Preliminary Results of Applying Dipmeter Data to Structural Study of the Carboniferous Fold-Thrust Belt Underlying the Fore-Sudetic Homocline, SW Poland

Paweł ALEKSANDROWSKI[4], Marian KIEŁT[2], Leszek KUROWSKI[4], Krzysztof MASTALERZ[3], Stanisław MAZUR[4], Józef NOWAK[1] and Piotr PASEK[1]

[1] *P.O.G.C. – Geofizyka Kraków, Poland*
[2] *P.O.G.C. – Geofizyka Toruń, Poland*
[3] *Pracownia Geologiczna "Explora", Wrocław, Poland*
[4] *Uniwersytet Wrocławski, Poland*

An attempt has been made to apply directional data acquired with a six-arm dipmeter Halliburton SED in a number of oil wells to study the structural geology of the Carboniferous fold-thrust belt composing the uppermost part of the basement below the Fore-Sudetic homocline. A collection of dipmeter data from c. 40 wells was delivered by the Polish Oil and Gas Company. The data were numerically processed using standard input parameters appropriate to slightly deformed, well stratified rocks, proved to be noise-dominated and of little potential in interpreting relatively highly strained and lithologically homogeneous Carboniferous flysch rocks. Therefore, an attempt to re-process the data, using more appropriate computing parameters selected by the interpreting team, was made by Geofizyka Kraków on a few data sets from a number of wells. In particular, one of the newly discovered gas fields near Kościan (SSW of Poznań) was structurally studied using reprocessed dipmeter data. It was established that clastic Carboniferous rocks generally showed a homoclinal attitude over an area of several tens of km2 and dipped to the NE at an angle of 30–50°. One of the wells, studied in detail, revealed that the homoclinal attitude of strata (average dip 40–50° NE to ENE) was overprinted with folds up to 50 m in size, with NW–SE-trending axes, shallow-dipping axial planes and NE polarity. The fold style interpreted from the dipmeter data was confirmed by the study of drill cores, which contained numerous hinges of metre-scale recumbent folds, with local gently dipping axial-plane or fan cleavage, particularly well developed in the overturned limbs of the folds. The cleavage turned to be discernible also in the dipmeter record. The core and stratigraphic data from the studied gas field show that the Carboniferous succession occurs in normal position there, except in the lower limbs of the recumbent folds. Borehole geophysical data, locally supported by core observations, allowed the recognition of several trachyandesite dykes, dipping to the SW at moderate to steep angles. The insufficient quality of the dipmeter data correlation results did not allow an identification of most possible faults/thrusts in the well; the few identified fault planes dip to the SW. In regional context, the recognized recumbent NE-verging folds can be alternatively explained either as due to gravitational collapse associated with domino-style faulting of the Carboniferous complex, or, as originally upright folds re-orientated due to intense uplift and tilting on the northern slope of the NW–SE-trending Wolsztyn–Leszno high. This high probably represents a Late Carboniferous strike-slip pop-up of metamorphic basement. Reprocessed dipmeter data in a number of wells from other areas of the Fore-Sudetic homocline revealed the NW–SE to WNW–ESE structural trend of local folds, i.e., analogous to that predominating in the Variscan West Sudetes.

Acknowledgements

This research is a part of the project “Palaeozoic Accretion of Poland” (PCZ 07-21) financed by the Polish Research Committee (KBN) and by the Ministry of Environmental Protection in cooperation with the National Fund for Environmental Protection and Water Management.

The Sudetic Marginal Fault, SW Poland, in the Light of Morphometric Studies

Janusz BADURA[1], Witold ZUCHIEWICZ[2], Adam GÓRECKI[3], Waldemar SROKA[4], Bogusław PRZYBYLSKI[1] and Marta ŻYSZKOWSKA[3]

[1] *Lower Silesian Branch, Polish Geological Institute, al. Jaworowa 19, 50-122 Wrocław, Poland*
[2] *Institute of Geological Sciences, Jagiellonian University ul. Oleandry 2A, 30-063 Kraków, Poland*
[3] *Institute for Land Reclamation and Grassland Farming, Regional Research Centre – Wrocław, ul. Kraiñskiego 16, 50-153 Wrocław, Poland*
[4] *Institute of Geological Sciences, University of Wrocław, Pl. Maxa Borna 9, 50-204 Wrocław, Poland*

The Sudetic Marginal Fault (SMF) is one of the most clearly marked tectonic zones of Europe, more than 300 km long, of which 200 km are represented by a well-pronounced morphotectonic scarp. Despite its morphological distinctness, the evolutionary history of this fault has not been fully recognized. Based on indirect evidence, it can be inferred that this structure

originated during the Variscan orogeny and became reactivated during the Alpine cycle. The age of correlative sediments indicates that the fault was active in Late Oligocene times already, although many researchers suggested either Middle Miocene or Pliocene as the onset of faulting. Most geologists infer that the fault zone became inactive in the Pliocene; and only few suggested a possibility of continuation of its mobility in Quaternary times, principally due to vertical glacioisostatic motions induced by the consecutive Scandinavian ice-sheet advances and waning tectonic activity of the fault itself. A detailed analysis of terraces of the main Sudetic rivers formed during the past 200 thousand years points to their divergence. The presence of overhanging valleys and rock steps at the outlets of some of these valleys appear to confirm the still existing tectonic mobility along the SMF.

Our cartometric study consisted in the construction of digital elevation models of different portions of the SMF, based on 1:10,000 equal-area topographic maps, and digital determination of topolineaments. Topographic maps transformed into a raster format helped to determine drainage basin parameters of 149 small basins that are located at the base of the Sudetic mountain front, as well as to draw longitudinal profiles parallel to the SMF scarp.

The southern portion of the SMF in Poland, nearly 77 km long, has been studied using morphometric analysis of both scarp and small drainage basin parameters, as well as due to construction of digital elevation models and digital processing of topolineaments. The footwall of the fault is morphologically expressed as a distinct scarp ca. 50 to 400 m high. As a morphological border, the SMF separates two units showing different morphology: the Sudetes, represented by mountain ranges with broad ridges and deeply dissected uplands, of average altitudes of 400–800 m a.s.l. near the fault; and the Sudetic Foreland of gently undulating relief (approximately 200–300 m a.s.l.) composed of scattered groups of hills or slightly dissected uplands. The mountain front is generally higher in the southeastern part (120–300 m between Žulova and Bielawa) and less elevated in the northwestern sector (50–180 m between Bielawa and Złotoryja), although wide differences are noticeable among particular local sectors. The southern portion of the SMF between Złoty Stok and Dobromierz was subdivided into 6 segments, orientated roughly NW (N28°W to N50°W), and ranging from 6.4 km to 17.8 km in length. These segments show different geological setting, variable heights of fault and fault-line scarps, different pattern of triangular or trapezoidal facets, as well as changeable values of physiographic parameters characterizing small-scale drainage basins located at the base of the scarp. Of the six segments distinguished in the investigated fault fragment, the segment situated in the Sowie Mts. shows the highest rate of recent uplift of the footwall, as indicated by very well-preserved triangular facets showing a two-tier arrangement. Morphometric analyses allow us to infer that the most useful parameters to characterize the SMF scarp are the mountain front sinuosity and valley floor width/valley height ratio, whereas the maximum basin relief, relief ratio (i.e., mean basin slope), and basin elongation ratio best describe small drainage basins located at the foot of the scarp. All these parameters clearly indicate that the properties of the Sowie Mts. segment of the SMF do not differ much from those typical for young, moderately active normal fault scarps described from elsewhere. This hypothesis is supported by the results of studies of both topolineament pattern, and digital elevation models of the fault zone. The latter portray very well a two-tier arrangement of triangular facets, resulting from at least two episodes of fairly recent uplift, amounting to some 80 m.

Microstructures, Deformation Mechanisms and Rheology of Metagabbros Deformed in Different Thermal Gradients

Lenka BARATOUX, Pavla ŠTÍPSKÁ and Karel SCHULMANN

Institute of Petrology and Structural Geology, Charles University, Albertov 6, 128 43, Praha 2, Czech Republic

We have investigated two metagabbro thrust sheets (Staré Město belt, Czech Republic) below and above syntectonic tonalitic sill intrusion. The deformation in both sheets is heterogeneous but in the upper metagabbro sheet it is more intense and penetrative due to higher temperature of deformation. The metamorphic temperature estimated using the Hbl-Pl thermometry shows 750±50 °C and 650±50°C in the upper and the lower sheet, respectively.

Magmatic amphiboles from the lower gabbro sheet show magnesium-hornblende composition with slightly increasing tschermakitic component associated with dynamic recrystallization. Similarly, magmatic plagioclase of An45-55 composition shows strong zoning towards the rims (An60). The recrystallized new grains vary in composition from An42 to An62. Magmatic amphiboles from the upper gabbro sheet also exhibit the magnesium-hornblende composition, and they evolve towards tschermakite or ferro-tschermakite with progressive recrystallization. Magmatic plagioclase shows An50-60 content, while the composition of recrystallized grains is varibale ranging from An45 toa An90.

Amphiboles and plagioclases of the lower gabbro sheet are characterized by the “core and mantle” structure in the less deformed samples. At higher strains, plagioclases and majority of amphiboles are completely recrystallized. Magmatic amphiboles with unsuitable orientation of the glide system are locally preserved as “locked-up” sigmoidal porphyroclasts