



● Thermo Scientific Niton XRF Analyzers
The Laboratory in the Field



Agenda

- Evolution of Portable XRF
- Why Portable XRF
- Markets
 - Environmental
 - Mining
 - Scrap
 - PMI
 - Precious Metal
 - RoHS / WEEE
 - Consumer Product
 - Academia

Why Portable XRF

- Increasingly the lab is moving to the field
- Deliver traditional laboratory testing
 - Palm of the operator
 - Low cost and reliable
 - Minimal sample preparation
 - Purpose built for harsh environments



- Real time results
 - Improves decision making & productivity
 - Saves time & money
- Eliminate delays associated with analytical turnaround time
- Measure more samples – statistical improvements
- Compliance with regulations
 - Reduce risk of recalls and civil penalties
- 30,000 analyzers used Worldwide

Evolution of Portable XRF

- Since late 1960s, XRF has evolved through 7 generations; each generation has added new capabilities
 - Smaller
 - Faster
 - Better performance
 - Easier to use
- Today, nearly all alloys can be tested with these powerful tools



Thermo Scientific Niton Analyzers – A Family Revolution

- 1994 – Niton® XL-300 Analyzer
 - Introduced for lead-paint analysis
- 2002 – Niton XLt Series
 - First mass produced x-ray tube-based handheld XRF analyzer
- 2007 – Niton XL3 Series
 - Integrated tilting color touch-screen display; customizable menus; optional camera & small spot
- 2008 – Niton XL3t GOLDD™ Series
 - Up to 10X faster testing times than conventional technologies; up to 3X more precise; light element detection (Mg-S)
- 2009 – Niton XL2 Series
 - Value choice – fast, accurate, lightweight, rugged
- 2010 – Niton XL2 GOLDD, Niton XL3t GOLDD+
 - Exceptional accuracy, precision & ease of use; superior light element detection (Mg-S)
- 2011 – Niton FXL Field X-ray Lab
 - Compact, portable unit with our highest performance, lowest LODs; operate virtually anywhere on site



A Feature-rich Family

- Easy to use, exceptionally fast
- Ergonomic design
- Lightweight
- Customizable menus; easy-to-read, icon-driven, color, touch-screen display
- Long battery life
- Multi-language support
- Standard analysis range of more than 25 elements (Mg to U)
- Nondestructive test
- Moisture-proof, dust-proof
- Bluetooth wireless, USB communications
- Password-protected user security



*Niton XL3t
GOLDD+*



Niton XL3t



*Niton XL2
GOLDD*



Niton XL2



FXL

One Tool, Many Industries

Alloys



Scrap metal recycling, PMI, quality control in production, Fabrication and manufacturing

Environmental

Based on US EPA Method 200,FPXRF has become the standard for on-site screening of organics in soils



Consumer Product

Solder, components, PCBs and finished goods are all gating points for RoHS compliance and Hi-Rel screening programs



Toys

Rapid screening of toys for lead and other heavy metals

Mining

Greenfield exploration, drilling programs and ore grade assessment require timely, accurate data for operations



Also: Archaeometry, Forensics, and many more...

Environmental Market

- In-Situ, measure direct to the soil for fast screening
 - Clay
 - Loam
 - Sand
- Comply with ISO/CD 13196 soil screening by portable ED-XRF
- EPA 6200 in USA
 - Run control standards
- Ex Situ
 - Dry
 - Grind
 - Sieve
 - Sample cup



Typical Environmental Elements Analysed

Thermo SCIENTIFIC										www.thermo.com/niton							
<p>Key to Energy Values</p> <p>Ag 47</p>										<p>NITON Analyzers HQ Billerica, MA U.S.A. Phone: +1 978 670-7460 Toll Free: 800 875-1578 (USA) Fax: +1 978 670-7430 E-mail: niton@thermofisher.com</p> <p>NITON Analyzers Europe Munich, Germany Phone: +49 89 3681 380 Fax: +49 89 3681 3830 E-mail: niton.eur@thermofisher.com</p> <p>NITON Analyzers Asia Central, Hong Kong Phone: +852 2369 6669 Fax: +852 2369 6665 E-mail: niton.asia@thermofisher.com</p>							
X-Ray Energy Reference																	
H Hydrogen 1	Li Lithium 3	Be Beryllium 4	Na Sodium 11	Mg Magnesium 12	Al Aluminum 13	Si Silicon 14	P Phosphorus 15	S Sulfur 16	Cl Chlorine 17	Ar Argon 18	B Boron 5	C Carbon 6	N Nitrogen 7	O Oxygen 8	F Fluorine 9	Ne Neon 10	He Helium 2
K Potassium 19	Ca Calcium 20	Sc Scandium 21	Ti Titanium 22	V Vanadium 23	Cr Chromium 24	Mn Manganese 25	Fe Iron 26	Co Cobalt 27	Ni Nickel 28	Cu Copper 29	Zn Zinc 30	Ga Gallium 31	Ge Germanium 32	As Arsenic 33	Se Selenium 34	Br Bromine 35	Kr Krypton 36
Rb Rubidium 37	Sr Strontium 38	Y Yttrium 39	Zr Zirconium 40	Nb Niobium 41	Mo Molybdenum 42	Tc Technetium 43	Ru Ruthenium 44	Rh Rhodium 45	Pd Palladium 46	Ag Silver 47	Cd Cadmium 48	In Indium 49	Sn Tin 50	Sb Antimony 51	Te Tellurium 52	I Iodine 53	Xe Xenon 54
Cs Cesium 55	Ba Barium 56	Hf Hafnium 72	Ta Tantalum 73	W Tungsten 74	Re Rhenium 75	Os Osmium 76	Ir Iridium 77	Pt Platinum 78	Au Gold 79	Hg Mercury 80	Tl Thallium 81	Pb Lead 82	Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86	
Fr Francium 87	Ra Radium 88	La Lanthanum 57	Ce Cerium 58	Pr Praseodymium 59	Nd Neodymium 60	Pm Promethium 61	Sm Samarium 62	Eu Europium 63	Gd Gadolinium 64	Tb Terbium 65	Dy Dysprosium 66	Ho Holmium 67	Er Erbium 68	Tm Thulium 69	Yb Ytterbium 70	Lu Lutetium 71	
Ac Actinium 89	Th Thorium 90	Pa Protactinium 91	U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103			

RCRA

Non-RCRA

Mining and Mineral Exploration Markets

- Ba
- er
- Pr
- efi

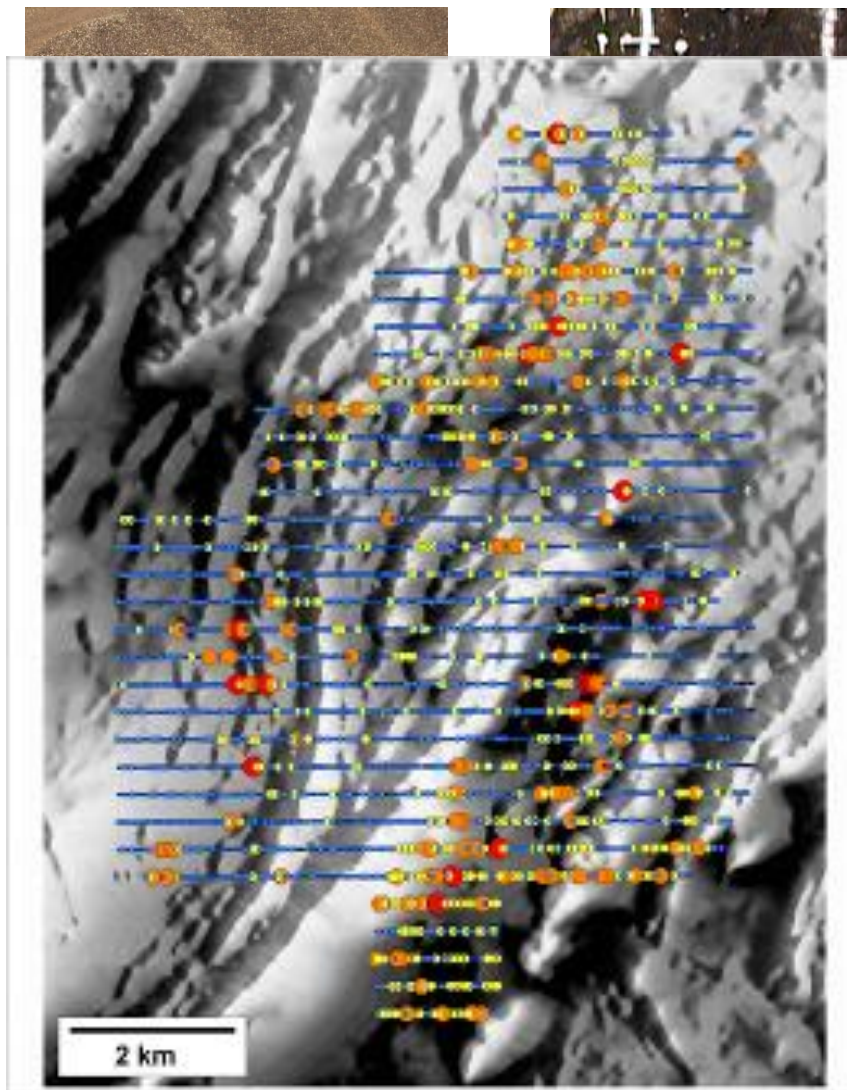


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- Improved sample turnaround time
- GIS field mapping for Exploration
 - Plot geochemical data on maps in real time
 - Reach infill and step-out decisions instantly
 - Make more informed decisions while saving significant time and labor costs



Mining Customers Around the World

- Thermo Scientific Niton XRF analyzers are providing answers to mining companies around the world.
 - Anglo American
 - African Consolidated Resources
 - Barrick Gold
 - Bell Copper
 - CODELCO Exploraciones
 - Colorado Goldfields
 - CVRD
 - Grupo Mexico
 - Rio Tinto Mining & Exploration
 - Store Norske Gull

Metal Recyclers Need Handheld XRF Analyzers

- **Applications**

- Take the instrument to Buys
- Check incoming or Stored Scrap
- Convert Turnings into Profits

- Analyse and separate

- Stainless and specialty steels
- Ni and Ni/Co alloys
- Cobalt alloys
- Titanium alloys
- Tool steels
- Copper alloys
- Aluminum alloys



PMI

- Typical markets
 - Refineries
 - Power Plants
 - Producers/fabricators
 - Aerospace
- Rapid grade identification – unique library of 400+ alloy grades
 - Incoming QA/QC
 - Inventory Management & Recovery
 - Outgoing QA/QC
 - In process material identification
 - Routine inspections
 - Maintenance and fabrication related material identification



New Alloy Applications Resulting from SDD (He Purge)

Opens up alloy testing and analysis applications that previously required OES or laboratory XRF spectrometers

- Al in Titanium Alloys
- Al and Si in Al/Si Bronzes
- Mg, Si and Al in Aluminum Alloys
- Al and Si in Super Alloys and High Alloy Steels
- High Si in Cast Steels
- Al in Zinc (Zn) alloys
- Mg alloys



Cautionary Items

- Plating
- Residual paint
- Read-through (thin foils)
- Corrosion, oxide layer
- Metallic dust on surface
- Turnings / powders - mixed alloys
- Shot-blasting (residual from pellets on surface)



Precious Metal

- Gold Jewelry comes in a large variety of alloys – literally 100's. The most common are
 - Yellow gold (Au/Ag/Cu)
 - White gold (Au/Pd/Ag or Au/Ni/Cu/Zn)
- Other less common gold alloys
 - Rose, red and pink gold (Au/Cu & maybe Zn or Ag)
 - Green gold (Au/Ag and sometimes Cd & Cu)
 - Spangold (Au/Cu/Al – heat treatment provides a fine surface texture)
 - Grey gold (Au/Ag/Mn/Cu)
 - Purple gold (Au/Al): brittle, typically used for decorative inlay
 - Blue gold (Au + In or Ga) brittle, typically used for decorative inlays or plating
 - Black gold (surface treated creating brown-black color)



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RoHS – WEEE Testing

- Manufactures are required eliminate toxic heavy metals and other restricted materials from consumer products
- Driven by voluntary compliance with European Parliament and Council's RoHS (7/1/2006) Directive; other potential market drivers: pending RoHS regulations in China and European end of vehicle life (7/1/2003) and WEEE (8/13/2005) Directives

➤ Cadmium (Cd)	100 mg/kg
➤ Mercury (Hg)	1,000 mg/kg
➤ Lead (Pb)	1,000 mg/kg
➤ Hexavalent chromium (Cr ₆)	1,000 mg/kg
➤ Polybrominated Biphenyls	1,000 mg/kg
➤ Polybrominated Diphenyl Ethers	1,000 mg/kg

- Niton 700 Series Analyzers

Equipment Covered by the RoHS Directive

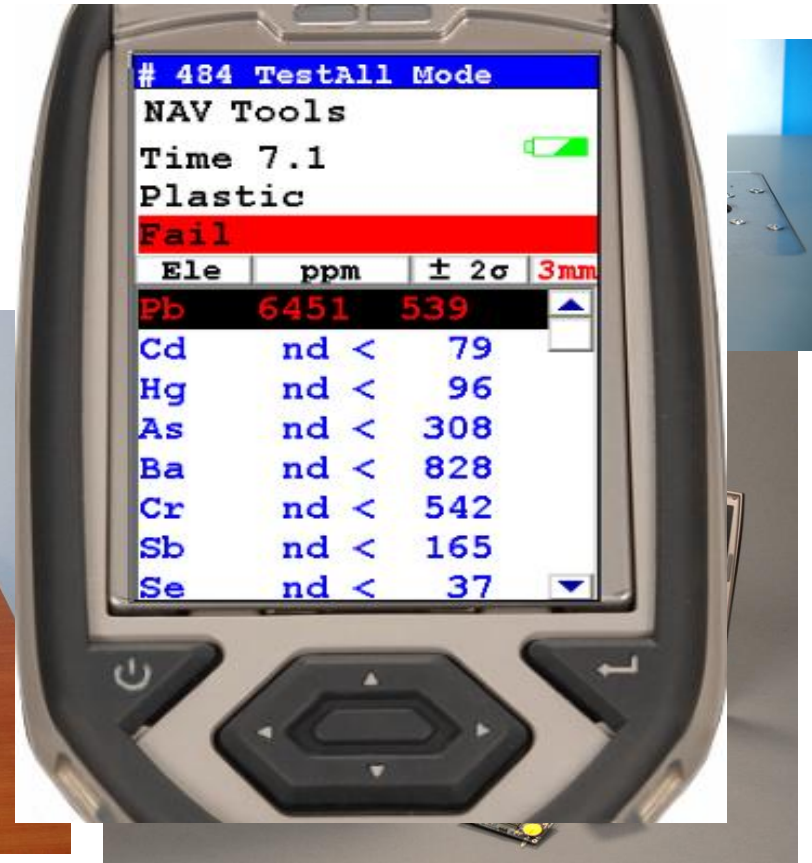
- Large household appliances
- Small household appliances
- IT and telecommunications equipment
- Consumer equipment
- Lighting equipment
- Electrical and electronic tools (large-scale industrial tools exempt)
- Toys, leisure and sports equipment
- Medical devices with the exception of all implanted and infected products (Category 8 devices exempt)
- Monitoring and control instruments (Category 9 devices exempt)
- Automatic dispensers



TOYS / Consumer Goods Screening



Large, extended objects



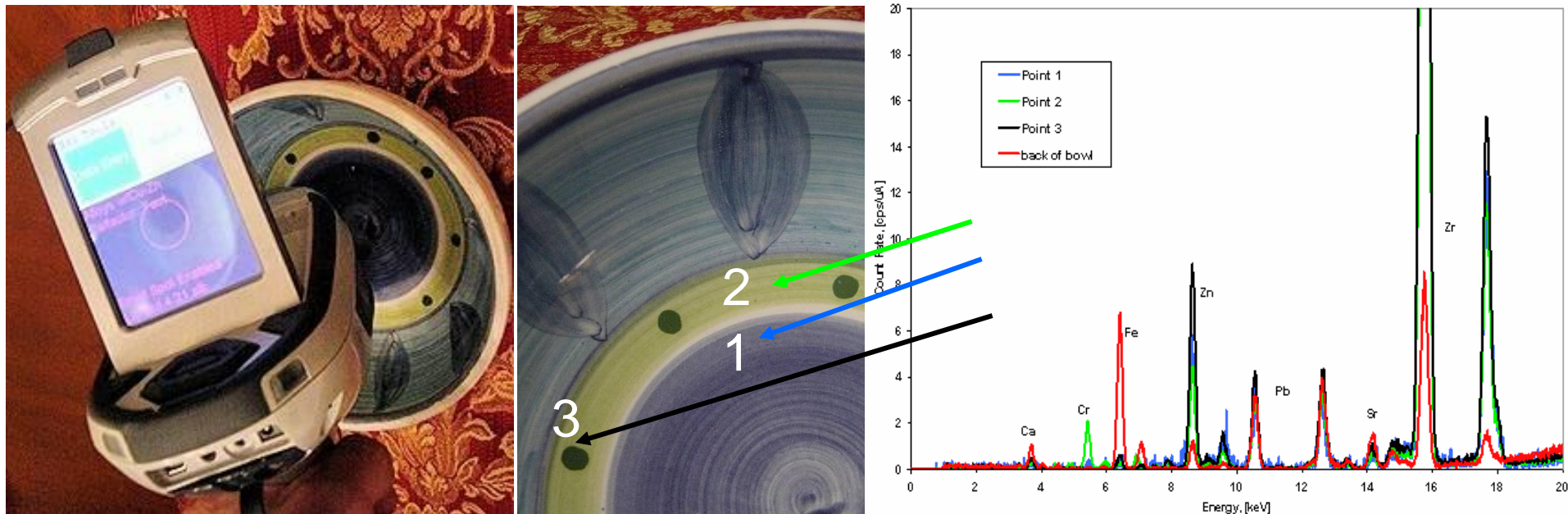
Irregular shape and small objects

Archaeometry, Museum Artifacts

- Testing paintings “The Scream” and “Madonna” by Edvard Munch at the University in Oslo
 - Restoration
 - Conservation
 - Authentication/Forgery



Archaeometry, Museum Artifacts

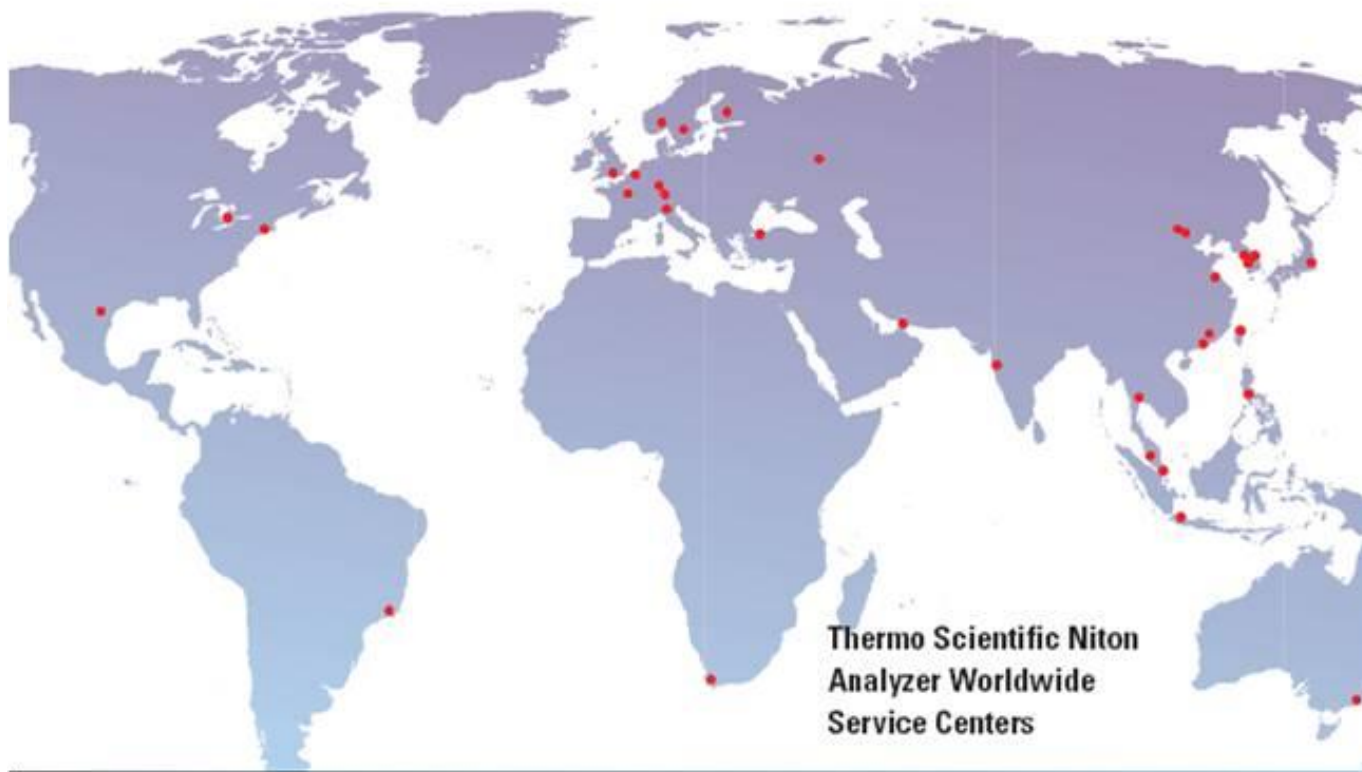


Summary

- Large installed base
- Take the analyzer to the field
- Designed for harsh environments
- Quantitative results
- Flexible sample types
- Real time information
 - Improves decision making & productivity
 - Saves time & money
- Measure more samples – statistical improvements
- Compliance with regulations

Worldwide Service and Support

More than 30,000 Thermo Scientific Niton XRF analyzers are in use daily in more than 75 countries on six continents



A dedicated network of more than 70 distributors and 30 factory-trained service centers around the world