CONTACT KARST OF BRKINI HILLS

BRKINSKI KONTAKTNI KRAS

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Izvleček UDK 551.44 (497.12 Brkini)

Mihevc, Andrej: Brkinski kontaktni kras

Vzdolž južnega obrobja flišnega hribovja Brkinov ločeno ponika 17 potokov. Potoki so na tem mestu oblikovali najbolj značilen kontaktni kras v Sloveniji. Reliefne oblike tega kontaktnega krasa kažejo na postopen razpad starega kraškega reliefa. Vanj so se do višine kraške vode poglobile slepe doline, ki imajo korozijsko razširjena dna. Na kraškem površju pa se je ohranilo še nekaj fluvialnih reliefnih oblik. Na nekaterih se odražajo sledovi recentne tektonike.

Ključne besede: krasoslovje, kraška geomorfologija, kontaktni kras, Kras, Brkini, Slovenija

Abstract UDC 551.44 (497.12 Brkini)

Mihevc, Andrej: Brkini Contact Karst

Along the southern border of the flysch Brkini Hills some 17 brooks sink forming the most characteristic contact karst in Slovenia. Relief forms of this contact karst show gradual dissection of former karst relief. Blind valleys with corrosionally widened bottoms developed by strong water table control while some fluvial forms, preserved on the karst surface, show differential tectonic movements.

Key words: karstology, karst geomorphology, contact karst Kras, Brkini, Slovenia

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PREFACE

One of the possible morphological karst classifications is the division according to the main morphological process. Karst relief formed by the influence of the allogenic flow could be designated by the term of the contact karst (Gams 1965).

The term grows familiar in Slovenia on the Classical Karst where the karst contacts non carbonate rocks and marked relief forms developed. The term is reasonable as such karst essentially differs from the karst which surface was formed without such influence. In the international karstological literature such forms and phenomena are treated as karst influenced by allogenic flow (Ford & Williams 1989).

Once the contact karst at the foot of Brkini was treated within the frame of cyclic geomorphological theory. The period of fluvial relief development should be followed by the karstification when the impermeable cover was removed. (Melik 1955, Radinja 1985) At the karstification beginning the superficial streams shortened and the last remains of this pre-karstic phase should be the blind valleys. Various forms of the blind valleys were later contributed to the climatical changes (Roglič 1957). Corrosionally widened and levelled bottom of the blind valleys and also bigger planations spread all over the Dinaric karst should be the result of the warm climate mostly. Cold periods in the Pleistocene accelerated the incision of the valleys, erosion and denudation in the water basins of the superficial rivers. Corrosion capacity of the sinking streams should affected the forms and dimensions of the blind valleys and it depends mostly on the aggressivity and quantity of the allogenic rivers (Gams 1962).

Karst is built by various morhostructural units and each of them is controlled by different conditions of water drainage which is the main morphological factor. It is well reflected there where from the continuous non-carbonate surface the waters flow in various morphostructural units and in spite of rather similar conditions different relief forms of contact karst develop (Mihevc 1990).

GEOLOGICAL AND HYDROLOGICAL PROPERTIES OF THE TREATED AREA

Brkini Hills are built by flysch non-carbonate rocks of the Eocene age consisting of beds of marl, non carbonate sandstones and conglomerates. Flysch rocks build erosionally dissected hills which contact the karst plain on the south western side. This one is built by

Paleocene and Cretaceous limestones dipping steeply below the flysch. The contact of flysch hills and limestones is 20 km long.

From flysch hills to the border limestones 17 separated sinking streams flow, draining altogether 29.2 km^2 of the flysch area. Water basins of the sinking streams vary from 0.5 km^2 to the biggest 13.2 km^2.

The brooks sink in the altitudes between 490 to 510 m a.s.l.. Some ponors continue in the accessible caves ending by the siphons of captured water in the altitudes between 370 to 430 m. The deepest cave is 150 m deep, and the longest is 6 km long.

There are more than hundred vadose caves in the karst plain and in one cave only the water could be reached at 350 m of the altitude.

Water tracing showed the diversion of the sinking streams water into three groups of springs. The lowest are along the coast in the Kvarner Bay and the highest are the Rižana springs at 70 m a.s.l.

MORPHOLOGICAL PROPERTIES OF THE CONTACT KARST

Characteristical forms of the Brkini contact karst are blind valleys with corrosionally widened bottom. A characteristic example of such valley is Odolina blind valley.

The blind valley was formed by the sinking stream draining 4.3 km^2 large water basin. The average discharge of the brook is about 15 l/s, but oscillations due to precipitation regime are frequent. The floods are rare and reach the narrow belt along the brook only. Periodical water hardness measurements indicated 111 mg of dissolved carbonates originating from the flysch marls.

Close to the brook's passage to the limestones the narrow fluvial valley widens. A valley, 1 km long and 300 m wide, developed on the limestones. Close to the contact it is 150 m deep and on the southern end it is deepened into the karst plain for 60 m.

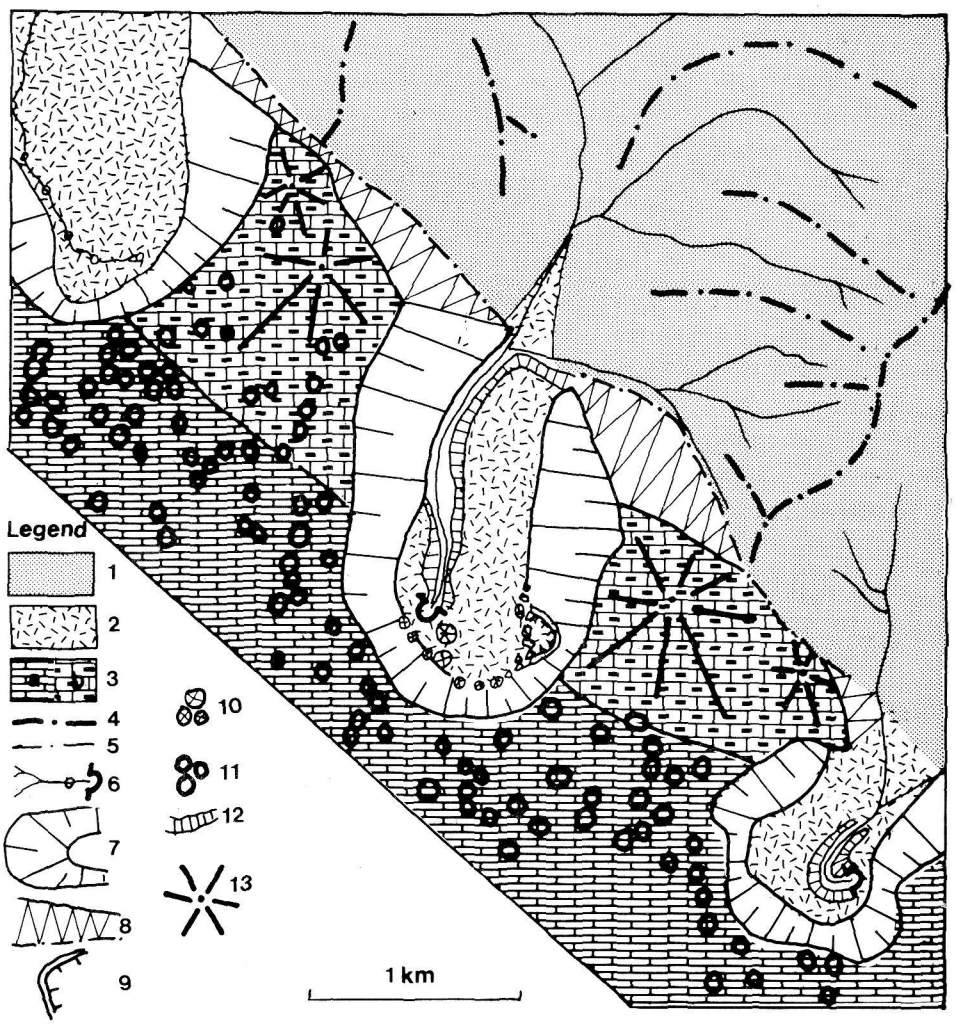
Fig. 1.: Morhological sketch of the Odolina blind valley. Legend: 1. surface on flysch, 2. blind valley bottom - flat corrosion widened surface covered with sediments on limestone, 3. surface on limestone, a. Matarsko podolje karst plain, with solutional dolines as dominant form, b. surface with dominant conical hills, 4. watershed, 5. contact flysch - limestone, 6. brooks with ponors and ponor caves, 7. slope of blind valley, 8. slope formed along the lithological contact, 9. ponor steephead, 10. alluvial dolines and sinkholes, 11. solutional dolines , 12. edges of alluvial terraces in the bottom of blind valley, 13. conical hill.

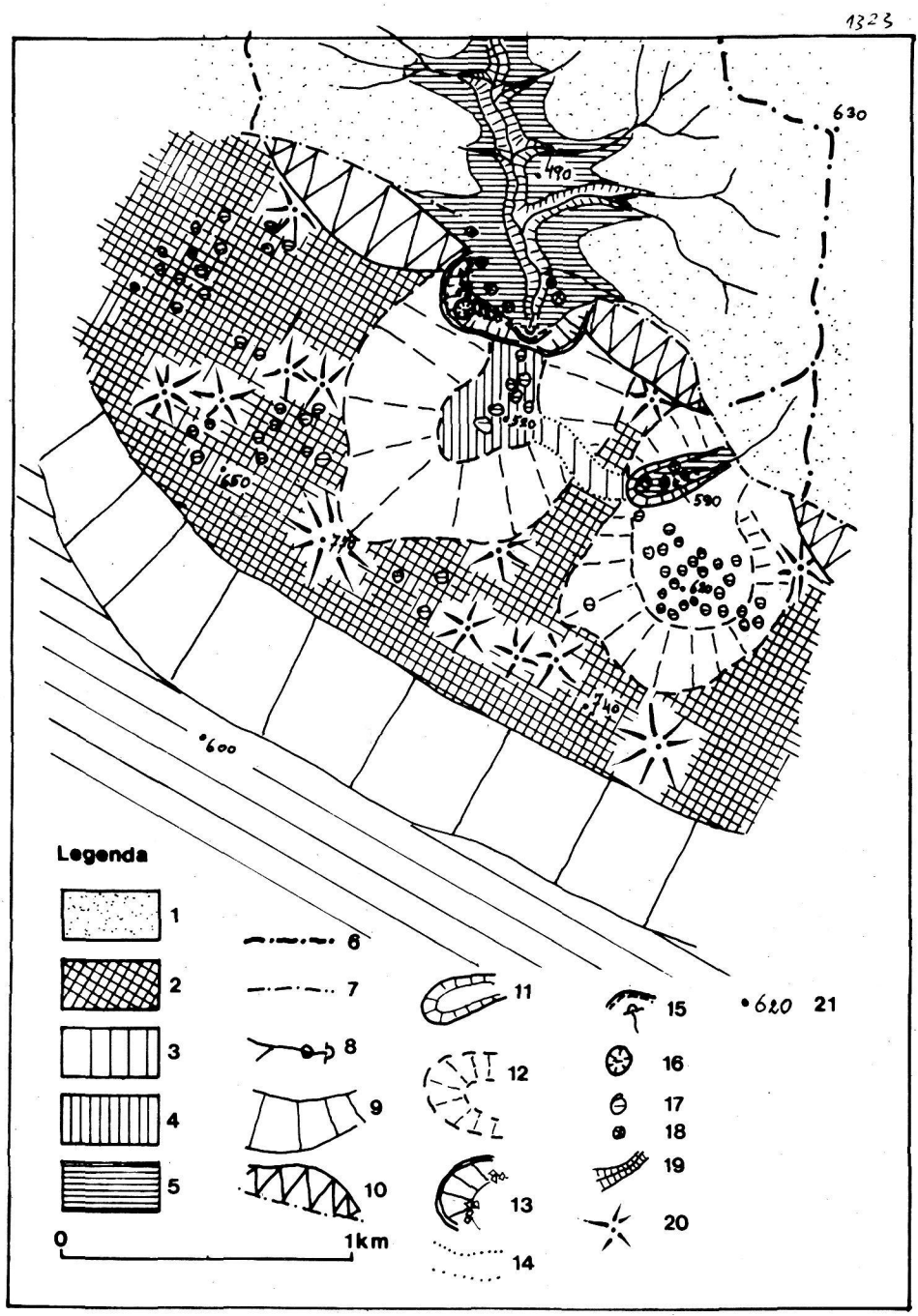
Sl. 1: Geomorfološka skica slepe doline Odoline in sosednjih dveh slepih dolin. Legenda: 1. površje na flišnih kamninah, 2. ravna naplavljena dna slepih dolin 3. površje na apnencu a. Matarsko podolje z vrtačami kot dominantno kraško obliko, b. površje s prevladujočimi kopasrtimi hribi 4. razvodnice na flišu, 5. kontakt fliša in apnenca, 6. vodni tokovi s ponori in ponornimi jamami, 7. pobočje slepe doline, 8. pobočje, oblikovano v apnencih na stiku s flišem, 9. strmejša zatrepna stena, 10. aluvialne vrtače in grezi, 11. vrtače, 12. ježe akumulacij v dnu slepih dolin, 14. kopasti vrh.

The valley's bottom is covered by the sediments, gravels and sands. Flood plain is cut by some younger, up to 25 m deep alluvial ponors and sinkholes and riverbed of the brook, sinking in the final part of the valley. In the sinkholes and in the riverbed the rocks are exposed having the relief below the sediments ranging up to 20 m (Fig. 1).

During the normal water level the brook sinks in the riverbed immediately after the passage to the limestones, during higher water level it flows into 117 m deep ponor cave composed by potholes and shorter channels. The cave is basically phreatic with strong traces of vadose transformation. It ends by the siphon of caught water on 370 m a.s.l.

Beside some blind valleys where the brooks sink there are some fossil blind valleys with corrosionally widened bottom without existing brook. It was either captured by other brook or the brook formed clearly separated shorter blind valley with corrosionally widened bottom, as is it the case with Račiška dana blind valley (Fig. 2).

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The Matarsko podolje is 20 km long and 2-5 km wide. Lowered surface is not a base-levelled plain, cross sections indicate that the bottom, disseminated by the dolines, is inclined southwestwards. In the longitudinal section the lowered surface gently raises from about 490 m on NW to 650 m on SE side. The lowered surface continues towards SE but from the highest point near the blind valley Brdanska dana it lowers on the distance of 2 km for 200 m.

The geomorphological sketch of the entire contact indicates a certain diversity of the forms of the brooks flowing from the flysch.

The first sinking streams in a series flow to the border limestones in the altitudes about 500 m in the lowest, NW part of the lowered surface. These brooks, for instance the brook Krvavi potok have deeply cut riverbeds in flysch but did not form the blind valley on the limestone. It sinks in his own riverbed on the levelled surface (Figs. 3, 4).

Most of the brooks namely developed blind valleys with corrosionally widened bottom. The bottoms of these valleys are situated between 490 to 510 m. As the valleys are incised in the border of the karst, uplifted towards SE, the blind valleys lying more to the south are deeper. The first deepened blind valley is cut for 50 m only while the deepest is the last one, deepened into border limestones for 250 m and its bottom lies 120 m below the bottom of the lowered surface.

CONCLUSIONS

The Brkini series of blind valleys with corrosionally widened bottoms with its situation along the karst plain, upraised lowered surface and some relief forms offer enough data to indirectly classify the sequence of the morphological events and dominant factors which were decisive for the formation of the actual relief forms.

Fig. 2.: Morhological sketch of the Račiška dana valley. Legend: 1. surface on flysch, 2. surface on limestone- Gradine, 3. limestone surface of Matarsko podolje, 4. Bottom ob fossil blind valley, 5. sediments in the bottoms of blind valleys, 6. watershed, 7. contact flysch - limestone, 8. brooks with ponors and ponor caves, 9. slope betveen Gradine and Matarsko podolje, 10. slope formed along the lithological contact, 11. Blind valley of Zavnja brook, 12. blind valley of Račiška dana, 13. ponor steephead, 14. blind valley of Zavnja, 15. vall in the ponor steephead, 16. collapse doline, 17. solutional dolines, 18.aluvial sinkhole, 19. edges of alluvial terraces in the bottom of blind valley, 20. conical hill.
Sl. 2: Geomorfološka skica kontakta pri Račiški slepi dolini. Legenda: 1. površje na flišnih kamninah, 2. kraške Gradine 3. Matarsko podolje, 4. dno fosilne slepe doline Račiške ponikalnice, 5. flišna naplavina v slepih dolinah, 6. površinska razvodnica, 7. kontakt fliša in apnenca, 8. vodni tokovi s ponori in ponornimi jamami, 9. pobočje Gradin nad Matarskim podoljem 10. pobočje oblikovano v apnencih na stiku s flišem, 11. slepa dolina Zavnja, 12. fosilna slepa dolina Račiške ponikalnice, 13. ponorni zatrep 14. dno suhe doline Zavnje, 15. stena in ponor v ponornem zatrepu, 16. udornica, 17. vrtača 18. aluvialni grez, 19. ježa v flišni naplavini 20. kopasti vrhovi 21. značilna višina površja.

The former shape along the ponors on the border of impermeable hills was karst corrosional plain. The water flowing on it had modest gradient in karst and was capable of the aplanation of the surface only.

The lowering of the piezometric level in the karst enabled the development of the relief depressions along the ponors. The deepening and the contemporaneous widening of the

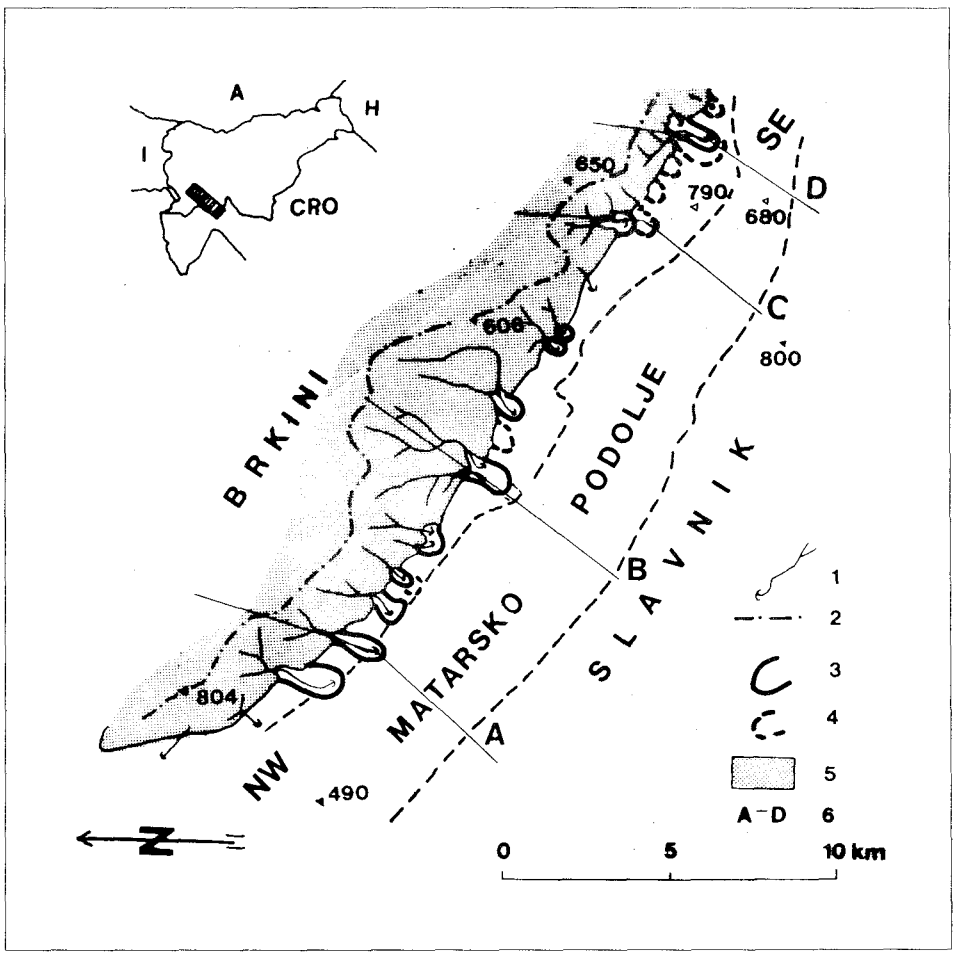

Fig. 3.: Geomorphological sketch of the contact karst at the foot of Brkini. Between Brkini hills and corrosion plain Matarsko podolje is narrow belt of higher relief formed in limestones. Legend: 1. Brook with sinkhole, 2. watershed, 3. blind valley, 4. fossil blind valley, 5. flysch, 6. cross section over blind valleys.

Sl. 3: Geomorfološka skica kontaktnega krasa ob robu Brkinov. Med Brkini in Matarskim podoljem je na apnencih ozek pas višjega reliefa. Legenda: 1. Potok s ponori, 2. razvodnica, 3. slepa dolina, 4. fosilna slepa dolina, 5. fliš, 6. profili čez slepe doline.

valleys followed the lowering of the karst water to the altitudes about 500 m. Bad permeability of the karst caused the deposition of the sediments in front of ponors and the deposits affected the planation and corrosion of the bottom of the blind valleys. The sedimentation was extremely intensive in the cold periods of the Quaternary and these deposits are preserved on the bottom of most of the blind valleys.

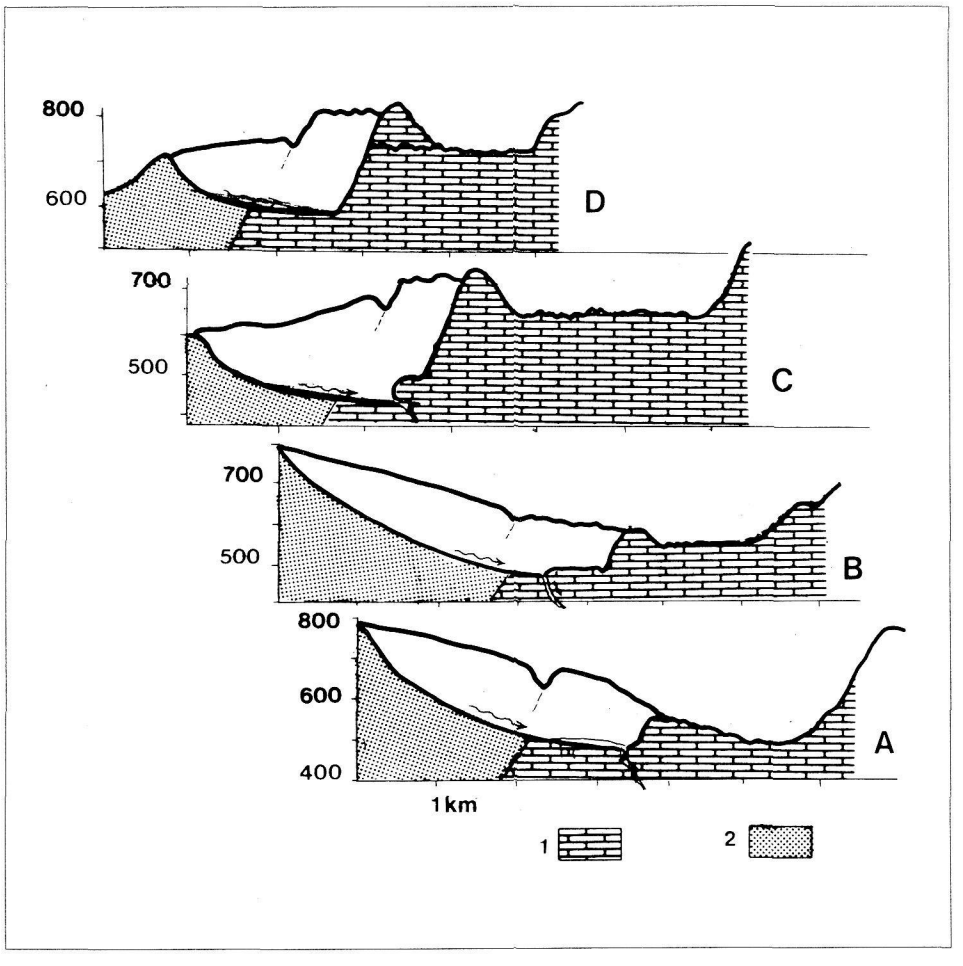

Fig. 4: Cross sections over the catchment areas of the sinking streams on flysch, blind valleys of the sinking streams and the bottom of Matarsko podolje. Blind valleys: A Odolina, B Jezerina, C Račiška dana, D Brdanska dana. Legend: 1. limestone, 2. flysch.
Sl. 4: Profili čez povodja ponikalnic na flišu, slepe doline in dno Matarskega podolja. Slepe doline: A Odolina, B Jezerina, C Račiška dana, D Brdanska dana. Legenda: 1. apnenec, 2. fliš.