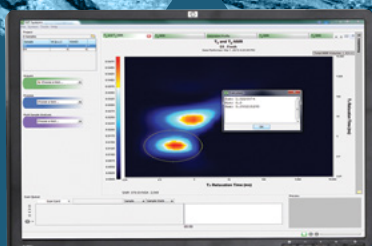
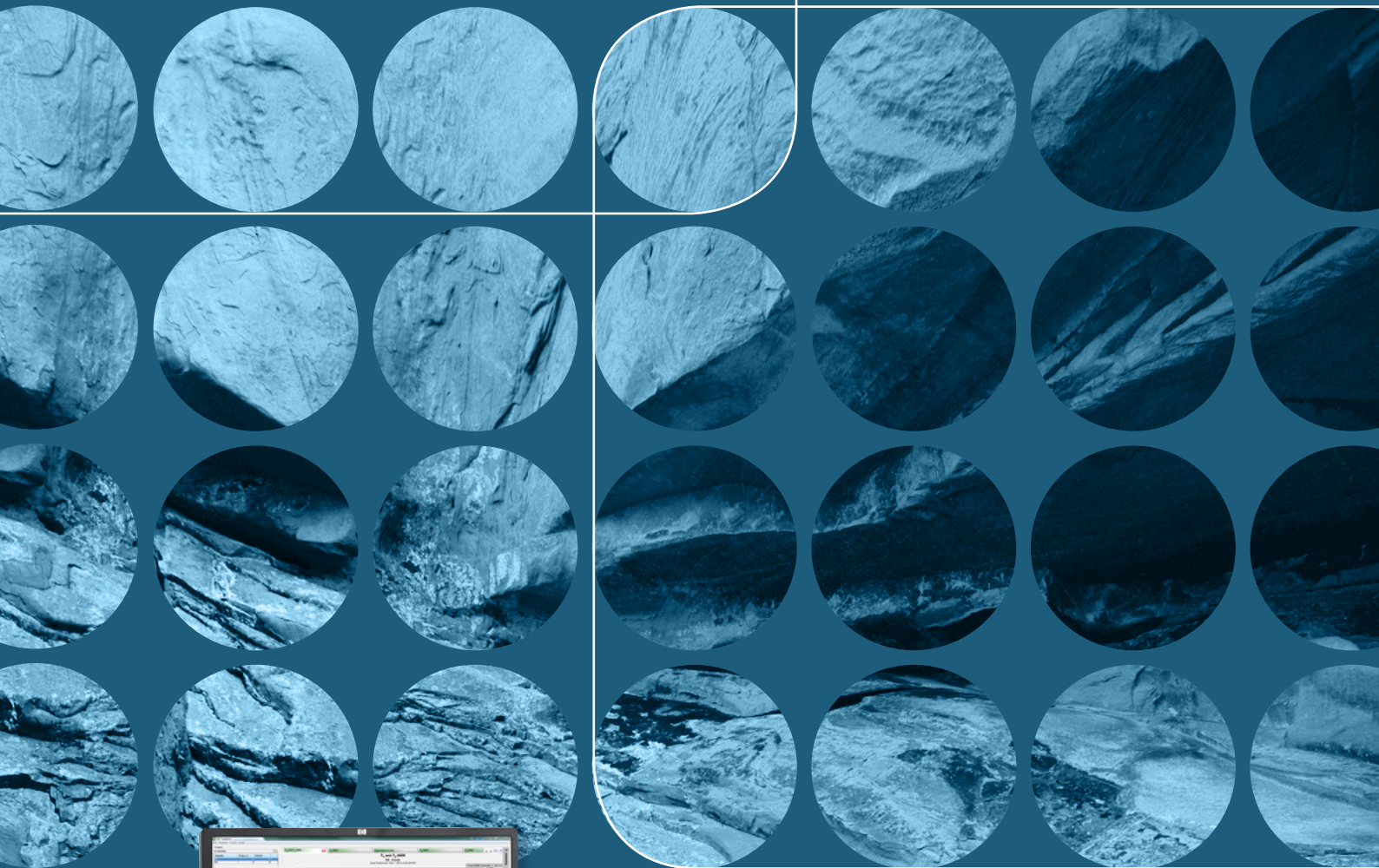


GeoSpec12

NMR core analysis with enhanced sensitivity



The Business of Science®

GeoSpec12

NMR core measurements on shales pose particular problems due to low porosity and small pores. Oxford Instruments' **GeoSpec12** addresses the problem.

Oxford Instruments has been supplying benchtop NMR instruments for core analysis since the early 1990s, when they were introduced to support the development and use of downhole NMR logging tools.

Most models in the **GeoSpec** range operate at an NMR frequency of 2MHz, to emulate downhole tools and also to minimise measurement artefacts caused by the paramagnetic material often found in sandstones. However, in recent years there has been a shift towards oil and gas exploration in shales, which has brought about a reappraisal of the use of NMR for core analysis because of the structural differences in the rock types. Whereas sandstones have typically 15-25% porosity and pore sizes of tens to hundreds of microns, shales are more likely to have 2-15% porosity and pores only a hundredth the size of sandstone pores. From the NMR perspective this means there is much less fluid from which to



obtain an NMR signal, and a need to reach shorter echo times in order to observe the shorter T_2 signals from the smaller pores.

Oxford Instruments first addressed this problem with the introduction of Q-Sense technology to the **GeoSpec** range, to allow shorter echo times and improved signal to noise ratios. Now, we have introduced a new model, **GeoSpec12**, to further improve sensitivity for low porosity materials by offering a higher operating frequency.

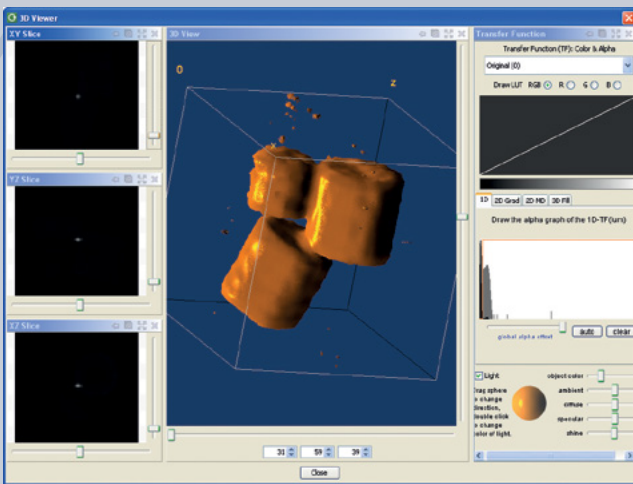
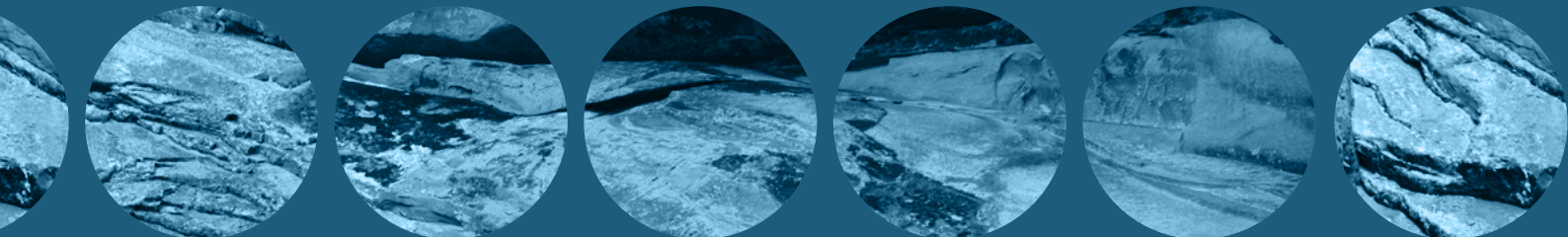


Image of 3 cores

Base specifications

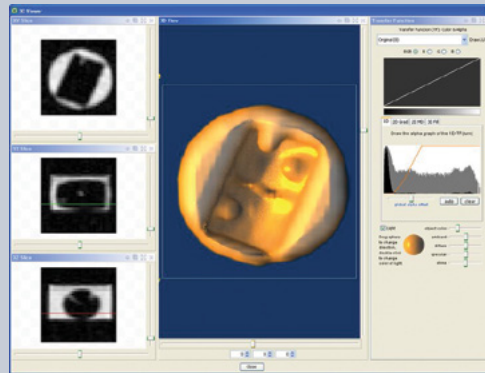
Operating field (frequency)	0.28T (12MHz proton resonance)
Maximum sample diameter	53mm
Gradient strength	>20 gauss/cm on three axes
Minimum tau (43mm probe)	35 μ s



GeoSpec12 operates at 12MHz, which gives improved sensitivity over 2MHz measurements while not being high enough to give significant magnetic susceptibility artefacts, particularly with shale samples. Measurements made at 12MHz show an increase in sensitivity of about 10 times, compared to measurements at 2MHz. This means that comparable signal to noise ratio (SNR) measurements can be made in about one hundredth of the measurement time required at 2MHz.

Green Imaging Technologies **LithoMetrix** software is supplied as standard for routine measurements including porosity, 1D relaxation distributions (T_1 or T_2) and free/bound water determinations. For more advanced users, **GeoSpec12** can be equipped with one- or three-axis pulsed field gradients to permit diffusion based measurements, profiling, and imaging. Corresponding software upgrades are available to **GIT Systems Advanced** for measurement of capillary pressure, gas isotherms,

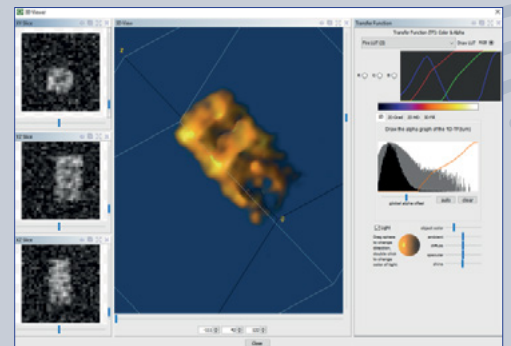
spatially-located T_2 distributions, 2D mapping (T_1 - T_2 and T_2 -diffusion), and 1D profiles, and to **GIT Systems Advanced 3D** for full 3D imaging. The superb



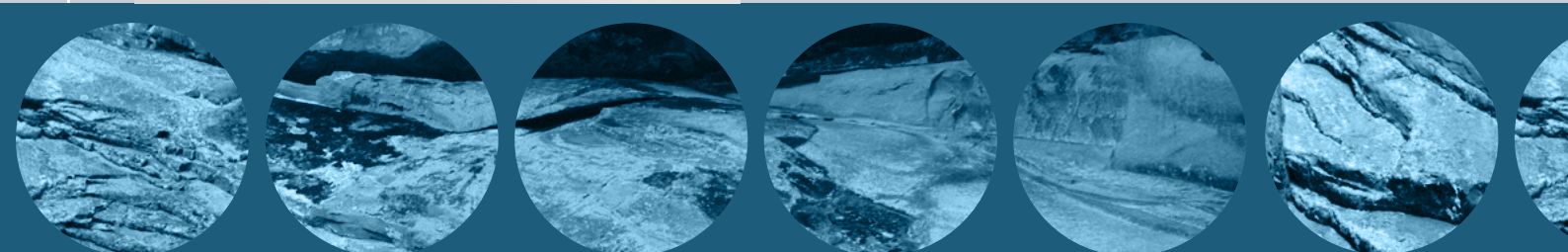
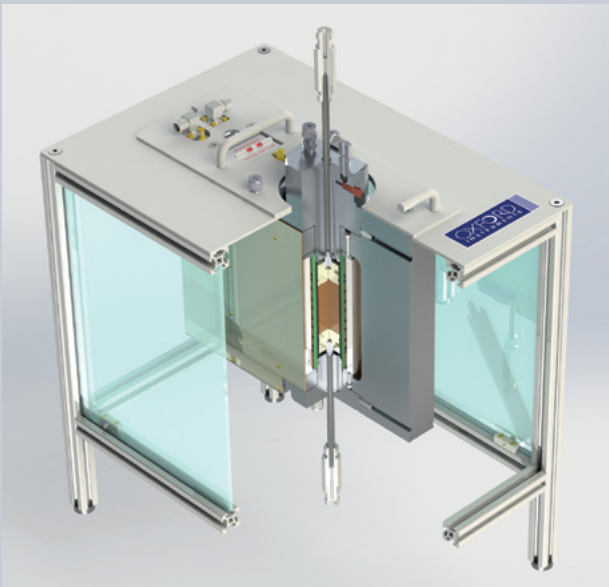
*A full suite of 3D viewing and analysis tools is included with **GIT Systems 3D** imaging software*

sensitivity of the **GeoSpec12** gives the temporal resolution required for flooding experiments, and combined with extensive rock based imaging sequences such as SPRITE and short Tau FSE, creates a revolution in core analysis.

*Vuggy carbonate plug imaged in **GeoSpec12***



GeoSpec12 can also be fitted with the **P5 Overburden Cell** for 1" or 1.5" core plugs, to allow measurements at up to 5000psi (1" cores) or 2500psi (1.5" cores), and up to 100°C. Please note that additional equipment is needed to generate and control pressures and temperature.



Global Support

The Oxford Instruments – Green Imaging Technologies partnership has experience of supplying systems all over the world, with instruments installed on 6 continents. Our hardware and software is developed, built and tested in-house.

We have our own core analysis laboratory, providing a service specialising in difficult rocks, which can be used to validate your own results or act as a backup to your own production lab. We have support bases in the UK, the USA, Canada, and China, as well as a network of partners and resellers with global reach. No matter where you are located, our global support network can provide prompt, personal service.



Oxford Instruments Magnetic Resonance

For almost 30 years, Oxford Instruments has been the industry standard for NMR instrumentation for core analysis. With over a hundred installations, Oxford Instruments truly understands the needs of core analysts, whether they be in oil companies, oilfield service companies or academia.

Innovation has been the driving force behind Oxford Instruments' growth and success ever since the business spun out from the University of Oxford over 50 years ago. It is now a global company with over 1,300 staff worldwide and a listing on the London Stock Exchange (OXIG).

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Green Imaging Technologies

Green Imaging Technologies (GIT) is the world-leader in developing innovative solutions for lab-based rock analysis using NMR. GIT's products and services offer fast, accurate, non-destructive analysis of rock core samples used by the oil and gas industry in exploration and reservoir characterisation.

Over the last decade, GIT's product offerings have evolved and expanded to include a full suite of routine and advanced core analysis tools. A culture of continual innovation has driven the company to become the industry leader in NMR core analysis. From prediction to production, GIT provides the solution.

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