Geologia Sudetica, 2014, 42: 161–166.

The CETeG 2014 excursion to the Upper Nysa Kłodzka Graben, the Sudetes: morphotectonics and tectonics

Stop 2.1

Idzików, Pasterskie Skałki hill (Eng. Shepherds' Rocks)

Leaders: Janusz Badura (PGI) & Marta Rauch (ING PAN)
Topic: Subvertically dipping conglomerates
Location: N50°16'19", E16°44'52"

In the NE part of the Nysa Kłodzka Graben, in the eastern edge of the Idzików Through, the narrow ridge of the hill is strongly manifested in the morphology. In the east, the Idzików Trough borders with the Śnieżnik Massif Range along the Wilkanów Fault (Fig. 1). The Pasterskie Skałki is a ~4800 m long, NNW–SSE trending hill. In the southern part of this hill, there are outcrops of Coniacian

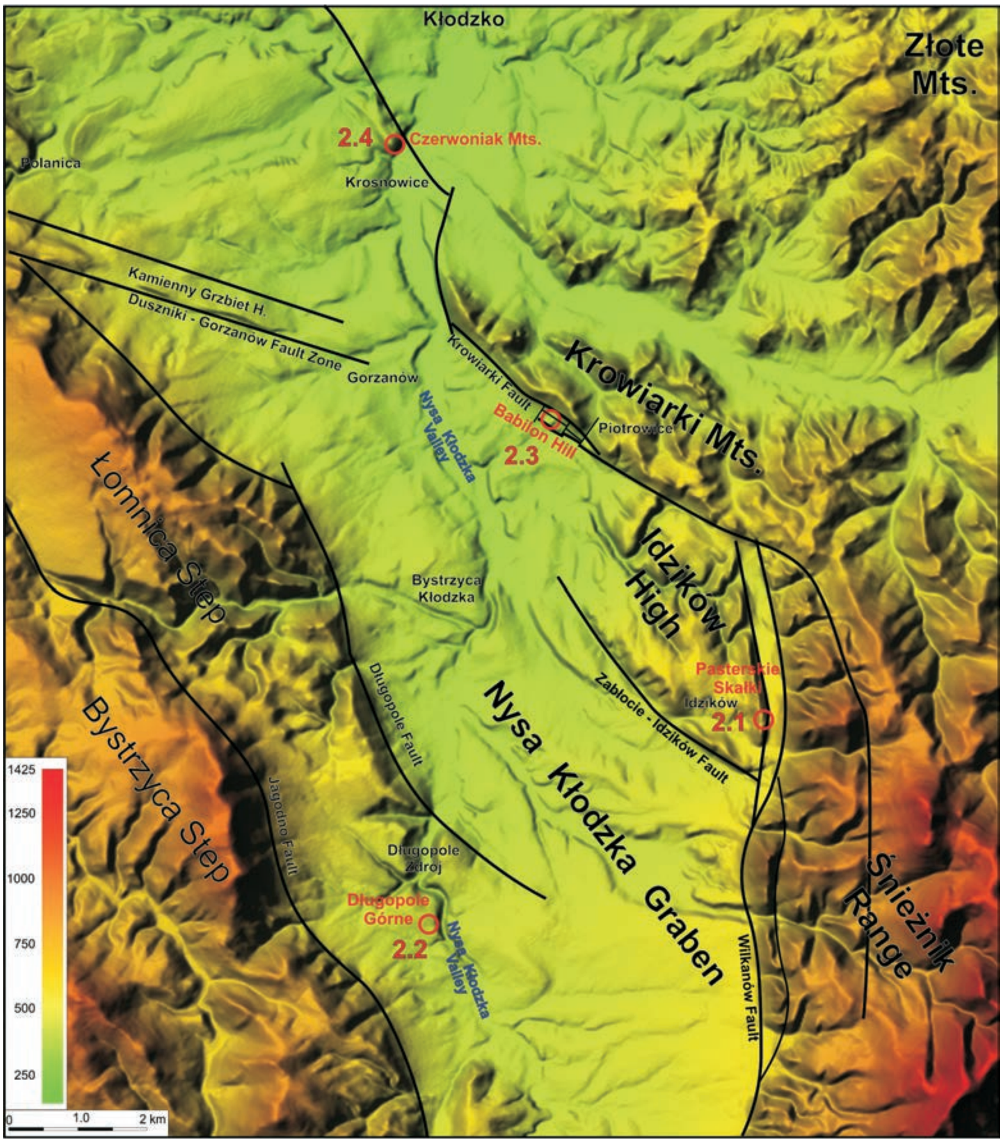

Fig. 1. Outcrops of Upper Cretaceous rocks (green) in the Upper Nysa Kłodzka Graben against the DEM model of the area with location of excursion stops. Vertical exaggeration 5 times.

Fig. 2. The crest of the Pasterskie Skałki hill. The rock is called "Dog". Photography shows steeply dipping Turonian sandstones and conglomerates. Photo taken by J. Badura, M. Rauch as a scale.

sandstones and conglomerates that dip steeply towards the west. The hill ridge exposes a group of 5 isolated crags which are up 5 to 10 m high, 8 to 20 m long and up 1.5 to 3 m wide (Fig. 2). The hill stretches parallel to the western edge of the Śnieżnik Massif Range, which is a tectonic boundary (e.g. Radwański, 1965; Wojewoda, 1997). There are two opinions in the literature on kinematics of this marginal fault. Radwański (1975) interpreted it as a reverse fault, whereas Wojewoda (1997) as a normal fault. According to our observations, in the Coniacian, it acted as a normal fault. A bedrock of the Idzików Trough was down warped in comparison to the Śnieżnik Massif Range during that time. The then existing Coniacian beds were steepened being rotated in a flexure fold caused by dragging on the marginal normal fault. In the Idzików quarry, still in the eastern edge of the Idzików Trough, a small distance to the west of the Pasterskie Sałki hill, the Coniacian beds are nearly in horizontal position. The Wilkanów Fault continued to have been active as a normal fault also in Miocene–Pliocene times, which is suggested by the triangular facetes which are observed in the morphology of the western margin of the Śnieżnik Massif Range (Badura & Rauch, 2014; this volume).

The age of the Idzików Conglomerates from the Pasterskie Skałki hill is interpreted as the Late Coniacian, although no fossil fauna have been found in these rocks so far (Pachucki, 1959). Their age is inferred from the similarity to conglomerates occurring in the Idzików Sandstones which contain fossil fauna and are exposed in the nearby Idzików quarry (Don & Don, 1960; Wojewoda *et al.*, 1997). However, no detail comparative studies on petrology of the conglomerates in the two localities have been carried out and the difference in the thickness of the conglomerate beds has not been explained. The similarity of conglomerates and their age are mainly interpreted based on an overall synclinal arrangement of beds in the NG (Jerzykiewicz, 1971; Don, 1996; Fig. 16 in Don & Gotowała, 2008).

The petrographic analysis of pebbles from conglomerates from the Pasterskie Skałki hill shows that the source area was located to the north and east of the graben, over the area of the Bardo Mts., Złote Mts., Krowiarki Mts. and Śnieżnik Range (Rode, 1934). Very minor admixture of Cretaceous rock pebbles indicates that this coarse-grained series was deposited either prior to the maximum transgression of the Cretaceous sea or later. The Cenomanian conglomerates are dominantly built of quartz and lidite pebbles (Žatečka, 1996). According to Wojewoda (1997), these are beach-related deposits. However, very poor sorting and indicators of turbulent flow suggest that they could originate in a fluvial environment.

The geophysical profile across the Pasterskie Skałki (Fig. 6 in Badura & Rauch, 2014) shows variation in resistivity of rocks, which is indicative of lithological variation. It is, however, not known whether the low resistivity rocks below the high resistivity ones should be interpreted as lower Coniacian mudstones or as weathered mica schists from the Orlica–Śnieżnik Dome in the basement of the Nysa Graben.

Stop 2.2

Długopole Górne

Leaders: Janusz Badura (PGI) & Marta Rauch (ING PAN)
Topic: Długopole Step
Location: N50°13'4", E16°38'15"

At Długopole Górne, middle Turonian sandstones crop out in an active quarry (Fig. 1). The quarry is located in the western edge of the Długopole Step (fig. 7 in Badura & Rauch, 2014 this volume). This morphological step is the southeastern prolongation of the Łomnica Step which is a morphological manifestation of a movable tectonic block within the basement of the western part of the NG. Initially, the Łomnica block moved downwards as it is covered by Upper Cretaceous deposits, especially in its SE part, which is called the Długopole Step. The tectonic block of Łomnica probably also moved upwards because the Cretaceous sediments are locally entirely eroded.

In a quarry, a large-scale cross-bedding dipping to the southwest can be observed in the walls (Figs 3, 4). The sandstones are cut by a system of orthogonal joints (NE–SW and NW–SE) and one set of subvertical diagonal joints trending in the WNW–ESE direction (Fig. 4).

Fig. 3. The quarry at Długopole Górne with the Turonian sandstones in the western edge of the Długopole Step. Panoramic photography shows the large cross-bedding in the lower level of the qurry. Within the upper level of the quarry the sandstone beds are nearly horizontal. Photo taken by M. Rauch.

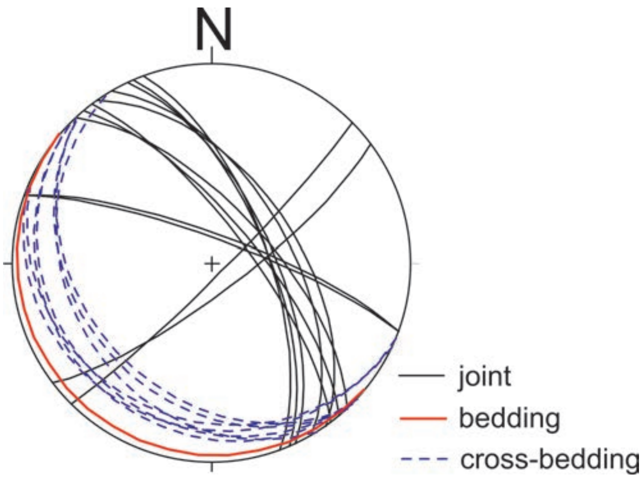

Fig. 4. Structural diagram showing orientation of bedding, cross-bedding and joints in sandstones.

Fig. 5. Photography shows the Babilon Mountain, view from the village of Piotrowice. Photo taken by M. Rauch

Stop 2.3

Piotrowice, Babilon Mountain

Leaders: Janusz Badura (PGI) & Marta Rauch (ING PAN)
Topic: The Duszniki–Gorzanów Fault Zone
Location: N50°20'23", E16°40'42"

The Idzików Trough borders to the north with the Krowiarki Mts. along the Krowiarki Fault which trends NW–SE. In the vicinity of Piotrowice, a deflection in the southern margin of the Krowiarki Mts. is noticeable (Badura & Rauch, 2014). There is a small and narrow hill called Babilon Mountain, which is, however, very distinctive in the morphology of the northern part of the Idzików Trough (Fig. 1). The hill is 10–20 m high and ~1100 m long (Fig. 5). It is built of Upper Turonian marls. The beds dip at an angle of ca. 35° to SSW and strike in the WNW–ESE direction. The Turonian marls border with Coniacian sandstones and claystones to the south and east.

The Kamienny Grzbiet ridge extending along the Duszniki–Gorzanów Fault Zone in the western part of the Kłodzko Valley (Grocholska & Grocholski, 1958; Don & Gotowała, 2008) is probably a prolongation of the Babilon Mountain ridge. The continuity of the structure was proved by deep hydrogeological boreholes that were drilled near the village of Gorzanów (Kiełczawa & Teisseyre, 2000). The uplift of the metamorphic basement between the Ka- mienny Grzbiet ridge and Babilon Mountain ridge is also noticeable on the map of the sub-Cretaceous basement (Badura & Rauch, 2014). The resistivity profiling showed that the width of the horst in the metamorphic basement below the Kamienny Grzbiet ridge is less than 1 km (Farbisz, 1996) and its length is ~12 km. The horst separates two deep troughs: the Krosnowice and Idzików Troughs.

The crest of the Babilon Mountain ridge is dissected by deep erosion-denudation valleys. They are most probably incised above diagonal faults. This is suggested by fragmentation of the ridge into sections which display en-echelon arrangement and are shifted in respect to each other by ~20– 50 m.

Stop 2.4

Krosnowice, Czerwoniak Mt.

Leaders: Janusz Badura (PGI) & Marta Rauch (ING PAN)
Topic: Tectonic superposition of Upper Cretaceous and Permian rocks with amphibolites of the Kłodzko Metamoprphic Massif
Location: N50°24'09", E16°37'31"

Fig. 6. The Czerwoniak Mt., roadcut exposure at Krosnowice. Photograph shows vertical Turonian calcareous mudstones. Photo taken by M. Rauch, J. Badura as a scale.

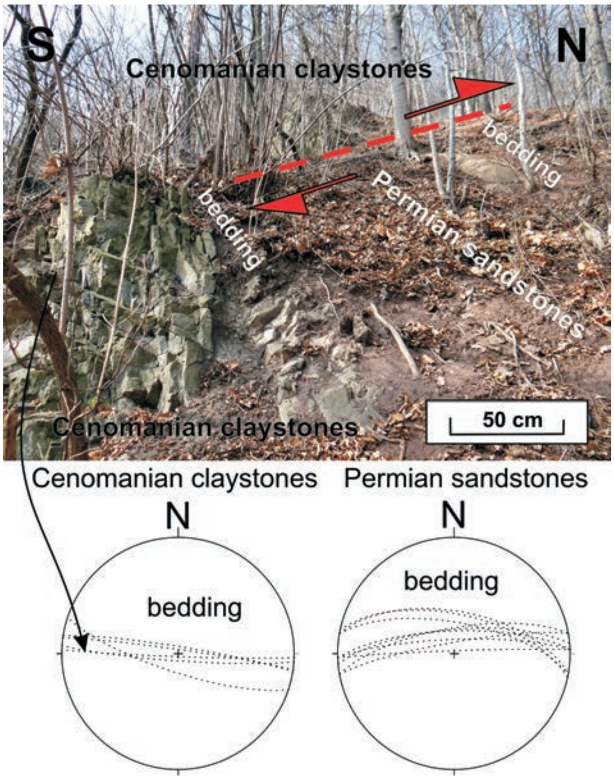

Fig. 7. The Czerwoniak Mt. Photograph shows the dextral strike-slip fault which cut the steeply dipping Cenomanian calcareous claystones with spongiolite and Permian sandstones. Stereograms (lower hemisphere) shows the bedding orientations within this locality. Photo taken by M. Rauch.

The Czerwoniak Mt. is one of the most extraordinary and broadly discussed geological localities in the Middle Sudetes. Three important geological units are in contact in this region: the Intra-Sudetic Synclinorium, the Kłodzko Metamorphic Massif and the Nysa Graben. The Krosno-

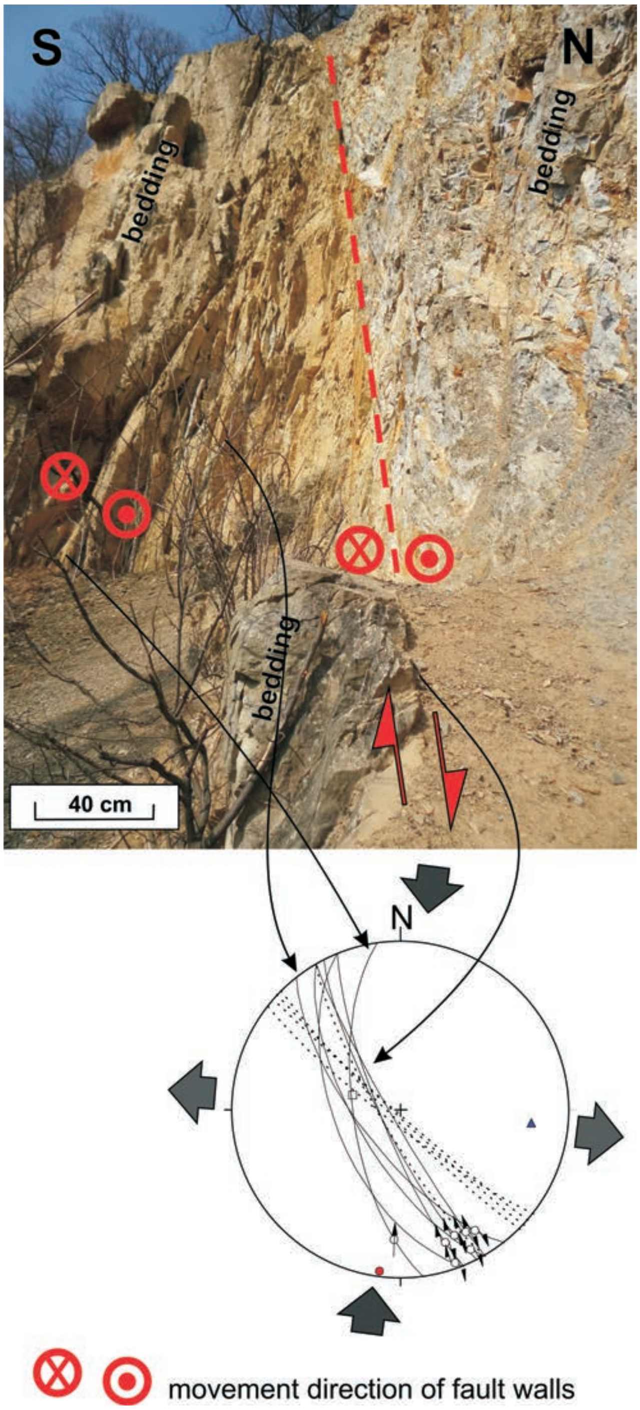

Fig. 8. Old quarry of Turonian sandstones at Krosnowice. Note subvertical dextral strike-slip faults (red colored) which cut the steeply dipping sandstones and calcareous mudstones at the Turonian–Cenomanian boundary. Stereogram (lower hemisphere) shows the orientation of the bedding and dextral strike-slip faults within this locality. Grey arrows near the stereogram indicate estimated orientation of horizontal compression and extension. Photo taken by M. Rauch.

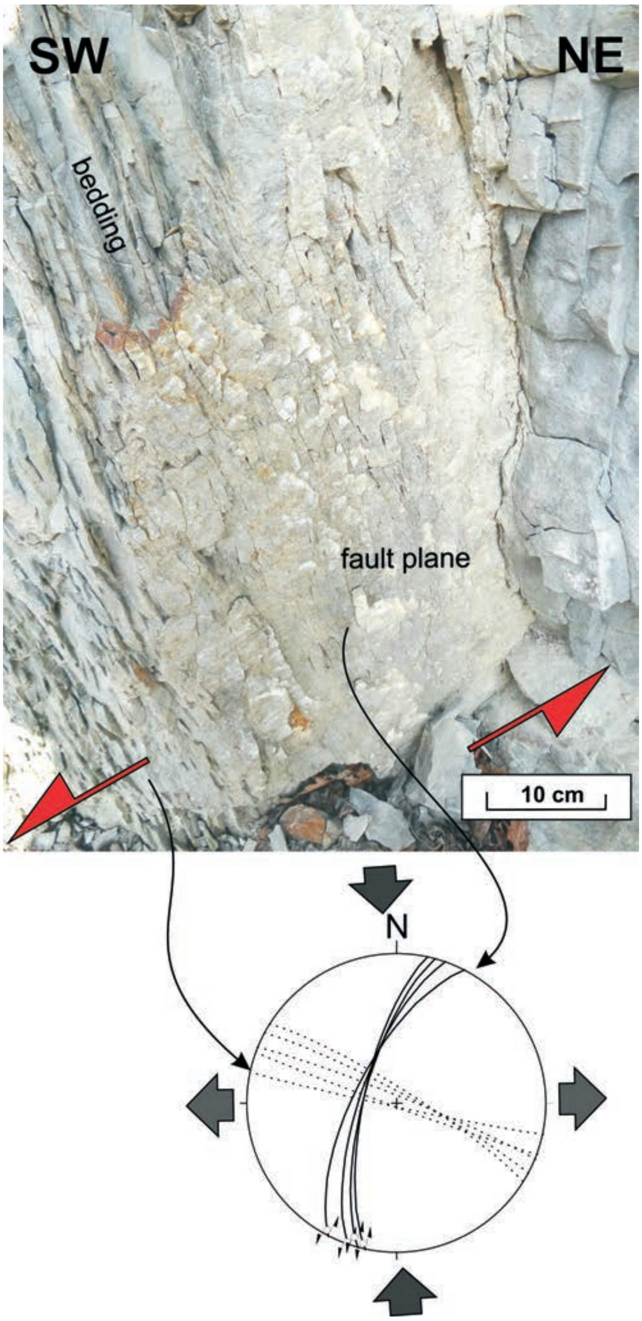

Fig. 9. The Czerwoniak Mt. Note a vertical sinistral strike-slip fault which cuts vertically disposed Turonian calcareous mudstones. Stereogram (lower hemisphere) shows the orientation of the bedding and sinistral strike-slip faults within this locality. Grey arrows near the stereogram indicate estimated orientation of horizontal compression and extension. Photo taken by M. Rauch.

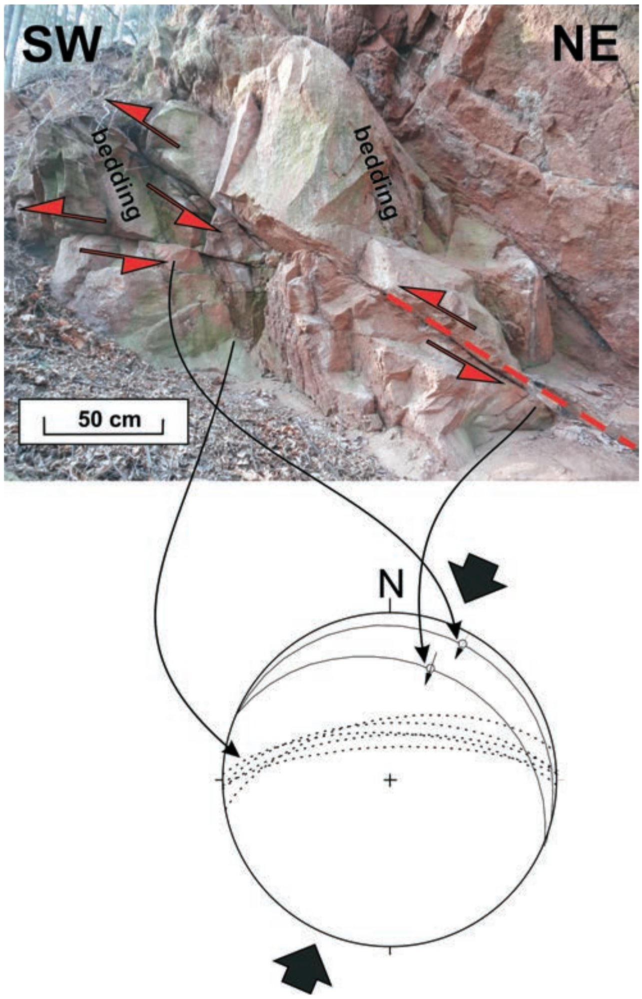

Fig. 10. Old quarry in Permian conglomerates and sandstones at Krosnowice. Photography shows the thrust faults which cut the steeply dipping Permian rocks close to the frontal thrust of the metamorphic Kłodzko unit. Stereogram (lower hemisphere) shows the orientations of the bedding and thrust faults. Grey arrows near the stereogram indicate the estimated orientation of the maximum principal stress axis. Photo taken by M. Rauch.

wice Trough is located in the northernmost part of the graben, in the Krosnowice Syncline (Don & Gotowała, 2008). The Czerwoniak Mt. is located in the north-eastern limb of this syncline, close to the western margin of the Kłodzko Metamorphic Massif. The Czerwoniak Mt. is built of Upper Cretaceous rocks in the SW and central parts and Permian rocks in the NE part of the mountain. In the northeasternmost part of the mountain, the amphibolites of the Kłodzko Metamorphic Massif crop out. The metamorphic rocks were thrusted towards SW over the Permian sandstones and conglomerates (Wojewoda & Burliga, 2008). The contact between the Permian and Upper Cretaceous rocks seems to be of sedimentary origin. These beds dip almost vertically and strike in the W–E and WNE–ESE directions (Fig. 6). The beds are cut by nearly vertical strike-slip faults which trend obliquely to the boundary between the Permian and Cretaceous deposits (Fig. 7). The dextral strike-slip fault planes are oriented NW–SE and NNW–SSE (Fig. 8). At the contact zone between the Cenomanian and Turonian rocks, in an old quarry, dextral movement along the bedding is evidenced by small-scale tectonic structures (Fig. 8). The strikes of the sinistral fault planes are NNE–SSW and NE–SW (Fig. 9). The thrust faults are very rare in the Upper Createceous rocks; they more commonly occur in the Permian rocks (Fig. 10). The strikes of the thrust fault planes are WNW–ESE and the fault planes dip to NE at an angle of up to 40°. The reconstructed maximum principal stress axis trends NNE–SSW.

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