Tracking the magnetic south pole

Return to Scott's Antarctic camp marks 100-year anniversary.

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Measurements of Earth's magnetic field will be made near Robert Scott's Antarctic hut.

Two scientists from New Zealand will travel to Antarctica today in a quest to continue a 100-year-long record of Earth's magnetic field: a record begun by British explorer Robert Scott at the start of his ill-fated expedition to the geographic south pole (see Turning the world upside down).

Record-keeping is necessary because the magnetic poles move about, thanks to the complex circulation of Earth's fluid outer core. During the past century, both magnetic poles have been moving northwest: the north pole from Canada towards Siberia, as fast as 60 kilometres per year, and the south pole towards Australia at 10–15 km per year. "It's quite an astonishing rate," says Stewart Bennie of GNS Science in Avalon, one of the two scientists due to head to the Antarctic on 28 December. The movement is thought to be a normal feature of the planet's magnetic wobble, and could change direction at any time.

Precise ground measurements of Earth's magnetic field are used to help calibrate satellite measurements and inform global models, such as the World Magnetic Model, which is used by the North Atlantic Treaty Organization and national departments of defence. That model is updated every 5 years, with the current version covering 2010–14.

There are more than 100 observatories around the globe taking such measurements on a regular basis, and nations supplement these with occasional field work — New Zealand has taken its measurements at Scott's hut once every 5 years or so since 1957. Hundred-year records are not in themselves unusual, but the location of this one is. "Most records longer than that are sitting somewhere comfortable in Europe," notes Tony Hurst, the second scientist on the trip.

Rocky outposts

Hurst and Bennie will take measurements at two sites, the first at Lake Vanda in Antarctica's dry valleys, where it almost never snows. "It's very startling scenery — there's no soil, just solid rock and stones, and mummified seals that must have turned right instead of left at the coast," says Hurst, who went on the same trip 6 years ago. They'll then visit Cape Evans, where Scott's hut and iron-free observation shelter still stand. "The observation shelter is made of something we suspect is asbestos but we're not going to touch it to find out," says Hurst. Both sites are located on dry rock; ice-bound stations would move too much to allow for repeat observations.

At each site, the duo will align their instruments using geographical features (a compass can't be used because the magnetic field it would follow is the very thing they are measuring). A magnetic theodolite will allow them to measure the angle of the magnetic field both parallel and perpendicular to the ground; the latter measurement, called the dip, is 90 degrees at the pole itself, where magnetic field lines dive straight into the ground. The researchers will also use an Overhouser effect magnetometer to measure the strength of the magnetic field. The planet's field has been declining since the 1800s, perhaps by chance, perhaps as a precursor to a 'flip' of the poles thousands of years from now.

Making a full set of measurements takes about an hour, says Bennie, but they'll make continual measurements throughout the day because the field wobbles a tiny amount owing to Earth's rotation and the effect of the Sun. "We probably should be making these measurements in the Antarctic winter, when the magnetic field would be quieter. But it's a lot nicer in the summer," says Bennie.

It will be Bennie's first trip to the Antarctic, an adventure he is hesitantly looking forward to. "I've never been a big fan of really cold weather," he admits.

Satellites would provide an easier way to make such observations, but only a few are capable of doing so: the German CHAMP satellite collected data from 2000 until 2010, and the Danish Ørsted satellite, launched in 1999, is still working. A European trio of satellites, called Swarm, is due to launch in 2012.

"The challenge with satellite-based maps is to produce something that's relevant at the surface. Satellites are in or above the ionosphere," notes Jeffrey Love, a US Geological Survey adviser for geomagnetic research in Denver, Colorado. Hurst says he has been told that ground measurements will become more, not less important, as they will be needed to calibrate the satellite devices.

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