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We will present new magnetostratigraphic results from DSDP Site 608 in the North Atlantic that reveal the presence of nine short-term polarity excursions in the middle to late Miocene. These polarity excursions do not correspond to subchrons in the most recent GPTS. Four of them correspond to cryptochrons. IRM component analysis suggests that these polarity excursions represent true fluctuations of the geomagnetic field. Comparison with published results from ODP Sites 845 and 1092, and from the continental Orera Composite Section, shows that all nine polarity excursions have been observed in more than one record. A refined criterion for a short-term polarity excursion to qualify as polarity subchron defines five new subchrons in the late Miocene: C4r.2r-1n, C4Ar.1r-1n, C5r.2r-1n, C5r.2r-2n, and C5r.3r-1n. The three events within C5n and the one in C5An.2n qualify better as polarity excursions and are most likely associated with decreases in paleointensity of the geomagnetic field. These results imply that the occurrence of short-term polarity excursions in the geomagnetic field is non-uniformly distributed through time - for example, being relatively more common in the early Late Miocene and the Pleistocene but virtually absent in the latest Miocene and Pliocene - but it remains uncertain if this is related to real behavior of the geodynamo.

GP32A-07 1510h

Deeptow magnetic survey of the Pacific Jurassic Quiet Zone: Implications for the marine magnetic anomaly timescale

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We present results of a recently completed near-bottom magnetic survey of the Pacific Jurassic quiet zone located in Pigafetta Basin in the vicinity of ODP Hole 801C. A total of 1550 km of tracklines were completed during 5 lowerings of the DSL120 sidescan sonar system of the National Deep Submergence Facility equipped with two magnetometer systems. The nominal altitude of the vehicle was 100 m above the seafloor with the average sediment thickness 300 meters. We collected simultaneous vector magnetic data from a digital Honeywell HMR2300 magnetoresistor sensor and absolute total field using a Marine Magnetics Overhauser sensor provided by KORDI. The survey had four primary goals: 1) to investigate the presence or absence of magnetic lineations related to seafloor spreading around ODP Hole 801C, 2) to extend the magnetic anomaly mapping south to the Rough-Smooth (RS) boundary, thought to be the limit of the oldest Pacific crust, 3) to extend and confirm correlations of previously collected deeptow results, and 4) to investigate the M33-M34 sequence which can be clearly correlated with the timescale but also shows a period of rapid field reversal. The survey around Hole 801C was navigated within a transponder net whereas the remainder of the surveys were navigated using acoustic layback and bottom-lock doppler. From our results, we confirm that anomalies in the M33-M34 sequence are highly-lineated and well-correlated between adjacent lines with a high reversal rate. We found that anomalies older than M36 become harder to correlate to about M40 where there may be a possible change in trend of the anomaly strike. The anomaly record appears to become more linear again as Hole 801C is approached. Around Hole 801C the anomalies show a clear lineation with a strike direction of 25 degrees, although the correlation is not as consistent as the younger anomaly sequence. The decrease in anomaly amplitude that is seen from M21 through the M36 sequence appears to be low through anomaly M40 and then increases to a higher value thereafter with an average amplitude of 200 nT at deeptow altitude. South of Hole 801C towards the RS boundary we find that magnetic anomalies continue with short-wavelength anomalies superimposed on a longer wavelength anomalies making them difficult to correlate. High amplitude anomalies mark the RS boundary itself. In summary, we find evidence for seafloor spreading anomalies throughout the survey area although there are areas where correlation is difficult.

GP32A-08 1525h

Paleomagnetic data from Late Cenozoic Fort Selkirk Lavas, Yukon,significance for secular variation and tectonics

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Directions of magnetization in 33 basalt flows from Fort Selkirk, Yukon Canada, of Bruhnes, Matuyama and Gauss (1 flow only) age are well grouped. Normal and reversed magnetizations are present and it is likely therefore that secular variations have been covered. The very high accuracy within-lavas allows a good estimate of the dispersion of secular variation to be made. The circular standard deviation (theta63) of directions is 8.5deg at latitude 62.7deg N. The mean, regardless of sign, differs significantly from the geocentric axial dipole (GAD) field, indicating a 15±6deg counterclockwise rotation. Data from rocks of the same age range from the Western Cordillera of Canada and the NW USA agree well with the GAD. Recent seismic and GPS studies show that the dynamic crust in the Yukon is only 20 km thick and intensely mobile. Heat flow is high, allowing a ductile decollement for the tectonic float to transfer stress more than 1000 km inland to the currently seismic McKenzie Mountains from the indentor, the Yakutat block, which is colliding with North America. Yukon crust is moving NE and rotating counterclockwise with respect to North America as a result of this on-going collision. The geodetically determined general rotation is much less than that suggested by paleomagnetic deviation, indicating that Selkirk area may be moving seperately within the mosaic of the Yukon crust. The deviation from the GAD field is evidently tectonic not geomagnetic.

GP32B MCC: 3002 Wednesday 1600h

Bullard Lecture

Presiding: **L Tauxe,** Scripps Institution of Oceanography

GP32B-01 1610h INVITED

Progress Towards Understanding the Geodynamo from Observations and Numerical Models

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The new generation of magnetic field satellites currently in orbit hold enormous promise for understanding the generation of the Earth's magnetic field. These new data, together with earlier observations, and in combination with numerical models of the geodynamo, are enabling new insights into the dynamo process. Our approach aims to dissect the full range of behavior of the field that is observed: from high-latitude concentrations of flux that persist, at least in the time-average, over periods of several million years, to magnetic jerks, abrupt changes in the field on a timescale of a year or less. We describe a simple dynamical model of the core consistent with these observations. A number of key questions remain. How do reversals fit into this model? Are they simply a more extreme manifestation of secular variation, or do they require some separate explanation? How do we account for the different field morphologies and range of magnetic field strengths observed in the Solar System?

GP41A MCC: 2000 Thursday 0800h

Environmental Magnetism I

Presiding: **T Evans,** University of Alberta**; A Roberts,** University of Southampton

GP41A-01 0800h INVITED

Magnetic Mineral Concentrations of Recent Lake Sediments as Recorders of Climate Variations

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We have been studying the mechanism by which the variation of magnetic mineral concentrations in recent lake sediments could record local climate variations. Our earliest work showed that magnetic mineral concentrations in lakes of different productivity (eutrophic, mesotrophic, and oligotrophic) from the Pocono Mountains of northeastern Pennsylvania showed a correlation to historic records of regional rainfall over the past 100-200 years. The robustness of these correlations was hampered by the reliance on ^{210}Pb dating of the lake sediments. The varve chronology of sediments from Lake Ely in northeastern Pennsylvania afforded a more accurate downcore comparison between magnetic mineral concentrations and a local historic rainfall record. The observation of a positive correlation between ARM and SIRM and the local rainfall record over the past 60 years suggested a model in which increased precipitation supplied more nutrients to a postulated magnetotactic bacteria population in the lake and enhanced the production of magnetosomes that were preserved in the lake sediments. A detailed study of the mineral magnetism of water filtered from the water column and recent lake sediments of Lake Ely indicates that magnetosomes are definitely present at the oxic-anoxic transition in the water column and in recent lake sediments. Comparison of the ARM intensity of water column filtrate with the ARM intensity of material collected six months later from a sediment trap, does give some support to the rainfall-nutrient model, but the correlation recorded over this short period is not strong and is incomplete. Comparison of the magnetic data to the historic temperature record suggests that the duration of lake ice cover may be a mitigating factor in the magnetic mineral recording of rainfall variation, i.e. colder winters with longer periods of ice cover would minimize mixing of lake waters by wind and allow larger populations of magnetotactic bacteria to develop in the following spring and summer. Based on our studies, the best lake from which to obtain a record of climate variations using magnetic mineral concentration is one with a magnetic mineralogy dominated by magnetosomes, i.e. where the detrital input to the lake has a easily distinguished, different magnetic mineralogy from the magnetosomes or has a much lower magnetic mineral concentration. In addition, the magnetic mineral concentrations may record a combination of precipitation and temperature variations.

GP41A-02 0815h

Toward Modelling Topsoil Magnetic Susceptibility for Demining Activities

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The Landmine Monitor estimates that landmines cause up to 20,000 fatalities and casualties worldwide every year, in over 100 countries affected by landmine contamination. Although detection technologies have become more sophisticated, the metal detector still remains the most widely employed detection system in landmine affected regions. With increased use of minimum metal mines, the performance and sensitivity of metal detectors are increasingly challenged. In addition to mine constituents, depth of burial and orientation, soil properties significantly affect metal detection capabilities. Soils with high magnetic susceptibility, in particular those dominated by viscous components, interfere with the response signal in both frequency and time domain metal detection systems. Using Bosnia and Herzegovina (BiH) as a pilot region, we created an expert system to predict topsoil susceptibility from environmental information within a SOTER data base.