Jílovice Fault

Structure ID: JIZ
Fault Section IDs: JIL1–JIL26, VYR1–VYR3, OPO1–OPO7
Related terms: Jílovice Fault, Výrava Fault, Opočno Fault (cze: jílovický zlom, výravský zlom, opočenský zlom)

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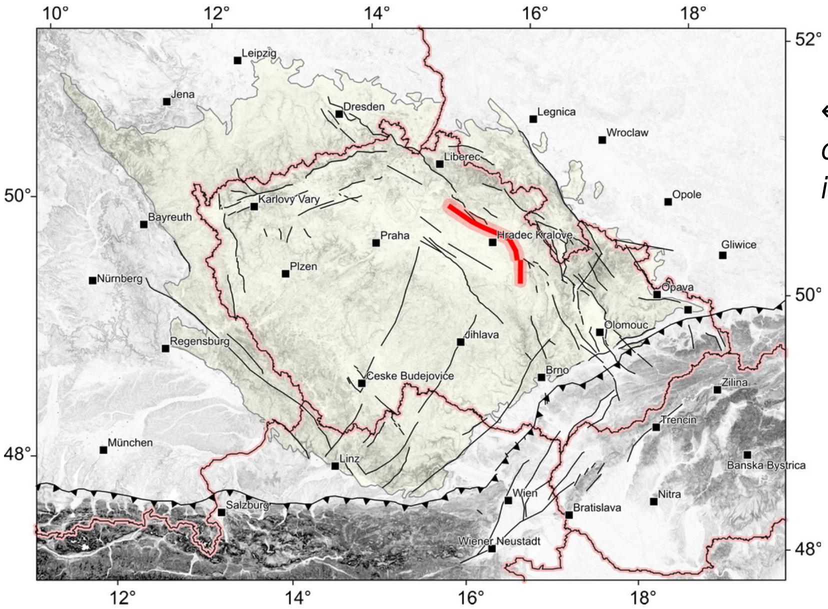

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General description

Primarily, the WNW–ESE, NW–SE and possibly up to N–S Jílovice Fault was defined based on a sharp surface stratigraphic and lithological boundaries of Late Cretaceous Formations between the central and northeastern parts of the Bohemian Cretaceous Basin – older to the NNE, NE and ENE (generally Cenomanian to Turonian) and younger to the SSW, SW and WSW (Coniacian to Santonian); cf. Soukup (1948), Zahálka (1950), Svoboda, Chaloupský et al. (1961), Čepek et al. (1963), Müller et al. (1998a, 1998b, 1999), CGS (2019). In my overview, I respected this stratigraphic criterium. The northeastern basin blocks, folded into an anticline-syncline system, uplifted and were more eroded in relation to the subsided much less deformed southwestern block of the central Hradec Králové syncline, characterized by brachyanticlinal to monoclinal structure with preserved more complete sedimentary succession. Consolidated Proterozoic or Paleozoic basement rocks outcrop from beneath Cretaceous strata nearby the Jílovice Fault Zone only in the prominent structures of Hořice Ridge corresponding to the Hořice anticline (large occurrences) and Vyhnanice Ridge as a part of the Libřice anticline joining there on the Opočno anticline (a few sites); CGS (2019) and related explanatory texts. A general length of the entire tectonic structure, extended between the wider surroundings of Jičín through the Hořice area and a vicinity of Jílovice to the surroundings of Vysoké Mýto, is more than 100 km, perhaps; the about 60 km long middle part (Hořice – Divoká Orlice River valley) is defined clearly

(CGS 2019). However, discrepancies still exist concerning continuations of the fault zone towards the WNW (consistent ruptures in the Český ráj / Bohemian Paradise area; e.g. Čech et al. 1995) or the NW, where it could be possibly related to the significant Lužice / Lusatian Fault (cf. Malkovský 1970, 1977, 1979, Malkovský et al. 1974), and towards the S (Vysoké Mýto syncline; souteastern part of the Hradec Králové syncline; cf. notes and illustrations in Maheľ, Malkovský 1984, Herčík et al. 1999, Krásný et al. 2012, Burda et al. 2016, Burda, Grundloch et al. 2016, Herrmann, Burda et al. 2016), the SSE or the SE, where it could be behind a few km long offset along the W–E Častolovice Fault related to some fault associated with the Potštejn anticline (e.g. Svoboda, Chaloupský et al. 1961; cf. Malkovský 1977). In these southeastern areas, contacts between different Cretaceous sedimentary formations occur than in the northwest. Since the main fault is in some places associated with other distinct or secondary ruptures, the entire structure has rather a character of the Jílovice Fault Zone (JIZ).

Fault structure and dip

A single, quite continuous and slightly undulating fault is primarily formed along the JIZ, generally striking N 95–125° S in its northwestern and middle parts and N 140–150° S or N 175–185° S in its southeastern parts. However, somewhere it along with subparallel subsidiary faults forms a disturbance belt with multiple structural steps or small horsts and grabens mostly up to 2 km, locally even 4 km wide. In the southeastern part, the main fault is associated with the subparallelly (NW–SE or N–S) oriented Výrava Fault (minimum length 20 km) and the NNW–SSE Opočno Fault (of similar minimum length) in a up to 10 km wide belt (CGS 2019 and related explanatory texts); both secondary normal faults separate different Cretaceous formations of Turonian age in a similar stratigraphic sense (older ones occurring towards the NE; Sekyra 1962, Müller et al. 1998b). The Jílovice fault evolved from an older flexural deformation. Its dip is commonly assumed to be between 8° and 60°; however, some authors preferred nearly vertical tectonic contact (e.g. Malkovský 1977). Direct structural measurements have been few (e.g. Sekyra et al. 1962 – inclination of 46° south of Libníkovice), but they have been supported by some geophysical data, partly compared with knowledge from boreholes (e.g. Soukup 1965, Bárta, Janda 1968, 1970, Müller, Soukup 1970, Kolářová 1971, Karous 1972, Macháčková et al. 1974, Zaw 1985, Pražák 1986). A similar fault inclination was also illustrated in a cross-section to the geological map southeast of Hradec Králové; the Výrava Fault was considered therein to be even steeper (Sekyra et al. 1965). According to the recent data (Burda et al. 2016), the differences in a basement elevation of Cretaceous strata along the main fault appears to be about 300 m in the vicinity of Hořice (northwest) and up to 600 m nearby Vyhnanice at Voděrady; during compilation of the former studies (e.g. Čech 1988, Müller et al. 1998b, 1999), the Cretaceous thickness values have not been known correctly, and thus these characteristics have been underestimated. The trace of the main Jílovice Fault corresponds to a consistent small difference in gravity between the northeastern (higher values) and soutwestern area (lower values, generally by about 30 mGal; e.g. Complete Bouguer Anomaly map by Sedlák et al. 1998). An indication of the fault occurrence in the regional magnetic (Šalanský 1995) or radiometric data (Manová, Matolín 1995) does not exist.

Cross structures and Segmentation

The Jílovice, Výrava and Opočno faults were parametrized separately during segmentation of the JIZ, made based on 1:50000 scale geological maps (CGS) and supplementary topographic data (DMR 4G;

ČÚZK 2017). Only a little short cross faults are considered between individual parts along the Jílovice Fault Zone. Moreover, a few of them located obliquely have been thought to join on the main ruptures and do not disturb their traces. Two perpendicular lines have been assumed southeast of Sobotka (CGS 2019). A number of cross faults have been found out at Ostroměř and Hořice (e.g. CGS 2019). In the about 30 km long WNW–ESE section running from this area towards Jílovice, where the main fault abruptly changes direction by about 35° to the NW–SE, no disturbance of the main fault has been marked in geological maps. However, perpendicular ruptures are assumed at the Jílovice Fault / Labe River valley crossing at Lochenice (Herčík et al. 1999, Krásný et al. 2012). A more complicated structure has developed in the southeastern part of the JIZ. Besides a few mentioned subparallel ruptures, the continuous main fault, at first bended into the NW–SE direction, is further partitioned into a number of shorter individual N–S sections. The joining faults have been mapped at the wider Hořice area (Jílovice Fault) or at Očelice (Výrava Fault). I took into account the described geometry of the JIZ during fault segmentation. The most abundant subsections were delimited nearby Ostroměř and Hořice in a vicinity of the Hořice Ridge whose subparallel steep southwestern, strictly linear slope was also included as one of the fault elements. The second area of higher subsection concentration evolved in the surroundings of the Vyhnanice Ridge. To the south of the Divoká Orlice River valley, I preferred a N–S trend of the JIZ supported mainly by a number of similarly striking individual subsections corresponding to linear topographic features, primarily scarps or valleys at the Tichá Orlice River and Loučná River valleys.

Scarp morphology

Geomorphological features related to the JIZ, as a structure being mostly accompanied by lowland relief, are quite discontinuous and separated by larger areas of subdued topography. They occur along both fault strands. Their locations in the north or the east largely prevails along the middle part of the tectonic zone, while relatively higher relief in the south or the west is developed only at both preferred fault zone terminations near Sobotka and Vysoké Mýto. Mainly the 20 km long and more than 150 m high flexured, generally SSW slope of the Hořice Ridge (within widest part of the Jílovice Fault s.s.) and the about 10 km long, similarly high flexured SW slope of the Vyhnanice Ridge (along the Výrava Fault running at the foot of the upland) are ascribed to the JIZ activity. However, their present-day prominence may be caused by selective erosion of more resistant outcropping Cretaceous strata instead of recent vertical movements. The small Výrava Ridge (with 30 m high SW scarp) evolved along the Výrava fault within the northwestern segment of the Libřice anticline; a further continuation of this positive tectonic structure towards the NW is assumed in the western surroundings of Jaroměř (cf. Herčík et al. 1999).

Seismicity

To be revisited after completion of earthquake catalogue. Fix Me!

Pre-Miocene evolution

The present-day tectonic structure along the JIZ originated mainly during the Late Cretaceous / Early Cenozoic inversion phase within the Bohemian Cretaceous Basin, generally related to compressional deformations in the Alpine foreland of Western and Central Europe (e.g. Malkovský 1980, Ziegler 1987, Coubal et al. 2015 and references therein). The crust was segmented along reactivated or new faults into blocks, the higher of which underwent a stronger erosion of Cretaceous strata. Flexures, thrust and normal dislocations, frequently being consecutive phenomena, evolved in the described area. Besides the Hořice and Libřice anticlines at the southern to western margin of the more deformed block, the Miletín syncline, the Dvůr Králové syncline, the Zvičina anticline and the smaller Kamenice anticline have evolved in the northern surroundings of the Hořice Ridge as other significant structures subparallel to the JIZ (Zahálka 1949, 1951, 1952, 1954, Sekyra 1962, Procházka, Holá 1971, Šraut 2008 and many other works referred to in this Jílovice Fault Zone description). In topography, they are manifested as troughs and ridges. A spatial predisposition of the JIZ by an older Variscan deformation is not excluded, similarly to some other important zones within the Bohemian Massif.

Fault activity in late Cenozoic

An activity of the JIZ during the late Cenozoic is possible to indicate only weakly by a spatial distribution of rarely preserved corresponding clastic deposits – if these are not entirely absent; continuous datable strata do not occur in the fault zone area, possibly except for the youngest loess sediments.

Tertiary

No Miocene deposits occur in the described region. However, unique residual fluvial gravels of presumably Pliocene age occur just on the flat top of the Hořice Ridge (about 450 m a.s.l.; CGS 2019), being an upland nearby the JIZ rising by about 150 m above the surrounding lowlands. Reliable absolute dating of the sedimentary material for a closer study of possible young tectonic processes is not yet feasible, perhaps, but these extreme vertical location of their sites does indicate any supplementary genetic factor to natural erosional development of the older regional fluvial system; the young tectonic influences cannot be yet excluded. A slightly anomalous distribution exists also for some of presumably younger (? Pliocene – early Quaternary) sites of clastic sediments scattered over hilltops of lower terrain within the wider surroundings of the Hořice Ridge in up to 30 x 30 km large area between the Cidlina River and Labe river valleys (CGS 2019). Their fluvial material was deposited by generally towards the south flowing paleo-streams of the Cidlina River or Labe River tributaries (Studénka, Javorka, Bystřice, Trotina), in the east possibly also by the Labe River itself. The JIZ runs across this specific region. Primarily, a higher vertical difference between occurrences in the Miletín Trough (335–375 m) and those south of the Hořice Ridge at the northeastern margin of the Polabí Lowland (260–295 m), with a maximum gradient of about 80 m height / 13 km length (0,35°) between both areas, indicates non-negligible influence of later ? Quaternary relative tectonic uplift of the northern block, perhaps. But other supporting data, focused just on the fault zone behaviour, are missing yet. Moreover, Quaternary changes in paleogeography of the regional fluvial system in a vicinity of Hořice occurred, how it was supported by the petrographic study by Blahůšek (1970).

However, the valley changes may be also explained by Quaternary climatic cycles causing in some periods an excessive material accumulation by neighbouring streams, their free flows over common sedimentary bodies and subsequent different downcutting, instead of a direct young tectonic activity (cf. Balatka, Sládek 1965). The Vyhnanice Ridge is characterized by a similar distinct marginal setting related to the flat Polabí Lowland like the Hořice Ridge, but no fluvial deposits occur on its summit. In spite of this fact, an analogous geomorphological development, possibly also involving slight differential tectonic uplift, may be considered there.

Quaternary

- ***Continuity of overlying strata***
  - A number of streams within the Labe River drainage area, whose higher terraces and sedimentary fills of valleys originated during younger Quaternary periods, flows across the JIZ. The largest are the Cidlina, Javorka, Bystřice, Labe, Dědina, Divoká and Tichá Orlice rivers. At the crossings, the river terraces are not continuous enough to serve as reliable indicators of possible young tectonic movements. Additionally, no consistent change in the valley sedimentary fills has been detected by quite frequent boreholes at any of the main streams (e.g. Burda, Herrmann et al. 2016 for the Labe River alluvial accumulation between Jaroměř and Hradec Králové nad Labem). Evident differences in thicknesses of loess cover (largely coming from the last glacial period) in the continuous sedimentary areas south of Jičín or west of the Labe River valley have not been found out as well. Quite interesting is nearly absolute absence of loess deposition east of the Labe River valley, pointing at a barrier effect of this large stream on regional transport of eolian material.
- ***Geomorphology***
  - The existence of the JIZ has manifested in a spatial arrangement of the present-day river network. Valley bends or short offsets at smaller streams, located where these cross through fault lines of the Jílovice Fault Zone, are not consistent in their direction sense – both sinistral and dextral phenomena occur along the main rupture. Thus, they likely have evolved along predisposed lines of weakness by selective erosion and do not support any additional lateral movement component within the primarily normal fault zone.

Related local evidence

(See layer **Local evidence** *on a map. The sites are listed in south-to-north order.)*

Considering the above mentioned facts, **no indisputable local evidence of younger Quaternary fault activity could yet be defined**. At the present time, the Jílovice Fault Zone appears to be inactive. However, origin and age of some clastic sediments either on the top of the Hořice Ridge or in its surroundings along the middle part of the tectonic structure, whose higher locations may be ascribed to a young (but not just recent) activity of the JIZ, is not yet known well. Their future detailed study will possibly bring new data, resulting in a reassessment of the movement rate.

Main data sources for fault map

Geological maps and explaining texts:

- scale 1:50000:
  - sheet 03-34 Sobotka (Tíma et al. 1999)
  - sheet 03-43 Jičín (Coubal et al. 1998)
  - sheet 13-21 Hořice
  - sheet 13-22 Jaroměř (Müller et. al. 1998a)
  - sheet 14-11 Nové Město nad Metují (Müller et al. 1998b)
  - sheet 14-13 Rychnov nad Kněžnou (Müller et. al. 1999)
  - sheet M-33-68-B Hradec Králové (Sekyra et al. 1965)
- scale 1:200000:
  - sheet M-33-XVI Hradec Králové (Čepek et al. 1963)
  - sheet M-33-XVII Náchod (Svoboda, Chaloupský et al. 1961)

Geophysics:

- regional gravimetry (Sedlák 1998)

Other notes

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