O premiku ob Savskem prelomu

Displacement along the Sava fault

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Kratka vsebina

Potrjena je domneva, da je Celjski prelom vzhodni podaljšek Savskega preloma, iz česar izvira hipotetična podmena, da so oligocenske plasti Radovljiške kotline, v kateri je andezitni tuf, odrezani in premaknjeni del oligocenskih plasti in enakega tufa iz Celjske kotline. Na podlagi tega je določen hipotetični premik ob Savskem prelomu 65–70 km. Savski prelom je najjužnejši od spremljajočih prelomov Periadriatskega lineamenta.

Abstract

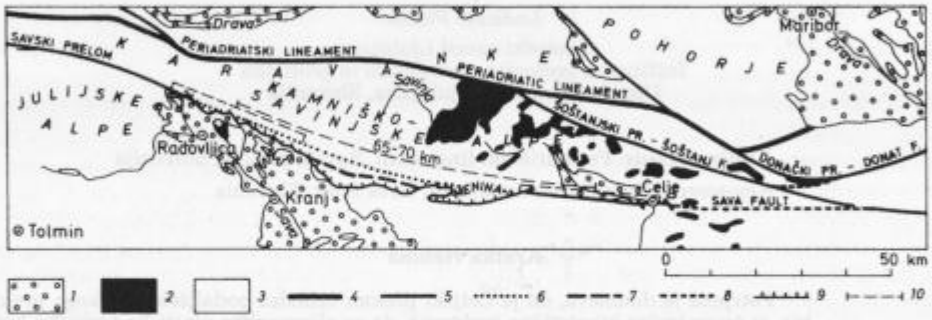
The presumption on the Celje fault being the eastern prolongation of Sava fault was confirmed. Therefrom arises the hypothesis that the Oligocene beds in the Radovljica basin in which andesitic tuff occure are a dislocated part of the are Oligocene marine clay and the corresponding tuff from the Celje basin. On this basis the displacement of 65–70 km along Sava fault was estirmated. The Sava fault is the southernmost fault of the Periadriatic lineament zone in the wider sense.

Savski prelom v Južnih Alpah je odkril Teller (1896), širše ga je pod tem imenom predstavil Kossmat (1913, 109–110). Potekal naj bi na meji med Karnijskimi Alpami, Karavankami in Kamniško-Savinjskimi Alpami na severu ter Julijskimi Alpami in Vzhodnimi Posavskimi gubami na jugu. V Zgornjesavski dolini naj bi bila prelomna ploskev strma, na vzhodu pa položna; ob njej naj bi bile Kamniško-Savinjske Alpe narinjene proti jugu na Vzhodne Posavske gube.

Savski prelom kot strm desnozmični prelom na celotni dolžini sta v skladu s tedanjimi spoznanji med prvimi obravnavala Hinterlechner – Ravnik in Pleničar (1967, 224) in na podlagi vzporejanja andezitnega tufa v oligocenski morski glini Radovljiške kotline z enakim tufom v Kamniško-Savinjskih Alpah sklepala na

premik ob njem do 25 km. Vendar iz njunega članka ni razvidno, do kod proti vzhodu naj bi segal Savski prelom. V tem smislu je zanimiva interpretacija Savskega preloma na karti strukturnega modela Italije (Bigi et al., 1990), kjer je kot vzhodni podaljšek Savskega preloma obravnavan Libojski ali Marijareški prelom (Buser, 1978, 1979) v Motniški sinklinali.

Podrobne raziskave zadnjih let v Posavskih gubah so pokazale, da je vzhodni podaljšek Savskega preloma t.i. Celjski prelom z listov Ljubljana (Premru, 1983a, 1983b) in Celje (Buser, 1978, 1979) na južnem obrobju Celjske kotline. To misel so uveljavili Kazmer s sodelavci (1996) in Fodor s sodelavci (1996, Sava-Celje fault). Po našem sega Savski prelom od Karnijskih Alp do stika s Šoštanjskim prelomom in še naprej proti vzhodu (sl. 1) in tvori pravzaprav najjužnejšega od spremljajočih prelomov Periadriatskega lineamenta.



Sl. 1. Potek Savskega preloma

1 Kvartar; *2* Oligocenski andezitni tuf; *3* Terciarne in starejše kamnine; *4* Periadriatski lineament; *5* Prelom; *6* Savski prelom prekrit z narivnimi grudami; *7* Savski prelom v narivni grudi; *8* Slabo viden Savski prelom na Osnovni geološki karti 1:100.000; *9* Narivna ploskev; *10* Območje Radovljiške in Celjske kotline z oligocenskimi plastmi znatne debeline

Fig. 1. Line of the Sava fault

1 Quaternary; *2* Oligocene andezite tuff; *3* Tertiary and older rocks; *4* Periadriatic lineament; *5* Fault; *6* Sava fault overlaied with thrust sheets; *7* Sava fault within the thrust sheet; *8* Poorly visible Sava fault in the Geological map 1:100.000; *9* Thrust plane; *10* Radovljica and Celje basin area with the Oligocene beds of considerable thicknes

Savski prelom je nastal kot desnozmični prelom, nato se je zaradi spremembe globalne geometrije, kar bomo obravnavali v posebni razpravi, spremenilo napetostno stanje. Trajektorije največje normalne napetosti so se tedaj postavile približno pravokotno na smer preloma in v tistih delih, kjer se ob njem stikajo kompetentne in nekompetentne kamnine, so se prve narinile na slednje. Tako so se Kamniško-Savinjske Alpe iz karbonatnih kamnin narinile na severovzhodni rob Radovljiške in Ljubljanske kotline ter na zahodni del Vzhodnih Posavskih gub. Nanje se je narinila tudi Menina planina. Omenjeno narivanje ni enotno, vendar narivne grude skoraj povsod prekrivajo glavno prelomno ploskev Savskega preloma. Tam, kjer je ta vidna, npr. na južnem robu Celjske kotline, pa je presekana z zmičnimi prelomi (Buser, 1978), kar tudi kaže na spremembo napetostnega stanja. Prelom med Kokro in Županjimi Njivami je segment Savskega preloma v narivni grudi. Narivanje Kamniško-Savinjskih

Alp prek Savskega preloma so opazili tudi avtorji strukturnega modela Italije. Povsem razumljivo je, da tega narivanja ne moremo enačiti s krovnimi narivi Kamniško-Savinjskih Alp.

Domnevna velikost desnozmičnega premika ob Savskem prelomu temelji na že omenjeni konstrukciji Hinterlechner-Ravnikove in Pleničarja, le da je mogoče z združitvijo prvotnega Savskega preloma in Celjskega preloma v enotni Savski prelom bolj logično razmišljati o tem vprašanju. Kazmer in sodelavci (1996) ugotavljajo premik 40 km, in sicer na podlagi razdalje med zahodnima robovoma Radovljiške kotline in Smrekovškega oligocenskega bazena, vendar se zdi sprejemljivo tudi vzporejanje oligocenskih plasti osrednjega dela Radovljiške in Celjske kotline, kjer so le-te v obeh primerih izjemno debele. Premik, konstruiran po tem načelu, znaša okoli 65–70 km (sl. 1). Vse tri variante (25, 40, 65–70 km) so hipotetične in jih je treba preveriti z nadrobnimi raziskavami.

Ob tej priliki je pomembno omeniti opazko Ampfererja (1917, 419), da so v eni od prelomnih ploskev prelomne cone Savskega preloma (terminologija v današnjem smislu) pri Mostah vidne vertikalne drse. Le-te bi lahko kazale na drugo fazo geneze Savskega preloma.

Desni premik ob Savskem prelomu se je moral zgoditi po oligocenski dobi, morda celo po miocenski, narivanje ob njem pa je povezano z neotektonsko aktivnostjo. Razlaga Savskega preloma v novem smislu se ujema z ugotovitvijo Jelena s sodelavci (1992) o razliki v razvoju terciarnih plasti v severnem in južnem krilu Celjskega preloma, ne potrjuje pa mnenja Buserja (1978, 1979), da poteka Savski prelom diagonalno prek Vzhodnih Posavskih gub, saj je premik ob prelomu mimo Zagorja ob Savi, ki ga Buser imenuje Savski, neznaten in ni v skladu s premikom v Zgornjesavski dolini.

Displacement along the Sava fault

The Sava fault in the Southern Alps was discovered by Teller (1896), and introduced under that name by Kossmat (1913, 109–110). Its position is supposed to be at the boundary between the Karnian Alps, Karavanke and Savinja Alps in the north, and the Julian Alps and Eastern Sava folds in the south. In the Upper Sava valley the fault plane is reportedly steep and in the east it is gentle. Along it the Savinja Alps were thrust southwards over the Eastern Sava folds.

The Sava fault was considered a steep dextral fault in its entire length accordingly with the concepts of those times among the first by Hinterlechner – Ravnik & Pleničar (1967, 224). Based on the comparison of the andesitic tuff in Oligocene marine clay of the Radovljica basin with similar tuff in the Savinja Alps they estimated the displacement along it to be at most 25 km. In their paper the eastward extension of the Sava fault is not clearly defined. Interesting from this aspect is the interpretation of the Sava fault in the map of the structural model of Italy (Bigi et al., 1990) on which the Liboje or Marija Reka fault in the Motnik syncline is considered as the eastern extension of the Sava fault (Buser, 1978, 1979).

Recent detailed investigations in the Sava folds have shown that the eastern extension of the Sava fault is the so-called Celje fault of the sheets of geological map 1:100.000 Ljubljana (Premru, 1983a, 1983b) and Celje (Buser, 1978, 1979) in the south borderland of the Celje basin. This concept was asserted by Kazmer et al. (1996) and Fodor et al. (1996, Sava-Celje fault). In this new sense the Sava fault

should extend from the Karnian Alps to the contact with the Šoštanj fault, and farther eastward (fig. 1), and it should represent actually the southernmost among the accompanying faults of the Periadriatic lineament.

The Sava fault was initially formed as a dextral, after which the tension state changed owing to a change of the global geometry. This should be discussed in a separate paper. The trajectories of the highest normal tension were then directed aproximately perpedicular to the fault direction. In those parts in which along the fault competent and incompetent rocks came in contact, the first were thrust over the latter. In this way the Savinja Alps that consist of the carbonate rocks were thrust over the northeast part of the Radovljica and Ljubljana basins and over the west part of the Eastern Sava folds. On the latter also Menina planina was overthrusted. The discussed thrusting was not uniform, but the thrusted units almost everywhere cover the main fault plane of the Sava fault. In places where it can be observed, as in the southern rim of the Celje basin, the fault plane is cut by strike-slip faults (Buser, 1978), which is also an illustration of the change of the tension state. The fault between Kokra and Županje Njive is a segment of the Sava fault in a thrust nappe. Of the existence of thrusting of the Savinja Alps over the Sava fault became aware also the authors of the structural model of Italy. It is entirely clear, however, that this thrusting cannot be equated with the nappes of the Savinja Alps.

The supposed size of the dextral displacement along the Sava fault is based on the mentioned construction of Hinterlechner-Ravnik and Pleničar. The combining of the original Sava fault and the Celje fault into a unique Sava fault made possible a more logical reasoning about this problem. Kazmer et al. (1996) report a displacement of 40 km, as based on the distance between the west rims of the Radovljica basin and the Smrekovec Oligocene basin. Acceptable appears also comparing of Oligocene beds of the central parts of the Radovljica and Celje basins, where they are in both circumstances of impressive thickness. The displacement as estimated according to this principle amounts to about 65–70 km (fig. 1). All three variants (25, 40, 65–70 km) are hypothetic, and their reality should be verified through detailed investigations.

Here the remark by Ampferer (1917, 419) should be mentioned on the existence of vertical striations in one of fault planes of the dislocation zone of the Sava fault (according to the present terminology). These grooves might be indications of the second stage of Sava fault evolution.

The right slip along the Sava fault must have occurred in the post-Oligocene, possibly even post-Miocene times, while the overthrusting along it might be associated with neotectonics. The interpretation of the Sava fault in the new sense is conforming with the statement of Jelen et al. (1992) on the difference of development of Tertiary beds between the north and south flanks of the Celje fault. This, however, does not confirm Buser's (1978, 1979) opinion on the trace of the Sava fault crossing diagonally the Eastern Sava folds, since the displacement along the fault at Zagorje ob Savi, named the Sava fault by Buser, is insignificant, and is not in accordance with the displacement that was established in the Upper Sava valley.

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