2001. The ores are characterized by slightly higher density and significantly higher P-wave velocity than the dioritic host rocks. The seismic surveys used 0.6 to 0.9-kg shallow dynamite sources, with a 24-channel end-on spread and offsets up to 350 m. The host orebody and associated igneous layers dip steeply toward the south, so careful processing of the seismic data was required. Weak reflections from stratigraphic contacts are visible on most of the profiles, including the top of the intrusion and base of the orebody. Since the observed reflections include a significant out-of-plane component, we developed a simple 2.5-D migration procedure. This method was applied to line drawings of the seismic profiles, providing the basis for delineation of the orebody in three dimensions. Synthetic seismic sections computed using the inferred bounding surfaces of the ore deposit are in reasonable agreement with observed reflections, even for along-strike lines not used to build the model. The ability to verify interpreted reflections using line intersections was critical to the development of our model. The results of this work establish the viability of seismic methods as an exploration aid for mapping the flanks of shallow, moderately dipping porphyry copper orebodies and associated strata.

NS43A-10 1415h

Applications of Near-surface Geophysical Techniques for Earthquake Soft-soil Response in Eastern Ontario

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There is ample evidence for significant paleo-earthquakes in the geological record of soft Holocene soils in Eastern Ontario (Champlain Sea sediments). Widespread, penecontemporaneous, large retrogressive earthflows in sensitive clays as well as other soil disturbances are attributed to ground motion amplification. Factors contributing to soft soil amplification include soil thickness, shear wave velocity-depth function, seismic wave attenuation, and the nature of near-surface acoustic impedance boundaries (e.g. buried bedrock valleys). In some circumstances these factors can yield a combined effect of velocity-gradient amplification, resonance amplification and 3-dimensional focusing which can exceed the shear strength of the cohesive soils and generate liquefaction in non-cohesive earth materials.

Several near-surface geophysical techniques have been adapted and tested as part of a project to develop new methodologies to apply to geotechnical hazard assessments of landsliding in sensitive marine clays of the Ottawa Valley. These include: surface compressional and shear seismic refraction and reflection methods, downhole compressional and shear wave velocity measurements, conventional borehole logging sondes and surface electrical and electromagnetic techniques. Examples of the application of these technique are given for areas of eastern Ontario where detailed geological studies of earthquake-induced deformation phenomena in thick Holocene soils are well documented.

Near surface geophysical techniques have been shown to be cost-effective tools to support geotechnical evaluations of critical geological controls on earthquake-induced soft soil deformation and landsliding. These techniques can be applied elsewhere in thick soft soil areas of the St. Lawrence Lowlands of Eastern Canada.

NS43B CC: 220 C-E Thursday 1330h

Near-Surface Geophysics Posters: Evaluation of Transportation, Building and Energy Infrastructure, and Related Resources *(joint with S, ED, MR)*

Presiding: **L Pellerin,** Green Engineering, Inc.**; M Chouteau,** Ecole Polytechnique

NS43B-01 1330h POSTER

Near-Surface Geophysics Poster Component of the Session on Evaluation of Transport, Building and Energy Infrastructure, and Related Resources I

Near-Surface Geophysics (noemail@xxx.xxx)

Near-Surface Geophysics, Poster Presentations

A list of the abstracts and authors that will be presenting posters in this session can be found in session NS43A. The authors are each giving a 5-minute overview of their poster in the session Near-Surface Geophysics: Evaluation and Transport, Building and Energy Infrastructure, and Related Resources I

NS44A CC: 516 B Thursday 1530h

Near-Surface Geophysics: Geophysical Implications of the Anomalous Temperature Effects on the Thermophysical and Electromagnetic Properties of Vicinal Soil Water *(joint with H, C, GC, PP)*

Presiding: **S A Grant,** Cold Regions Research and Engineering Laboratory**; S A Arcone,** Cold Regions Research and Engineering Laboratory

NS44A-01 1530h

Conversion of Bouguer Gravity Data to Depth, Dip, and Density Contrast With Complex Attributes Analysis Technique in the Area of Greece.

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The complex attributes analysis is an operator used in the extracting parameters of the buried structures with susceptibility and density contrasts distributions, which lead to the gravity and magnetic anomalies in the region of interest. In this paper is presented the complex attributes analysis of gravity field filtered for wavelengths lower than 50 km in the territory of Greece. The area o Greece has a complex tectonic history and fault system dominated by the subduction of the African plate beneath the Euroasia. A Low-pass filter is used on the Bouguer Anomaly to cut off wavelengths lower than 50Km in order to delineate the major faults structures of interests at big depths. The complex attributes technique aids in interpretation of potential field anomalies, because it can delineate the edges of concealed targets. In obtaining the source parameters from the complex attributes like the local depth, strike and dip, the assumption of sloping contact for the subsurface model is used. The estimated local parameters are in agreement with results obtained by previous interpretations. They can be used in combination with other method to interpret the anomalous field.

NS44A-02 1545h

Anomalous Thermal Expansion of Confined Aqueous Solutions

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The thermal expansion coefficient of water and aqueous solutions is greater in small pores than in bulk liquid. This phenomenon, first reported by Derjaguin et al. [J. Colloid Interface Sci., 109, 586, 1986], has been systematically studied in a series of porous glasses with different pore sizes. We find that the expansion begins to increase when the pore diameter is less than 15 nm. Near room temperature, the thermal expansion coefficient of pure water rises by about a factor of 1.8 in pores with 3.1 nm diameter. The maximum in the density of water is shifted downward from 4 degC in bulk to about 7 degC in 7.4 nm pores. Expansion of a series of salt solutions was measured, and the enhancement was comparable to that of pure water, so there was no indication of an influence of the size of the hydrated ion on the magnitude of the expansion in pores as large as 3.1 nm. Molecular dynamics studies, as well as a variety of spectroscopic measurements, reported in the literature indicate that one or two molecular layers are densely packed against the pore wall. We interpret the high thermal expansion to result from a change in the proportion of molecules included in those layers; as the thermal energy decreases during cooling, more molecules are attracted into the dense layers, and the thermal contraction is therefore enhanced. The layered structure is also supported by measurements of the permeability of the porous glasses. The permeability of a given material decreases as the size of the liquid molecule increases, because the layers bound on the surface reduce the effective pore volume. We find that the permeabilities of our samples can be predicted by assuming that two monolayers are immobilized on the pore wall. Measurements made on saturated cement paste show that the thermal expansion is about 1.6 times greater than that of bulk water, and increases as the permeability decreases, indicating that the expansion is dominated by the smaller pores in the size distribution.

NS44A-03 1600h

Dielectric properties of wet sediments versus temperature at 10-6,000 MHz

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Knowledge of the dielectric properties of sediments is important to studies of subsurface radiowave propagation, especially as it applies to ground-penetrating radar (GPR) operating in the 50-1,000 MHz bandwidth. In areas contaminated by nuclear waste and in desert environments, water within the soils can be unusually warm, with temperatures ranging up to 50°C. For the GPR bandwidth, past results suggest that relaxation effects may cause significant dispersion and loss of the radar signal within the subsurface. To this end, we have employed a network analyzer-based system with a modified HP805 coaxial-type sample holder to investigate sand and silt at water contents ranging from 0% to 30% and temperatures ranging from 0°C to 50°C. The correct operation of this system has been verified with methanol, ethanol, and isopropyl alcohol which are dispersive in the GPR frequency range.

Preliminary results suggest that dry sand and silt, which have relatively constant dielectric response across our frequency range of interest, experience no enhanced dispersion at elevated temperatures. With increasing water content, however, we find increasing dispersion at higher temperatures: for nearly saturated sand and silt, the real part of the complex dielectric permittivity decreases by up to 25% at frequencies above 100 MHz while it decreases less, or even slightly increases, below this frequency. Other than the low frequency peak in e" due to conductivity effects, there are no additional imaginary dielectric loss peaks at elevated temperatures or water contents for sand and silt-sized materials. Further investigations are planned for clay soils to control for grain size in quantifying temperature-dependent dielectric dispersion effects.

NS44A-04 1615h

Effect of soil particle size on the temperature sensitivity of capillary pressure.

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The temperature sensitivity of capillary pressure is about four times what one would predict based on the temperature sensitivity of water's surface tension. Temperature–sensitive soil wettabilities have been proposed to explain this difference, but experimentally measured changes in planar–surface wettabilities with temperature are inconsistent with this proposition. A possible explanation for the disparity between directly measured temperature–induced changes in wettabilities of planar surfaces and the temperature sensitivities of soil wettabilities inferred from capillary pressure may lie in the long–standing observation that the temperature sensitivity of capillary pressure increases with decreasing soil particle size. *Grant and Or* [in press] recently developed a disjoining–pressure model for the effect of particle size on the temperature sensitivity of capillary pressure that could be fitted to the available data and yielded parameter estimates consistent with current models of disjoining pressure profiles above surfaces. This model, however, does not explain the disparity between the inferred temperature sensitivity of soil wettabilities and those measured on planar surfaces.

NS44A-05 1630h

Response of Low Cost Dielectric Moisture Sensor to Temperature Variation

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Temperature affects dielectric moisture sensors through direct effects on sensor circuitry, through effects on the dielectric constant of water, and through effects on relaxation frequency of bound water. Advances in electronics have produced several low cost instruments for in situ water content measurement. The objective of this study is to investigate the source of temperature sensitivity, among the factors mentioned above, in low cost dielectric soil moisture sensors. Probes were tested in variety of known dielectric substances where the temperature was varied over time. In addition, the probes were evaluated in several soils along with standard TDR methods. Results show temperature sensitivity of the measurements but suggest they are due to bound water-soil interactions rather than temperature sensitivity of the sensor itself.

URL: http://www.decagon.com/appnotes/echotempnote.pdf

NS44A-06 1645h

Bound Water and Thermodieletric Phenomena Affecting Soil Water Content Measurement using Time Domain Reflectometry and Radar Remote Sensing

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We documented a potentially substantial temperature influence on near-surface soil water content (θ) measurements using time domain reflectometry (TDR) and suspended Horn Antenna GPR, in the presence of large diurnal temperature fluctuations. Laboratory experiments revealed interplay between reduction in the dielectric constant of bulk water with increasing temperature (T); and an increase in measured bulk dielectric constant with increased T resulting from release of bound water. The key factors that affect whether measured water contents increase or decrease with T are the specific surface area and the water content, which in combination determine the ratio of bound to bulk soil water. A physically-based model which considers the interrelationships of these factors was developed and tested with TDR, radar, and network analyzer measurements. The model was instrumental in developing correction factors for remote- and TDR-based hydrological measurements based on soil type and average θ. We successfully used the thermo-dielectric model in an inverse mode to deduce specific (wettable) surface area of porous media. The modeling approach was also implemented for remote delineation of different soil textures based on differential thermodielectric response on radar backscatter and microwave emissions. Potential complications due to thermal effects on Maxwell-Wagner relaxation within TDR measurement frequency will be discussed.

Reference Style for Abstracts

When referencing a meeting abstract, please use the following format, which indicates that this abstract volume is a supplement to the regular *Eos* issue. This format meets all AGU requirements for a complete reference.

Pfister, R. G., and M. S. Nestler (2004), Sharing community data, services and tools using the EOS clearinghouse (ECHO), *Eos Trans. AGU, 85*(17), Joint Assembly Suppl., Abstract OS41B-06.