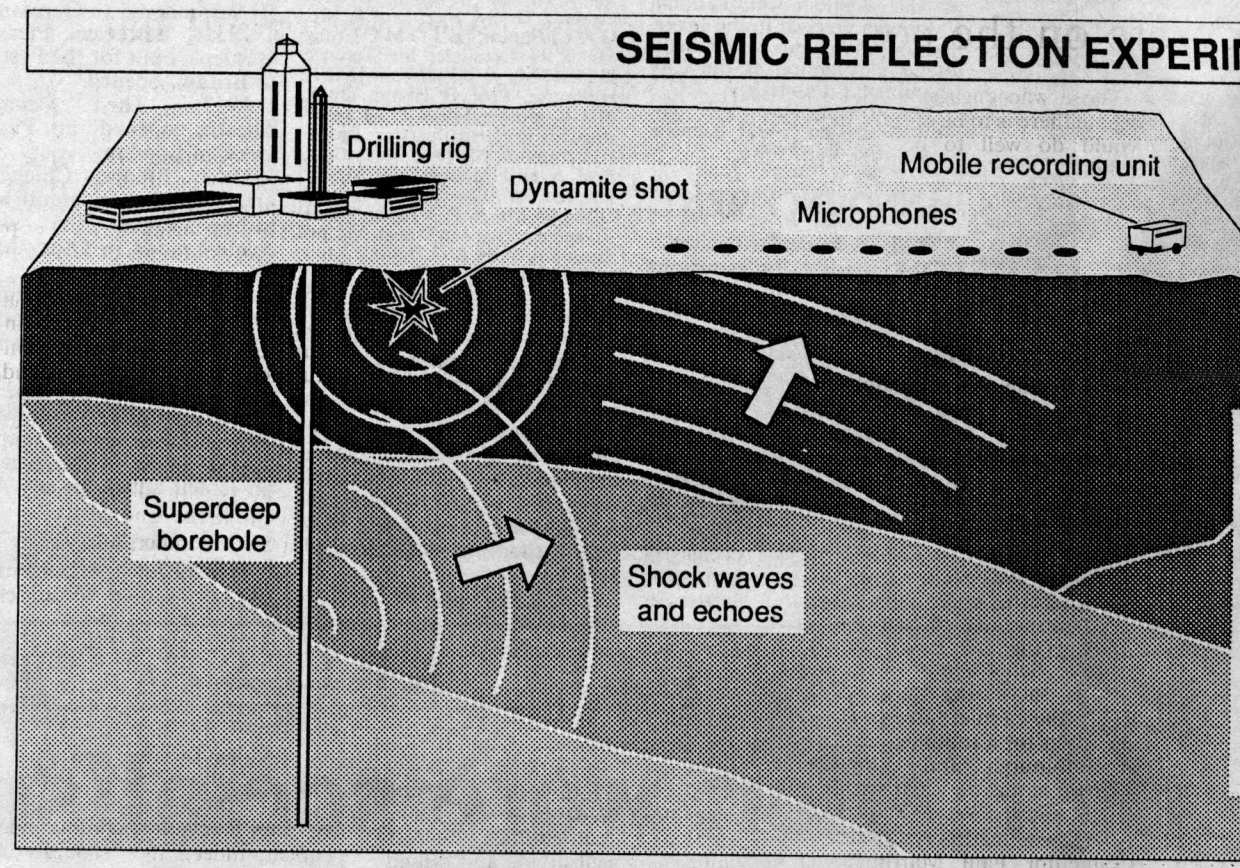
An in-depth look at

Scientists in the USSR are digging deep to uncover the mysteries of the earth's core — and two Scots geologists are closely involved. ***Maria MacDonell*** *studies an example of east-west co-operation*



WHEN it comes to drilling holes in the ground the Soviet Union is miles ahead of the West. For the past 20 years they have been drilling what, at 12km (and still drilling) is the deepest hole in the world, by a long way — and two Scottish geologists and an American have recently been given the go-ahead to experiment at the site. It is the beginning, they say, of a unique and fruitful relationship in the world of science.

They cannot wait to get on the site, situated in one of the remotest parts of the world, in the Arctic circle, on the Kola peninsula near the Norwegian border. Until two years ago no westerner had ever been there. The area is one of the world's richest sources of minerals, especially copper, nickel, platinum, gold and cobalt and it was in pursuit of information about these that the Soviets started to drill in the Seventies, developing their technology to meet problems as they arose.

David Smythe, geophysics professor at Glasgow University, read with interest about this pioneering work by the Soviet Ministry of Geology and saw possibilities for the application of his own work of "seismic imaging", echo-sounding the earth's crust in order to portray a cross-section of its layers.

(David Smythe has long been used to creating low-frequency ground vibrations. He was the original bass player of the well-known Scottish pop group The Rezillos. He can be heard on their first single, *I Can't Stand My Baby,* which became something of a cult item among New Wave music fans.)

Smythe contacted Con Gillen, assistant director of the Department of Continuing Education at Edinburgh University, an expert on the geology of the Kola peninsula and a polyglot with a speciality in Russian. Smythe also approached Professor Scott Smithson, of Wyoming University, famous for his land geophysics. "I am an intellectual entrepreneur," Smythe said. "I'm good at getting people together. Between us we have the equipment, expertise, language and contacts."

In summer 1989 Gillen attended an international geological conference in Washington and, in his best Russian, bent the ear of Soviet minister of geology, Igor Koslovsky, who introduced him to his depty, Vladimir Zychenko. "He gave his personal guarantee to take it further. He kept his word," Gillen said.

So it was that in September last year, Smythe, Smithson and Gillen stood before a panel of Soviet scientists in Moscow to present their ideas. "It was touch and go to the last minute," Gillen admitted. "They were all sitting there day after day watching and listening to us demonstrating that we weren't bluffers. It was a real grilling. On the last day they finally gave us the go-ahead."

All aboard for the Polar express: Professor David Smythe of Glasgow (right)

"What we are doing," Smythe explained, "is putting together western technology for seismic imaging where the west is ten years ahead of the east in its technology, and marrying this with unique data from this hole where the Soviets have a ten-year lead over the West. The best of science is coming together at the one site in the world where this could happen — the Kola peninsula. It is a chance in a lifetime."

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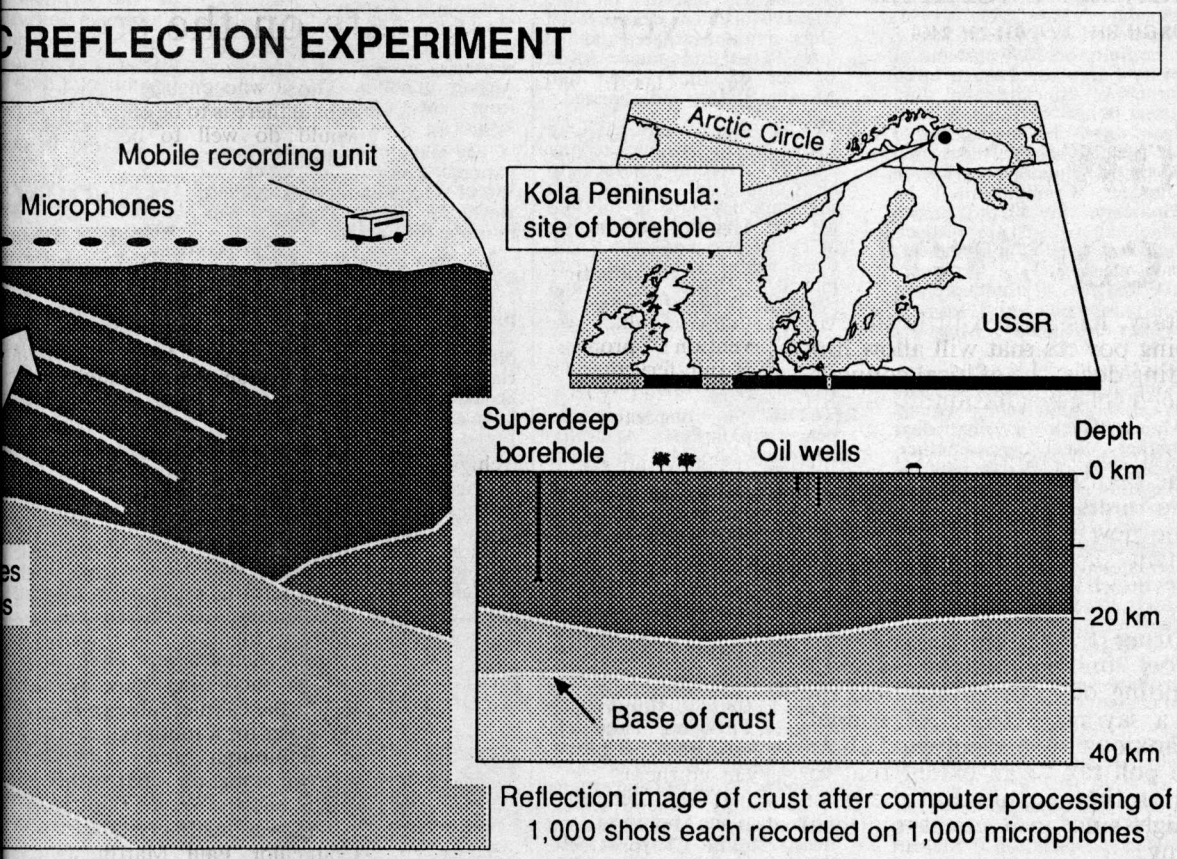

s: Professor David Smythe of Glasgow (right) with two Soviet colleagues

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Seismic imaging at the Kola well will involve setting off small dynamite charges at points along a 100km line, and, by recording the returning sound waves, constructing a cross section of layers of the earth. They will also use four "Vibroseis" trucks lent by Bergen University. "Each 12-ton truck has a base plate underneath which raises the truck off the ground," Smythe said. "The trucks vibrate in unison, for 30 seconds at 50-metre points along the line, sending vibrations into the ground. They're very noisy because of the generators for the hydraulics, but environmentally friendly." By combining information from this echo sounding with that provided by samples from the hole, scientists will have a unique opportunity to learn about the earth's crust.

The Soviets' hole has already come up with a few surprises. "At eight kilometres they were expecting to find a basaltic layer rich in magnesium and iron, like Arthur's Seat," Gillen said, "but their whole concept of the geology of the Soviet Union was overturned when they found gneisses, like in the north-west of Scotland, acidic rocks rich in calcium and potassium — completely the opposite to what they expected." They were also astonished to find, as deep as 9km, instead of solid mass, briney fluids flowing through cracked rocks.

Smithson, Smythe and Gillen have just returned from the Soviet Union, where they were treated like royalty. After meeting scientists in Leningrad they took the Polar express to the Kola expedition headquarters at Apatity, near Murmansk. "It was a 24-hour train journey with nice company, cheese and bread, lots of vodka and tea every hour, in a big samovar," Smythe remembered. "The Russians say they feel particularly comfortable with the Scots," said Gillen. "They feel we are much closer to them than the English — in our outlook on life. Several times they said 'we like you and we know you like us. We trust each other and therefore we can do good science together'. This is the start of a serious long-term relationship and there's no looking back. The work has started." The Soviet Ore Geophysics Organisation is putting 1.5 million roubles, its annual budget, into the project.

Next month five senior Soviet scientists will spend a week in Glasgow to enjoy an itinerary of concerts and castles planned by Smythe and Gillen and, more importantly, attend a one-day seminar for senior managers in the mining industry, to discuss long-term collaboration with the west in the exploration of Soviet mineral resources. And they want Glasgow and Wyoming to co-ordinate such developments.

THEY recognise Glasgow University's expertise in applied geology, and its strong links with East Kilbride's world famous Scottish Universities Research and Reactor Centre, specialising in age-dating of rocks. "They also want to make the well available to the world as an observatory of the earth," Gillen said, "and they've invited us to go in August for the inauguration ceremony."

In October Soviet experts will arrive in Glasgow to look at equipment and do paperwork for its shipment from Leith in December to start work in February. "I can't wait to see their faces when they see our computers," Smythe said. "We're giving them the chance to come to Glasgow and Wyoming to play with the best computers in the world. The west is decades ahead of Russia in computer technology. What we're sending to Kola is late-1980s technology, and that's 20 years ahead of what they're using now.

"What we will be doing will have worldwide implications for what geologists and geophysicists think the continental crust is composed of. It's the start of major long-term collaboration of mutual benefit to us and the Soviets and to the rest of science."