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Time-lapse resistivity measurements in an undermined area (case study of Dětmarovice, Czech Rep.)

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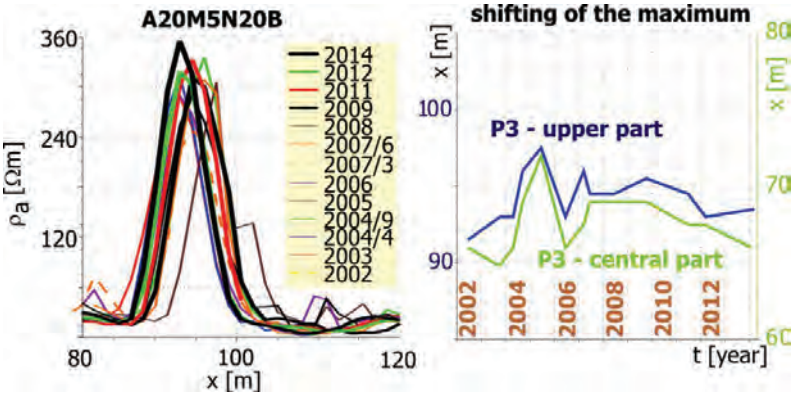

Two electrode distances of symmetric resistivity profiling were used within field measurements in an undermined area, affected also by slope processes (Dětmarovice area – Czech Republic). The results of used deeper measurement range (A20M5N20B), i.e. with estimated real depth range of 10-15 m, are presented in the figure. The figure shows a relocation of the maxima of resistivity anomalies. The left graph of apparent resistivity indicates that location of the maximum of resistivity anomaly is significantly changing. The anomaly was detected at the toe of the slope deformation; however, we cannot assume that fossil landslide, or even active landslide, could cause such resistivity changes. At the toe of slope deformation, we cannot expect tensile stress, which could cause increase of apparent resistivity. A difference of anomalous values reaches ca. 260 – 330 Ωm, compared to surroundings, thus it is higher by orders than surrounding resistivity field. Considering the fact that this anomaly is more significant with use of deeper array than with the one of shallower geometry (A5M5N5B), we have to search for its explanation among processes, which run in deeper parts of rock massif. Firstly, we have to examine possible effects of changes induced by undermining and to investigate the processes that can originate during formation of a subsidence basin. On the right part of the figure, we can observe a relocation of the maximum of the resistivity anomaly in time. Similarly to other processes, resistivity changes in subsidence basin are not monotonous. A time course of the shift of the maximum is uneven with rapid changes in its position. Another phenomenon, discovered within repeated geoelectrical measurements, is the existence of time-limited anomalies. We would like to remind that it concerns processes within the rock massif, not on its surface or within the near-surface layer. At the moment of detection of such anomaly, we did not find out its geological explanation. Measurements during next phase showed that the anomaly did not last for a long time. However, it was a unique case; therefore this fact remained out of our interest.

Finding of another similar anomaly at locality Ujala I finally attracted our attention. Searching for its explanation contended with the fact that such anomalies occur only with use of deep-range geometry of measurement. No such anomalies were found in near-surface layers. A character of the survey did not enable us to perform field measurements in sufficiently short intervals to be able to describe genesis of the anomaly, its time course and termination. Firstly, we supposed that the anomalies could have been related to tensile zones of newly formed slope deformations. Other anomalies were, nevertheless, detected far from the areas of possible landslide origin. Such explanation is, thus, low probable. We have to search for a connection with other processes running inside the rock massif. Time-limited resistivity changes related to the changes of groundwater regime represent one of the possibilities. We suppose that groundwater level variates in time within individual rock blocks or, alternatively, preferred pathways of groundwater change. Another possible explanation is an effect of tension zones originated in relation to a formation of subsidence basin. In the presented study, we would like to perform the results of repeated geoelectrical measurements by means of symmetric resistivity profiling. The repeated measurements in the area highly affected by deep mining of black coal (besides the influencing by mass movements) showed that the apparent resistivity field is not constant in time. Some of the anomalies change their location both “upslope” and “downslope”. Other anomalies are time-constrained and we registered them either in single case or, some of them, in more than one moment. We have not succeeded in exact explanation of such processes yet. We suppose that they can be provoked by changes caused by dynamic processes related to the changing situation of slope deformations or with processes connected with development of subsidence basin. These changes can also affect groundwater regime.