions is about 750 V, minimising sample surface effects, after which the ions are accelerated to 10 kV.

### Secondary Mass Analyser

This comprises an electrostatic sector, a quadrupole matching lens and an electromagnet. This combination and design gives small values for all second order image aberrations. The energy window is adjustable under computer control by up to  $\pm 50V$ . A computer controlled monitor for the total transmitted secondary beam current is located between the energy slit and the quadrupole matching lens. The highest mass collected for 10 kV ions is approximately 350.

### Advanced Multi-Collector

The flexible Advanced Multi-collector (AMC) has one fixed and four moving heads. Each moving head can be configured with continuous electron multiplier or Faraday cup. The central fixed head has provision for a Faraday cup, or discrete dynode multiplier and retardation lens, for conventional Pb/U geochronology. The moving heads provide separation from 1 AMU at mass 65 to a maximum separation of 1 in 6 AMU (Li).

### Training and Support

Comprehensive training in instrument operation and maintenance is provided with every instrument. The training takes place in Canberra during final testing, and on-site after commissioning. All purchasers gain access to world class applications support from the Australian National University's Research School of Earth Sciences. The standard one year warranty can be extended and Service Contracts are available if desired.

### Running Costs

**SHRIMP IIe** is designed to offer low downtime, easy maintenance, trouble free operation and low cost per analysis.

## Options

- Multi-collector. An advanced multicollector with a 3-channel central array and 2 independent moving heads. The central array has adjustable 1 AMU separation for masses 180-208 while the moving heads provide separation from 2 AMU at mass 207 to a maximum separation of 1 in 8 AMU. Both Faraday cup and continuous dynode electron multiplier detectors can be used. Head separation and slit selection can be done without breaking vacuum.
- Caesium source and charge neutralisation system for negative secondary ion analysis.
- Automation: The **SHRIMP IIe** can automatically load and orient a sample holder, and automatically perform analyses on user-defined locations on the sample. The software uses a digital image of the sample to define the positions.