GEOLOGIJA *45/1,* 277–280, Ljubljana 2002

Predhodna objava rezultatov strukturnega profiliranja Kraškega roba in Istre (AC Kozina – Srmin, Sečovlje)

Preliminary results of structural profiling of the Kras edge and Istria (Kozina – Srmin Motorway, Sečovlje)

Ladislav PLACER

Geološki zavod Slovenije, Dimičeva 14, 1000 Ljubljana, Slovenija

Ključne besede: Tektonika, meja Jadransko predgorje – Zunanji Dinaridi, Istra
Key words: Tectonics, boundary Adriatic foreland – External Dinarides, Istria

Kratka vsebina

Nova avtocesta Ljubljana – Koper poteka na odseku med Kozino in Srminom preko Kraškega roba, ki ga v geološki terminologiji imenujemo Kraški narivni rob. Ta v najširšem smislu zajema prostor med robom Tržaško-Komenske planote in Savudrijskim grebenom ter tvori mejo med Jadranskim predgorjem in Zunanjimi Dinaridi. Detajlno geološko kartiranje odseka avtoceste Kozina – Srmin je pokazalo, da Kraški narivni rob ni monofazna tektonska struktura, temveč se je izoblikoval od konca eocena do danes preko več različnih deformacijskih faz, ki vključujejo poleg manjših, odzive treh pomembnejših dogodkov; dinarskega krovnega narivanja, premike ob zmičnih prelomih smeri NW-SE in podrivanje Istre proti NE. Slednje dogajanje je porušilo prvotno simetrijo jugozahodne meje Zunanjih Dinaridov med Južnimi Alpami in velebitskim lokom.

Abstract

On the section Kozina-Srmin the new motorway Ljubljana-Koper is crossing the Kras edge, which in geologic terminology is refered to as the Kras thrust edge. In the widest sense it comprises the area between the edge of the Trieste-Komen plateau and the Savudrija ridge, creating the boundary between the Adriatic foreland and the External Dinarides. Detailed geologic mapping of the motorway section Kozina-Srmin slowed that the Kras thrust edge is not a monophase tectonic structure, but has been formed through several different deformation phases from the Eocene until today. Besides smaller ones these phases include responses of three significant events; the Dinaric nappe thrusting, displacements along the strice-slipe faults with NW-SE trending and underthrusting of the Istria toward the NE. The latter event destroyed the primary of the SW boundary of the External Dinarides between Southern Alps and the Velebit arc.

V okviru programa geološke naravne dediščine, ki ga financira Družba za avtoceste v Republiki Sloveniji (DARS), se sistematično geološko spremlja zemeljska dela na novi avtocesti med Kozino in Srminom. Spremljava zajema strukturne (Geološki zavod Slovenije), stratigrafsko-paleontološke (Paleontološki inštitut ZRC SAZU) in speleološke (Inštitut za raziskav krasa ZRC SAZU) fenomene. Ker poteka trasa preko

celotnega Kraškega roba, ki je ena od krajinskih znamenitosti slovenskega ozemlja, je strukturno-geološka spremljava zastavljena kot poglobljen študij njegove celotne nagubane in naluskane zgradbe, ki zajema v geološkem smislu širše območje od samega roba in sega nekako od Kozine do Savudrijskega tektonskega hrbta. Imenujemo ga Kraški narivni rob, ki predstavlja mejo med Zunanjimi Dinaridi in Jadranskim predgorjem. Zato se vzporedno obdeluje tudi nagubane plasti v Strunjanu, arhivirane podatke rudnika premoga v Sečovljah in hidrogeološke vrtine na območju Tržaško-Koprske sinklinale.

Dosedanje védenje o zgradbi Kraškega narivnega roba je izhajalo iz podatkov Osnovne geološke karte, po kateri je rob Kraške planote naluskan v sistem narinjenih gub ob bolj ali manj strmih reverznih prelomih, ki se v jugozahodnem krilu Čičarijske antiklinale raztezajo v dinarski smeri proti jugovzhodu. Na območju Učke pa naj bi nastopali tudi krovni narivi. Na podlagi analize premikov Trnovskega in Hrušiškega pokrova ter Snežniške narivne grude je bila postavljena hipoteza o eksponencialni zakonitosti narivanja Zunanjih Dinaridov tega dela Slovenije (Placer 1981) po kateri je bila določena skupna dolžina luskanja Kraškega narivnega roba v profilu Hrušica – Tržaški zaliv okoli 4 km. Raziskave mezozojskih sedimentov vzhodne Furlanije pa so pokazale na možnost, da bi jurski in kredni pelagični sedimenti s tega območja lahko prvotno tvorili enoten sedimentacijski bazen z enakimi sedimenti srednjega in južnega Jadrana (Cati et al. 1989). Danes naj bi bil ta bazen prekrit z narivi Kraškega narivnega roba. Tako zastavljena hipoteza terja izdatnejši premik Istre nasproti Zunanjim Dinaridom in ima oporo v interpretacijah številnih geologov, ki so razlagali zamik Istre nasproti Kvarnerskim otokom z desnim premikom ob prelomu vzdolž vzhodne istrske obale ali pa brez preloma, le s povijanjem nagubanih in narinjenih struktur. Vzporedno s sedimentnimi so potekale tudi stratigrafsko-paleontološke raziskave in nakazovale razliko v razvoju posameznih strukturnih enot Istre nasproti Zunanjim Dinaridom (Drobne, 2000). Našteta dejstva se ujemajo s hipotezo Romandića (1990) o rotaciji Istre v nasprotni smeri urinega kazalca in njenim pomikom proti severovzhodu.

Vse to terja ovrednotenje naštetih domnev, zato je strukturna spremljava avtocestnega odseka Kozina – Srmin prvovrstna raziskovalna priložnost. Na podlagi dosedanjih ugotovitev je mogoče skleniti, da vključuje Kraški narivni rob več faz premikov od katerih predstavlja luskanje v zvezi z eksponencialno odvisnostjo krovnih narivov Trnovskega cikla le eno, najstarejšo fazo v nizu deformacij, ki poleg luskanja vključujejo še obsežno podrivanje in zmikanje. Ti premiki niso lokalnega značaja, temveč so odraz spreminjajočih se odnosov med Jadranskim predgorjem in Zunanjimi Dinaridi od konca eocena do danes. Poleg tega predstavlja Istra izpostavljeno oglišče rotirajočega bloka večjih dimenzij, ki je porušil prvotno simetrijo narivnega roba Zunanjih Dinaridov med Južnimi Alpami in velebitskim lokom. Navidezno iregularne deformacije v sistemu dinarsko usmerjenih struktur so posledica tega dogajanja.

Strukturna spremljava avtoceste je podrejena standardom kartiranja v merilu 1 : 5000 in večjemu merilu, če je to potrebno, zajema pa tudi širši pas ob avtocesti. Cilj kartiranja je določiti tip deformacij in smer ter velikost premikov, njihovo eno ali večfaznost in podobno. Vodilne strukture se številčijo od prvega preloma na severovzhodu, ki ga je mogoče šteti za deformacijo povezano s Kraškim narivnim robom (Skadanski prelom po vasi Skadanščina pri Kozini) proti jugozahodu. Za vsak tip pomembnejših deformacij (normalni prelom; reverzni prelom; zmični prelom; položni nariv; prelom z večfaznimi premiki n.pr. 1. zmični premik, 2. vertikalni premik; prelom nedoločljivega značaja in podobno) je številčenje vodeno posebej. Od Kozine peko Srmina, Izole, Strunjana in Sečovelj do Savudrijskega tektonskega hrbta izdelujemo referenčni profil, ki bo podlaga za konstrukcijo profilov severozahodno od tod preko globokih vrtin v vzhodni Furlaniji in jugovzhodno od tod preko tektonskih oken in krp v okolici Učke. Na območju Istre je na voljo nekaj deset hidrogeoloških vrtin, ki jih vključujemo v interpretacijo. Iz profilov in zaporedja deformacij bo mogoče izdelati model geneze Kraškega narivnega roba od konca eocena do današnjih dni in določiti njegovo vlogo v recentni dinamiki tega prostora. Ker nastanek Kraškega narivnega roba ni izoliran fenomen, ugotovitve vplivajo na interpretacijo širšega prostora.

Preliminary results of structural profiling of the Kras edge and Istria (Kozina – Srmin Motorway, Sečovlje)

In the frame of the Natural Heritage Program financed by the Motorway Construction Authority of Republic Slovenia (DARS), a systematic geologic accompanying of excavation works at construction of the new motorway between Kozina and Srmin is being conducted. Since the motorway trace passes across the entire Kras edge that is one of important natural features of the Slovenian territory, the structural geologic accompanying of the construction site was planned as a careful study of the entire folded and thrust faulted structure. In geologic sense it comprises a wider area of the edge and extends from about Kozina to the Savudrija horst. The structure is called the Kras thrust edge, which represents the boundary between northwestern part of the External Dinarides and Adriatic foreland. Therefore parallel to this also the folded beds at Strunjan are studied as well as the archive data of the Sečovlje colliery and hydrogeologic boreholes in the area of the Trieste-Koper syncline.

The previous understanding of the structure of the Kras thrust edge has been derived from data of the Basic geologic map 1: 100.000 according to which the Kras plateau edge was thrusted into a system of thrust folds along more or less steep reverse faults that extend in the southwest limb of the Čičarija anticline in the Dinaric direction toward southeast. In the Mt. Učke area also owerthrusts are believed to exist. Based on an analysis of shifts of the Trnovo and Hrušica nappe and the Snežnik thrust sheet the hypothesis of the exponential nature of overthrusting of External Dinarides of this part of Slovenia was proposed (Placer 1981) according to which the total length of thrusting of the Kras thrust edge in the Hrušica – Trieste gulf area was estimated to be about 4 km. Studies of the Mesozoic beds of the eastern Friuli indicated in addition the possibility of an originally uniform sedimentation basin for the Jurassic and Cretaceous pelagic sediments of this area and similar sediments of the central and southern Adriatic (Cati et al. 1989). At present this basin should be covered by thrusts of the Kras thrust edge. Such a hypothesis requires a considerable movement of Istria towards the External Dinarides, and it is supported by interpretations of numerous geologists who explained the movement of Istria with respect to Kvarner islands by a dextral shift along a fault following the eastern Istrian shore, or without a fault, only by bending of the folded and thrust structures. Parallel with sedimentation studies also stratigraphic-paleontologic studies were performed. They indicated a difference in the development of individual structural units of Istria with respect to External Dinarides (Drobne, 2000). The listed facts are consistent with Romandić's (1990) hypothesis on anti-clockwise rotation of Istria and its shift towards northeast.

All this requires to elaborate evaluation of the listed hypotheses. Now, with the possibility of structural accompanying of the motorway Kozina – Srmin construction a unique research opportunity is being offered. The results established hitherto permit to make inference about several phases of movements in the Kras thrust edge. In them the reverse faulting associated with the exponential dependence of the nappe structure of the Trnovo cycle represents only a single, the oldest phase in the series of deformations. Besides reverse faulting the latter include also wrench faulting in NW-SE direction and extensive underthrusting of the Istria towards NE. These movements are not of local character, but are an expression of changing relations between the Adriatic foreland and the External Dinarides from end of Eocene to the present. In addition to this, Istria represents the exposed edge of a rotating block of larger size that destroyed the original symetry of the overthrust edge of the External Dinarides between the Southern Alps and the Velebit arc. The seemingly irregular deformations in the system of Dinaric trending structures are the result of this process.

The structural accompanying of the motorway construction is being performed according to standards for mapping at the 1 : 5000 and larger scales, if necessary, and

it covers a broader belt of terrain along the motorway trace. The goal of mapping is to determine the type of deformation, and direction as well as extent of shifts, their unior polyphase nature and the like. The leading structures are numbered from the first fault in southeast that could be considered a deformation associated with the Kras thrust edge (the Skadanščina fault named after the village of Skadanščina near Kozina) towards southeast. The numbering was carried out separately for every type of more important deformations (normal fault; reverse fault; strike-slip fault; low-angle fault; fault with polyphase shifts, e.g. 1. strike-slip shift, 2. vertical shift; fault of undefined nature, and similar). From Kozina across Srmin, Izola, Strunjan and Sečovlje to the Savudrija horst a reference profile is being compiled that shall serve as a base for constructing profiles to northwest from there across the deep boreholes in eastern Friuli, and to southeast of there across tectonic windows and klipps around Mt. Učka. In the Istria region several tens of hydrogeologic boreholes are available, and they are also being included into interpretation. From profiles and succesion of deformations a genetic model of Kras thurst edge from end of Eocene to the present can be set up, and its role in recent dynamics of this area assessed. Since the genesis of the Kras thrust edge is not an isolated phenomenon, the expected results will indubitably contribute also to the structural interpretation of the wider region.

Literatura – References

Cati, A., Sartorio, D. & Venturini, S. 1989: Carbonate platforms in the subsurface. – Mem. Soc. Geol. It. *40* (1987), 295-308, Roma.

Drobne, K. 2000: The North-Western Part of the Adria Carbonate Platform from the K/Tc Boundary to the Flysch Deposition during Paleocene-Eocene. – Riassunti delle comunicazioni orali e dei poster, 80ª Riunione estiva, 231-232, Trieste.

Placer, L. 1981: Geološka zgradba jugozahodne Slovenije (Geologic structure of the suthwestern Slovenia, Abstract). – Gologija *24/1*, 27-60, Ljubljana.

Romandić, S. 1990: Analiza podataka dubokog geoelektričkog sondiranja na području zapadnog dijela Dinarida (Deep geoelectrical sounding data analysis for the western part of the Dinarides). – Nafta *41/78*, 301-372, Zagreb.