

**INVERSE CORRELATION BETWEEN INDUCED SEISMICITY AND b-VALUE,  
OBSERVED IN THE ZINGRUVAN MINE, SWEDEN**

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*(Received June 2005, accepted September 2005)*

**Abstract**

A three-dimensional monitoring seismic network has been in operation in Zinkgruvan mine, south-central Sweden, since November 1996. We make use of 6037 rockbursts,  $-2.4 \leq M \leq 2.6$ , recorded during a 7-year period and determine b-value as a function of time. Calculated b-values show large time variations, roughly between 0.6 and 1.8. Almost all statistically significant (99%) drops in b-value can be associated with an occurrence of larger shocks ( $M \geq 1.6$ ) in the mine, either as isolated events or as a sequence of several shocks.

**KEYWORDS:** b-value, mining-induced seismicity, rockbursts, forecasting

**AMPLITUDE SPECTRA OF SEISMOGRAMS RECORDED AT EQUAL  
EPICENTRAL DISTANCES FROM BLAST IN NW BOHEMIA**

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*(Received March 2005, accepted October 2005)*

**Abstract**

Two experimental blasts were recorded at equal distances of approximately 43 km and various back-azimuths from 115° to 265° using a net of 14 field seismic stations situated in the western part of the Bohemian Massif. These records are used for study of the frequency contents of seismic waves generated by surface source. Some of the measuring sites were located on rocky subsoil, others on subsurface layers of various thicknesses. The Fourier spectra of P-wave group were found to be very different from site to site, even if their mutual distances were only several km. No clear relation between the frequency of the spectral maxima for vertical and horizontal components and the type of subsoil were found. This documents a complex structure of the region in the uppermost part of the crust. Not only local subsoil, but the whole path between source and receiver should be taken into account to explain the measured spectra.

**KEYWORDS:** Bohemian Massif, refraction method, amplitude spectra, local geologic structure

## ANALYSIS OF FACTORS FORMING THE GROUNDWATER REGIME IN THE WEST BOHEMIAN SEISMOACTIVE REGION

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*(Received June 2005, accepted November 2005)*

### Abstract

Groundwater levels began to be monitored in three hydrogeological wells in the seismoactive region of Western Bohemia in June 2000. The main purpose of the monitoring was to observe the effects of seismicity on the groundwater regime. The fluctuation of the groundwater level in particular wells is influenced by precipitation, air pressure changes and earth tides. All the three observed wells were subjected to tidal analysis of the measured groundwater levels, in order to determine their sensitivity to crustal strain. Anomalies related to seismic activity were observed during the August – December 2000 swarm in the NK 2 well, which is situated in the epicentral area of Nový Kostel.

**KEYWORDS:** West Bohemian seismoactive region, groundwater level fluctuations, August - December 2000 swarm, tidal analysis, hydrogeological effects of earthquakes

## PHYSICAL, MECHANICAL AND DEFORMATIONAL PROPERTIES OF METABASALTS, AMPHIBOLITES AND GNEISSES FROM KSDB-3 COMPARED WITH SURFACE ANALOGUES

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*(Received September 2005, accepted November 2005)*

### Abstract

\*Physical and mechanical properties were carried out on core samples of metabasalts, amphibolites and gneisses from various depths of the Kola Superdeep borehole (KSDB-3) measured at uniaxial and triaxial loading conditions. The same tests were performed on the samples of their surface analogues. The comparative investigations between values obtained on the core samples from the various depths in the borehole cross section and their surface analogues gave valuable information about changes of these properties as a function of depth. An idea of the stress condition assessment based on laboratory tests was initiated. The results of tests are in some cases affected by the small amount of rock material that we had at our disposal.

**KEYWORDS:** samples of metabasalts, amphibolites and gneisses, laboratory tests at uniaxial and triaxial loading conditions, physical a mechanical properties

## DENSITY LIMITS OF RECRYSTALLIZATION INFERRED FROM ROCK GLASSES

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*(Received December 2004, accepted March 2005)*

### Abstract

Plot of densities ( $\rho_{\text{ROCK}}$ ) versus packing index of the metamorphic rocks ( $\phi_{\text{ROCK}}$ ) and their glasses gives the lines with the slope of  $a = 21.6 \pm 0.28$ . This revealed slope in combination with density and packing index data determines the rock densification trajectory, densification index (D.I.) and rock density limits. The associated rock volume changes may be modelled and their crustal limits approximated. The studied metapelites have the density range of 2.69-2.86 g/cm<sup>3</sup> and their corresponding rock glasses 2.40-2.62 g/cm<sup>3</sup>. Packing indices for these rocks are  $\phi = 59.1-60.9$  and for their fused glasses  $\phi = 54.0-56.3\%$ . Maximum density limit for these rocks is estimated to be  $\sim 3.2$  g/cm<sup>3</sup>, and 17 % associated volume reduction.

**KEYWORDS:** rock density limits, rock glasses, packing index, volume change

## GEOCHEMICAL CONSTRAINTS OF HYDROTHERMAL ALTERATIONS OF TWO-MICA GRANITES OF THE MOLDAUBIAN BATHOLITH AT THE OKROUHLÁ RADOUŇ URANIUM DEPOSIT

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*(Received January 2005, accepted August 2005)*

### Abstract

Hydrothermal alteration of two-mica granites at the Okrouhlá Radouň uranium deposit is accompanied by the formation of episyenites. Episyenites originated from these granites typically show very intensive leaching of quartz, albitization of magmatic plagioclase and K-feldspar and chloritization of biotite. Later stages of alteration are characterized by significant carbonatization of episyenites. Mass balance constrains of episyenitization involve a loss of silica and a gain of sodium, calcium and CO<sub>2</sub>. A significant part of the uranium mineralization (coffinite and pitchblende) was formed during the Permian extensional phase of late Variscan evolution of the Bohemian Massif.

**KEYWORDS:** uranium, alterations, two-mica granite, geochemistry, Moldanubian batholith, Bohemian Massif

## WATER LEACHING OF ALKALINE METALS, Al AND Si FROM SELECTED ALUMINOSILICATES

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(Received March 2005, accepted September 2005)

### Abstract

Laboratory prepared mica Cs-tetra-ferri-annite, CsAlSiO<sub>4</sub>, Cs-montmorillonite and Cs-zeolite 13X together with natural phyllosilicates (biotite, muscovite, illite, and Na-montmorillonite), orthoclase, analcime, and zeolites (NaY-Z, Na4A-Z) were tested on leaching of alkaline metals, Al, and Si with water at 100 °C. There was found good potential for leaching of alkali elements. Cesium is better leachable from Cs-minerals (mica, aluminosilicate and zeolite) than K or Na from relating K- and Na- mineral analogues. From all samples except zeolites silicon leaches more easily than aluminium. Iron and/or aluminium bonded in octahedral positions in micas and montmorillonites are the least leached elements almost from all samples except zeolites. From tetrahedral position of zeolites the aluminum leaches out easily due to rich pore texture of zeolites. The leaching of alkali elements and aluminium increases with increasing ratio of Al/Si in related solid samples. The structural considerations that led to the hypothesis about very high structural stability and limited leachability of micas have been fully confirmed. The micas are most leach-resistant materials and therefore Cs-tetra-ferri-annite can be considered as a waste form for the fixation of Cs from radioactive Cs waste. Cs-montmorillonite bonds Cs<sup>+</sup> more strongly than Na<sup>+</sup> ion so that Na-montmorillonite can be considered for an outer barrier capable of buffering the possible escape of Cs.

**KEYWORDS:** cesium, leaching, Cs-tetra-ferri-annite, CsAlSiO<sub>4</sub>, Cs-zeolite, Cs-montmorillonite

## INVESTIGATIONS OF COKING COAL BLENDS CONTAINING A COAL TAR PITCH-BASED CARBONACEOUS WASTE COMPONENT TOWARDS UTILIZATION IN COKE OVENS

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(Received June 2005, accepted November 2005)

### Abstract

Herein, are presented results of laboratory-scale investigations of co-pyrolysis of artificial coking components made of carbonaceous waste materials and a coal tar pitch (labeled synthetic coking coal or SCC) in admixture with a typical coal blend used in coke manufacturing in Poland. The solid SCC component is prepared by combination of organic wastes and a molten coal tar pitch at elevated temperatures in a laboratory mixer followed by water quenching to room temperature. The results indicate the utmost utility of a range of otherwise environmentally troublesome carbonaceous wastes in the classical coking process.

**KEYWORDS:** organic wastes, waste utilization, pitch, pyrolysis, coking, smokeless fuel

# INTERACTIVE TOOL FOR DEMONSTRATION OF THE EFFECT OF CAUSAL AND ACAUSAL FREQUENCY FILTERING ON SEISMIC SIGNALS

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*(Received August 2005, accepted September 2005)*

## Abstract

Although causal and acausal (zero-phase) frequency filtering are procedures routinely used in seismic signal processing, many users of respective software tools are not fully aware of at first glance subtle, but for the exact interpretation of the filtered time series significant, differences between the two methods. Typical effects are waveform distortions due to the non-linear phase response in the former case, and generation of spurious anticipatory signal components due to the acausality of the process in the latter. In the present paper an interactive MATLAB program for the tutorial demonstration of the mentioned effects is described. The program allows processing of external (real) seismograms as well as internally generated synthetic seismic signals. All parameters specifying the synthetic signal and the filter properties (type, order, corner-frequencies) can be entered interactively. The amplitude and phase responses of the filters and the results of the filtering procedure are displayed, and the kinematic as well as dynamic parameters of the filtered signals such as onset times, time shifts, time differences and amplitudes can be picked with the cursor. Typical examples of causal vs. acausal filtering are given to demonstrate the performance of the program and the differences between the two approaches (there are presented two synthetic examples to illustrate basic filter behaviour and two examples of real seismograms analysis).

**KEYWORDS:** effect of causal and acausal filtration; seismic signal processing