

CROSS SECTION



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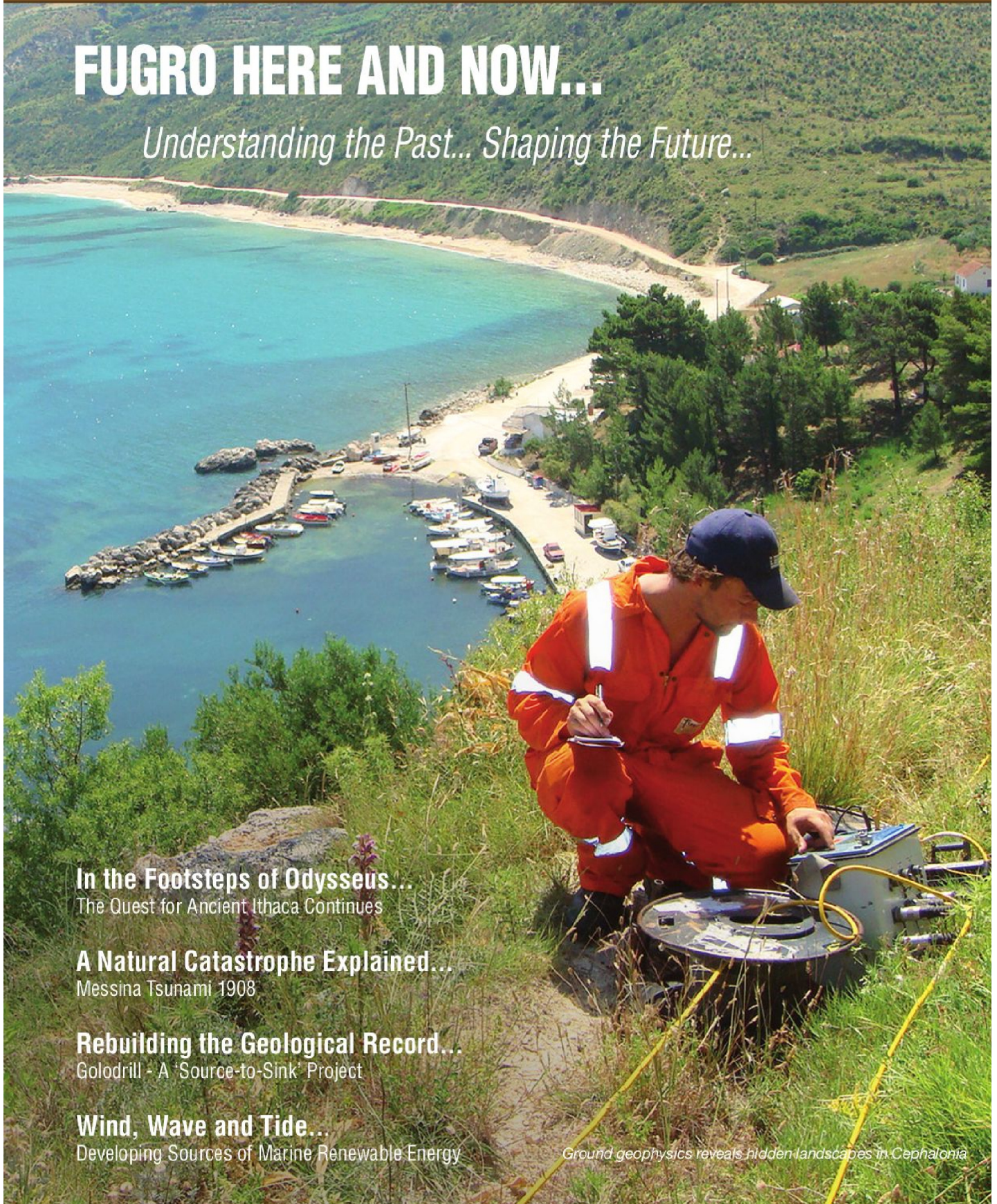
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HUNT FOR HEAVY METAL

NON-INTRUSIVE GROUND INVESTIGATION TECHNIQUES MAP CONCENTRATIONS OF ZINC SLAG

From the mid 19th century, zinc production dominated De Kempen, on the Belgian-Dutch border. Just two working foundries remain, but zinc smelting has left its mark on the environment. Fugro techniques have helped identify concentrations of foundry waste, containing potentially harmful contaminants.

Until around 1975, zinc slag by-products were typically used in local road construction in the area of De Kempen. The distribution of zinc slag is variable and largely undocumented, but desk studies suggest that up to 1,340 linear kilometres of road pavement could be affected. Because of concerns that leaching might cause heavy metal contamination in the soil, De Kempen's environmental agency, ABdK, decided to map the distribution and volume of the zinc waste to prioritise whatever remedial work might be necessary.

Trials of Non-intrusive Survey Methods



Fugro AperiO survey system on site in De Kempen

Traditional investigation methods involve coring into the pavement material to determine its composition, then interpolating between boreholes to map the distribution of any contaminants. ABdK were keen to

explore alternative options and, in 2007, invited tenders for pilot investigations employing less expensive and less time consuming non-intrusive methods. Two contracts were awarded - one to Medusa Explorations, promoting a radiometric solution, and a second to Fugro AperiO, offering a combination of GPR (ground penetrating radar) and ground conductivity techniques.

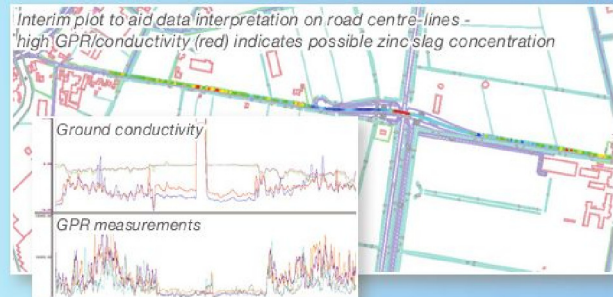
In isolation, the three non-intrusive techniques provide a useful, but often fragmented or incomplete, subsurface picture. However the pilot project showed that, in combination, radiometry, GPR and ground conductivity measurements, were capable of building a robust, detailed and almost seamless map of the zinc slag deposits. Following a competitive tender, Fugro and Medusa were jointly awarded a contract to survey an initial 750 kilometres of De Kempen's roads on the Dutch side of the border.

The work involved reconnaissance visits, geophysical surveying, data modelling and delivery of results as



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part of a geographic information system, or GIS. Fugro AperiO coordinated the data acquisition effort, integrating the three survey techniques on board a single vehicle platform capable of collecting data at speeds of 20 kilometres per hour.



Bespoke Data Acquisition System

High resolution ground conductivity data is conventionally collected on foot, using hand-held electromagnetic apparatus deployed at least 2.5 metres away from any metallic objects. For this project, Fugro designed and commissioned a bespoke trailer, made entirely from plastic, to contain the equipment. The survey vehicle was equipped with server grade computers and a data back-up system, plus a dedicated electrical power supply. Fugro employed a forward-facing video camera to aid data analysis and referenced all data to a common positioning framework, using differential GPS augmented by an inertial navigation sensor.

Shaun O'Hagan, head of Fugro's materials testing and geotechnical laboratories in the Netherlands, remarked, "The combination of Fugro AperiO's ground conductivity and GPR techniques with Medusa's radiometrics expertise has produced a highly successful and reliable non-destructive testing solution, capable of determining the presence of zinc slag in De Kempen, quickly,

accurately and with the minimum of disruption to everyday activities in the area". This innovative three-pronged approach offers exciting prospects for investigations of suspected contaminants, in highway and other environments, elsewhere around the globe.

