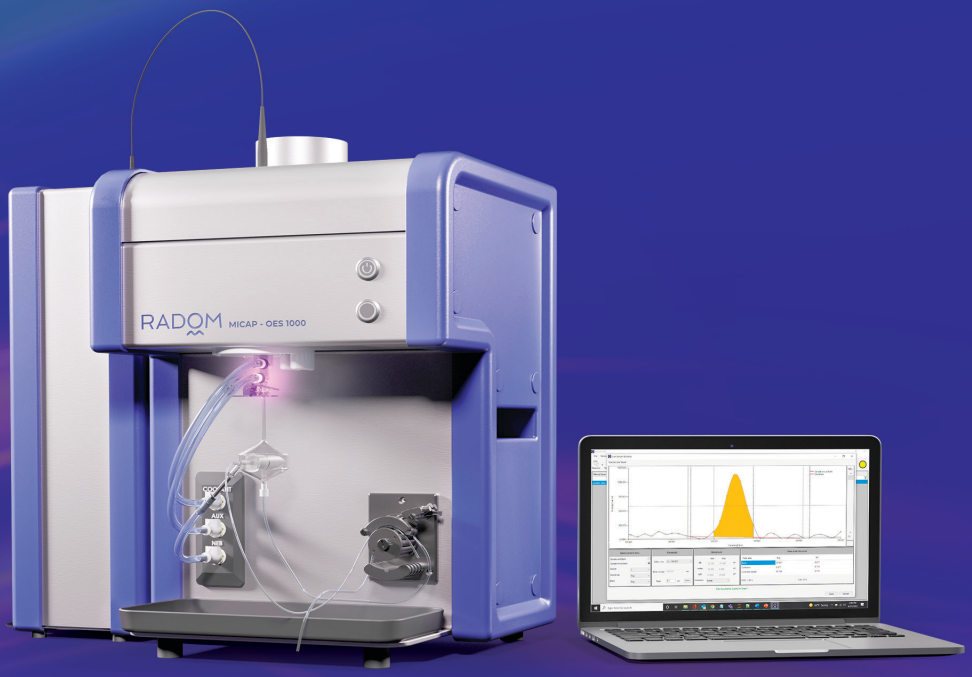
RADOM™
INSTRUMENTS

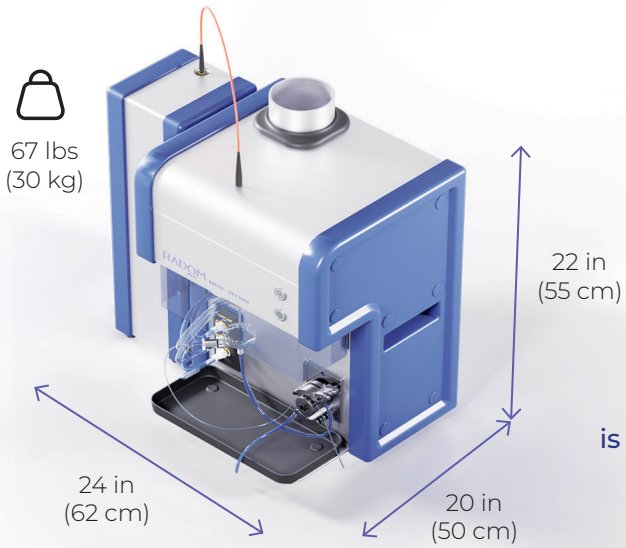
MICAP - OES 1000

Microwave Inductively Coupled Atmospheric Plasma Optical Emission Spectrometer



POWERED BY CERAWAVE™

- Lowest Operating Cost
- Simultaneous Measurement
- Robust N_2 ICP with Cerawave™
- Smallest Laboratory Footprint



MICAP-OES 1000
is a compact easy-to-use and install instrument.

Figure 1: MICAP-OES 1000 Dimensions. Small, light-weight design made possible by Cerawave

Radom Instruments developed the solution for onsite instrumentation with Microwave Inductively Coupled Atmospheric Plasma – Optical Emission Spectrometer with 1000W power. This innovative nitrogen-based plasma atomic spectroscopy instrument replaces the traditional argon generated plasma technology.

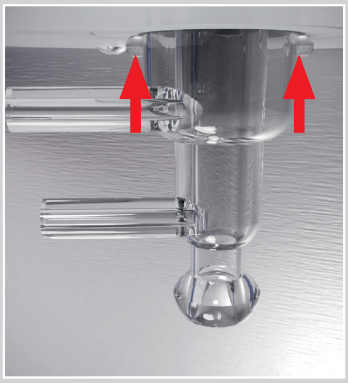
MICAP-OES 1000 uses highly efficient Cerawave technology which eliminates the electric water-cooled coil found in commercially available ICP-OES instruments today. Cerawave does not need water or air cooling and nitrogen is less expensive than argon. The power of Cerawave technology, coupled with a high-resolution echelle polychromator with CMOS detector, provides simultaneous measurement of elements in the prepared sample. The ability to screen core samples on location means results can be determined more quickly. An added benefit is the ability to collect more samples in an area to create a comprehensive map of the potential yield.

Table 1. Sample Introduction Area (SIA)

Autosampler	Teledyne Cetac Technologies ASX-560
Sample Tubing	Black/black PVC 0.76 mm ID
Drain Tubing	Yellow/blue PVC 1.52 mm ID
Nebulizer	Low-flow quartz nebulizer 1.0 mL/min
Spray chamber	Single pass cyclonic
Torch	20 mm quartz torch with 1.5 mm injector

The axial plasma view is made reproducible by the automatic plasma tail removal system that is comprised of the torch installation guide and alignment peg system.

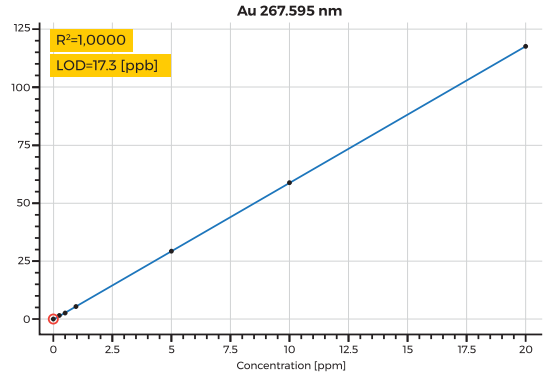
1. Torch guide



2. Torch alignment pegs

3. Completed assembly

Figure 2: Torch installation assembly



Typical calibration curve for gold (wavelength 267.595 nm) standardized from 0.025 ppm to 20 ppm displays the correlation coefficient as R2 and the calculated LOD.

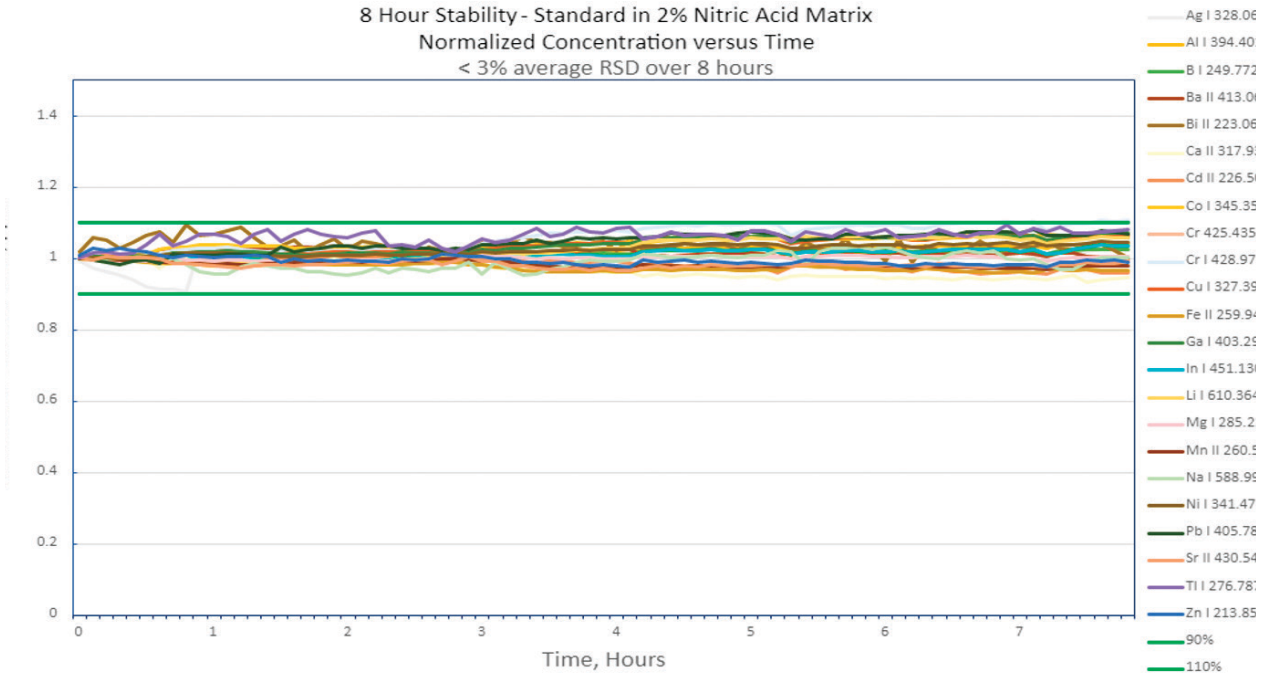
Results and Discussion

The CRM ID listed in the Table 2 summary provides certified results for gold based on statistical results submitted from participating laboratories. The certificate provides gold certification with preparation of ore by Pb (lead) fire assay, 4-acid digestion, aqua regia and cyanide leach. The study performed with MICAP-OES 1000 was aqua regia preparation only. According to the certificates, the aqua regia digestion participants use ICP-OES, ICP-MS and AAS to report the gold values in the ore.

The CRMs were prepared in duplicate and no additional dilution was required from the digested preparation of 2g to 50mL.

Table 2. OREAS CRM Results for Gold in Aqua Regia Digestions

Analyte	Wavelength	CRM ID	Certified Value	Preparation 1	Preparation 2	Dilution	Recovery1	Recovery2
Au, ppm	267.595	238	2.95	2.99	2.84	1x	101%	96%
		242	8.33	6.95	7.28	1x	83%	87%
		255b	4.08	3.82	3.77	1x	94%	92%
		256b	7.58	7.61	7.13	1x	100%	94%
		257b	14.17	14.55	15.42	1x	103%	109%



MICAP-OES

vs. ICP-OES

NEW POSSIBILITIES

- Powered by proprietary Cerawave technology
- Smallest and lightest instrument on the market
- Easy set up (box-to-bench in less than one hour!)
- Works with local nitrogen generation
- Lower service maintenance
- Higher operational efficiency
- Lower ownership cost (pays for itself in less than 3 years!)
- Lower carbon footprint

It's better for your lab and for the environment!

SERVICE MAINTENANCE ADVANTAGE

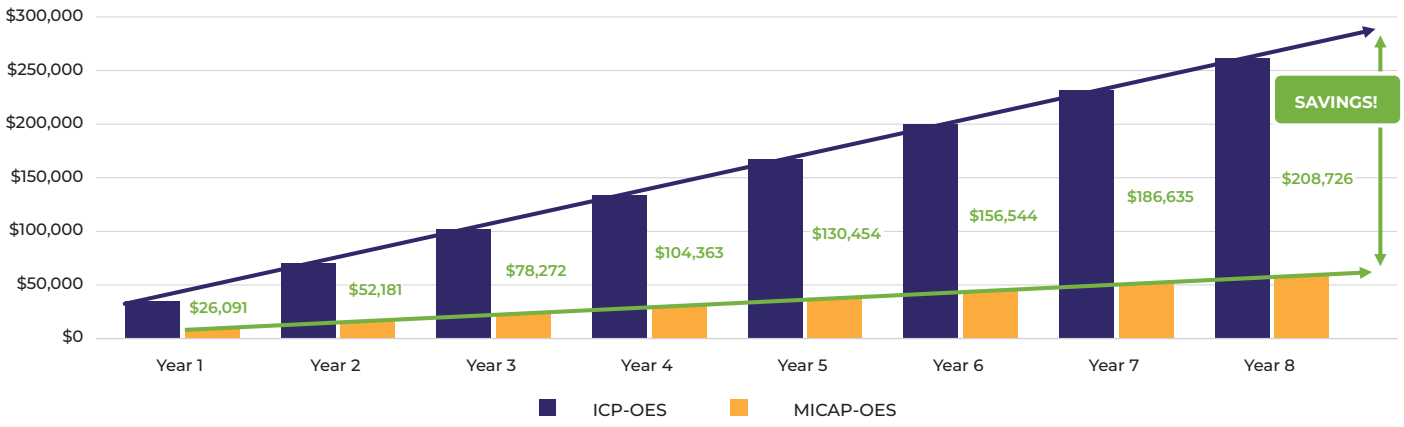
- No maintenance required for RF generators/coils, detector or optical alignment, chiller malfunction (overheating or not in well-ventilated area) – MICAP does not have these!
- Simple, easy maintenance by end-user of peristaltic pump and fiber optic connection – no more waiting for service engineers!
- 2 year warranty vs. typical 1 year warranty
- Service Package -1st year includes user replaceable components (peristaltic pump, fiber optic cable, collimator, and second Starter Kit)

ANNUAL OWNERSHIP COST

	ICP-OES	MICAP-OES
Year 1	$109,836	$82,067
Year 2	$33,336	$7,067
Year 3	$33,336	$7,067
Total cost:	**$176,508**	**$96,200**
	Cost savings:	**$80,308**

3-year total cumulative cost savings of $80,308 over traditional ICP-OES!

CUMULATIVE COST SAVINGS



Total cumulative cost savings of $208,726 over argon-based ICP-OES!

MICAP-OES 1000 saves 1,256 Metric tons of CO_2e over 8 years. It has the lowest carbon foot-print of any OES instrument in the market!

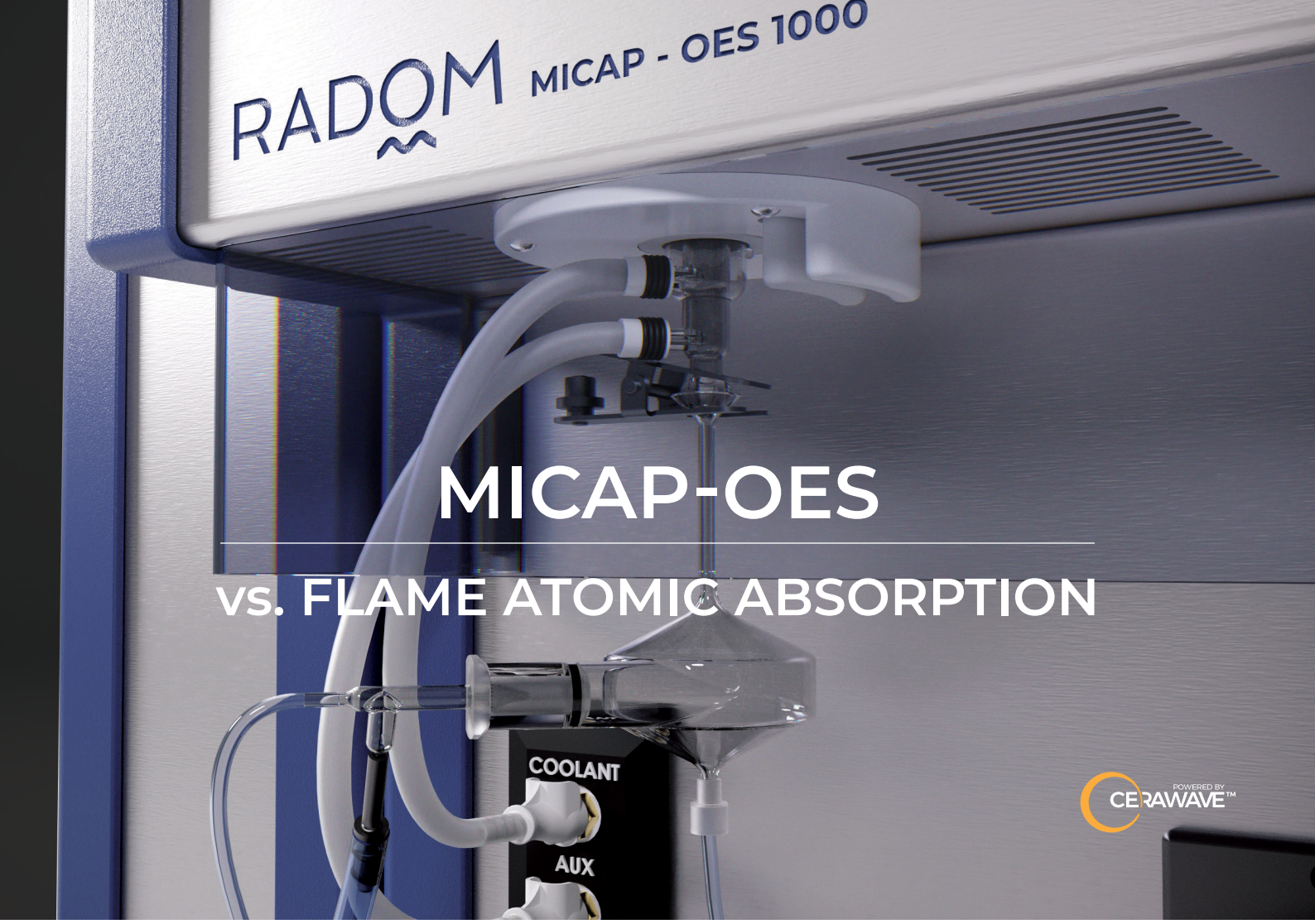
LIFETIME CO_2e EMISSIONS SAVINGS COMPARED TO ARGON-BASED INSTRUMENTS

kWh saved	1,772,540
Metric tons of CO_2e saved*	1,256

Equivalent to:

Homes' annual electricity use	244
Gasoline-powered passenger vehicles	280
Total gallons of gasoline consumed	141,357
Total smartphones charged	152,812,225

*Based on 8-year useful-life. Source: EPA.GOV (https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator.)



MICAP-OES

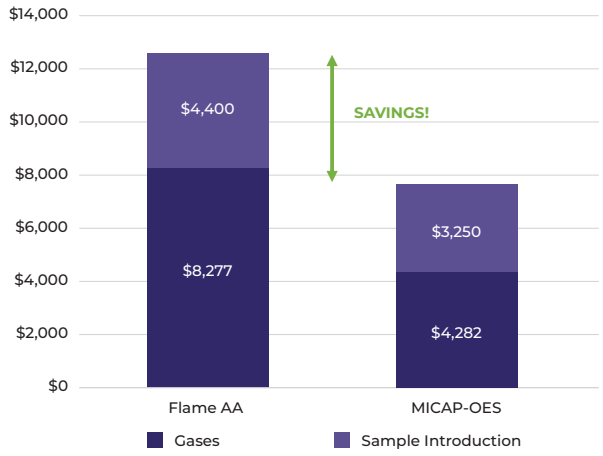
vs. FLAME ATOMIC ABSORPTION

FASTER AND SIMPLER ANALYSIS

- Safer - eliminates the need for combustible gases and potential for flashback
- No optimization of fuel/oxidant ratios, burner height or rotation which can be subjective to individual users
- Simultaneous elemental measurements in less than 3 minutes/sample (3 replicates)
- Full wavelength spectrum analysis and simultaneous measurement
- Library of emission lines for minimization of interferences and result confirmation
- Less sample preparation, less chemistry, and less consumables required

Analysis Time Considerations	Flame AA	MICAP-OES
Number of elements	7	7
Number of solutions	35	35
Time per sample analysis for 3 replicates	40 sec	2.3 minutes
Burner/fuel/lamp optimization and warmup time	30 min	20 min
Time per sample analysis for 3 replicates	20 min	20 min
Preparation time (6 elements)	2 hr	-
Instrument setup/warmup time (6 elements)	3 hr	-
Analysis time (6 elements)	3 hr	2 hr
Total	**8 hr**	**2 hr**

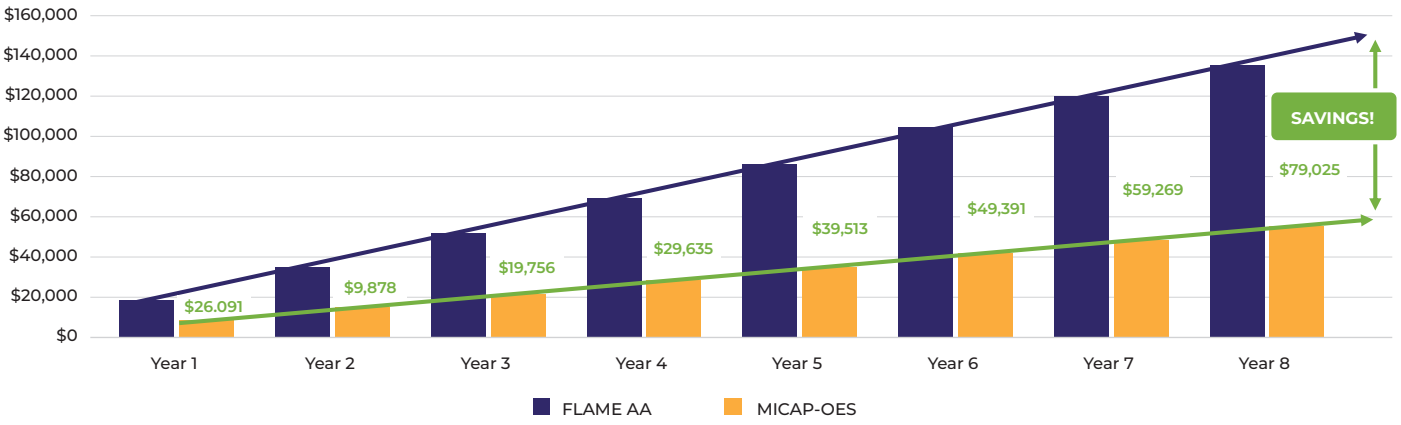
ANNUAL CONSUMABLE COST COMPARISON



MICAP-OES 1000 is 4x faster than Flame AA!

MICAP-OES 1000 saves $5,100 per year on consumables!

CUMULATIVE COST SAVINGS



Total cumulative cost savings of $79,025 over traditional Flame AA!

> *MICAP-OES is a logical replacement to the many AA systems, existing MP-AES systems and even many ICP-OES systems in harsh mining environments.*
>
> *– Major Gold Mining Company User, US*

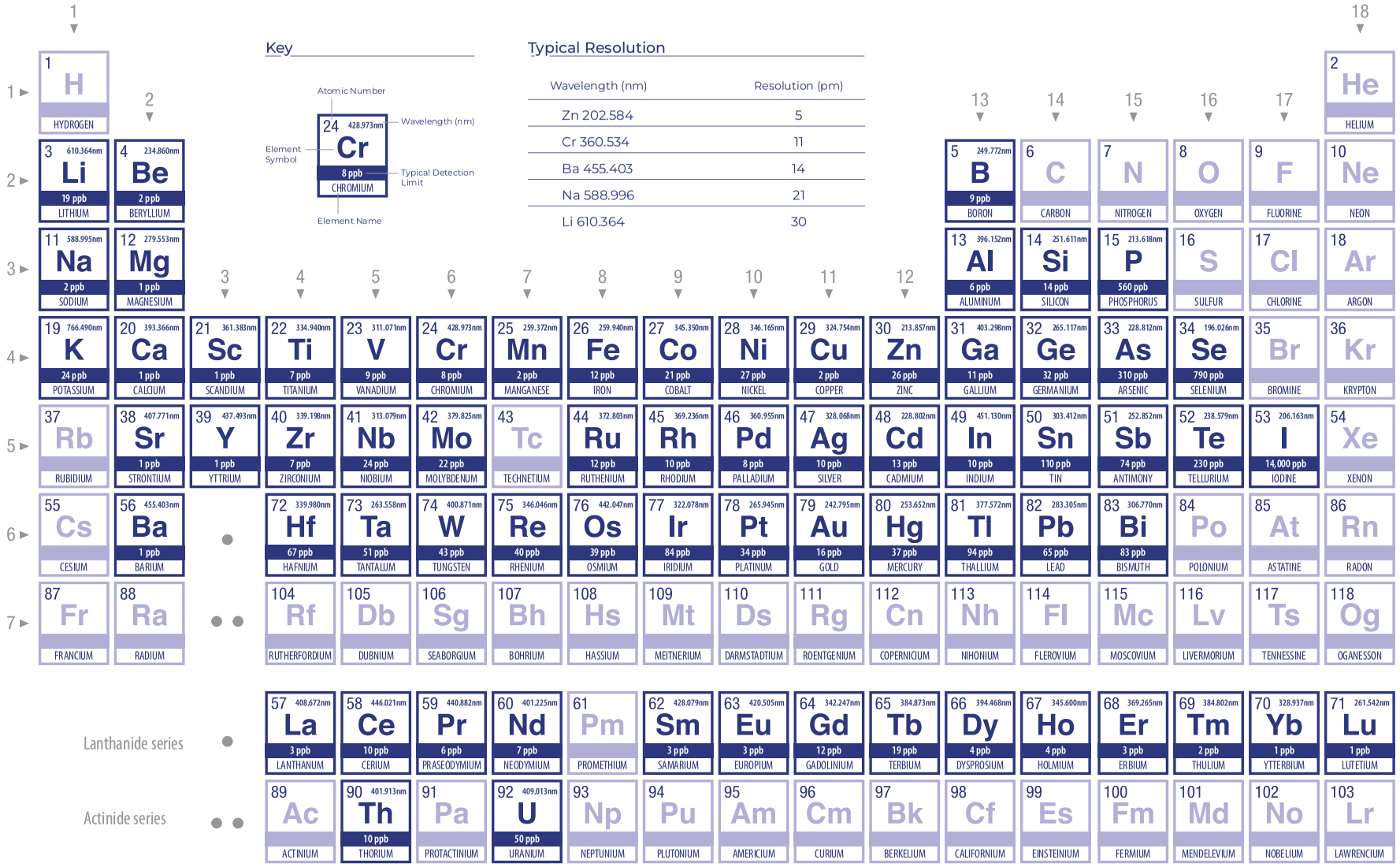
> *I can see the MICAP-OES system used on oil platforms.*
>
> *– Danish Offshore Technology Centre*

> *Cerawave improves plasma robustness ... improves detection capabilities.*
>
> *– Alicante University, Spain*

> *Laser ablation on the front of this OES instrument is likely a good solution for mine solid sampling in the field.*
>
> *– University of Gothenburg, Sweden*

MICAP - OES 1000

Typical Limit of Detection and Resolution



Detection limits are averaged from multiple systems.
Values are calculated from 3x the standard deviation of 10 measurements of a blank; each with three, 30 second replicates.

Scan the code to access our website for additional information and our resources

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This information is subject to change without notice.

For any questions or additional resources:

inquiries@radomcorp.com or call 877-977-2366

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