

JERZY BUTRYM (LUBLIN), WITOLD ZUCHIEWICZ (KRAKÓW)

ON NEW SITES OF SOLIFLUCTION AND DELUVIAL (WASHOUT) DEPOSITS IN THE ROŻNÓW FOOTHILLS, OUTER WEST CARPATHIANS

INTRODUCTION

The paper deals with Quaternary slope deposits occurring in the Rożnów Foothills, Outer West Carpathians (Fig. 1). Special attention has been given to critical evaluation of the results of thermoluminescent datings.

STATE OF KNOWLEDGE

Quaternary deposits covering floors and sides of valleys of the Dunajec river and its tributaries have been studied by Uhlig (1888), Szajnocha (1902), Sokołowski (1935), Klimaszewski (1937, 1948, 1961, 1967), Kozikowski (1953), and Starkel (1972, 1988). In the last decade, detailed geomorphic and geological studies were carried out by Zuchiewicz (1983, 1984), who dealt mainly with Quaternary fluvial covers and the development of river terraces. Aeolian and washout deposits in southern part of the Rożnów Foothills were described by Butrym and Zuchiewicz (1985, in print) and Butrym *et al.* (in print), whereas results of malacological studies of loess-like covers were presented by Alexandrowicz and Zuchiewicz (1988, in print).

GEOLOGIC AND GEOMORPHIC SETTING

The area under study (Fig. 1) belongs to the Rożnów Foothills, developed on rocks that compose the Silesian, Grybów (Dukla s.l.), and Magura thrust sheets, built up from flysch complexes of differentiated age (Cretaceous through Oligocene) and resistance to erosion.

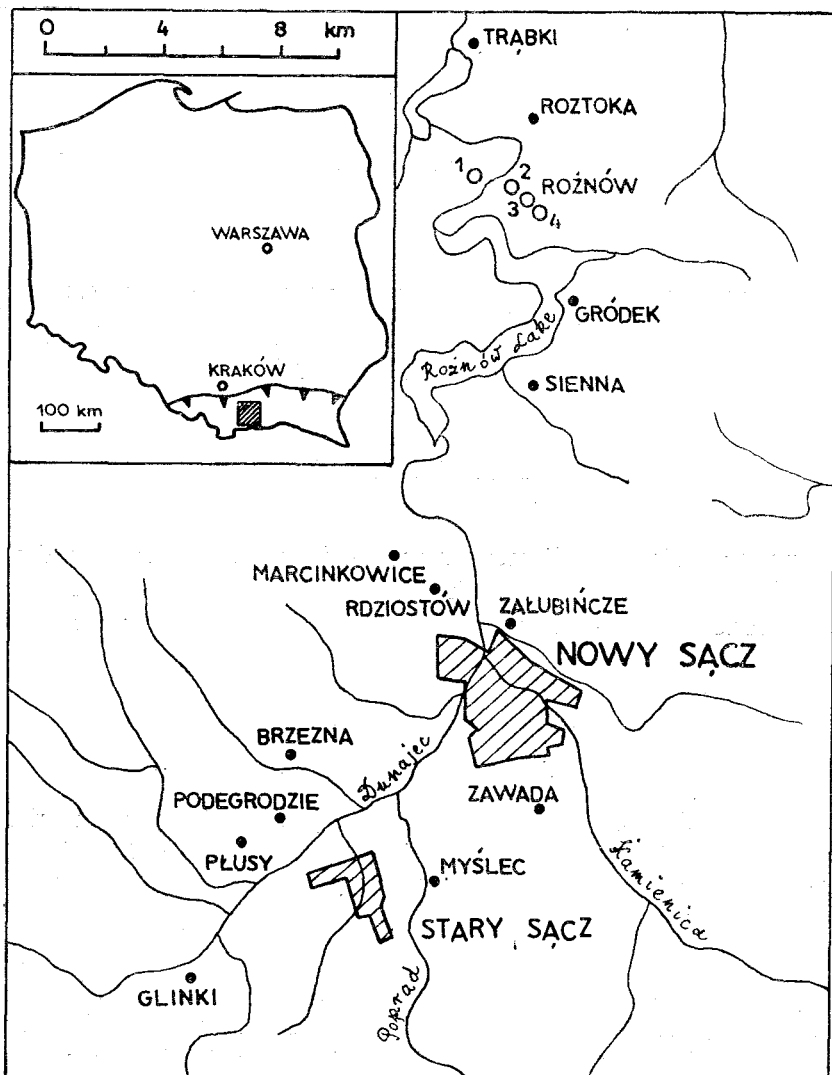


Fig. 1. Localization sketch showing place names mentioned in the text. 1—4: sites of solifluction-deluvial deposits of the Rożnów area, dated by the TL method at: 1 — 42 ± 6 ka BP (Lub-819), 2 — 60 ± 9 ka BP (Lub-818), 3 — 71 ± 10 ka BP (Lub-817), 4 — 51 ± 7 ka BP (Lub-816)

Ryc. 1. Szkic lokalizacyjny. 1—4: stanowiska osadów soliflukcyjno-deluwialnych w rejonie Rożnowa, datowanych metodą TL: 1 — 42 ± 6 ka BP (Lub-819), 2 — 60 ± 9 ka BP (Lub-818), 3 — 71 ± 10 ka BP (Lub-817), 4 — 51 ± 7 ka BP (Lub-816)

The region in question is composed of a number of ridges (400—450 m a.s.l.) separated by valleys of the Dunajec river and its tributaries, attaining up to 250 m in depth. The valley sides bear flights of rock-cut, erosion-accumulational and cut-and-fill terraces formed, as re-

cently supposed (Butrym, Zuchiewicz in print), during the Otwock, Narew, Nida, San, Odra, Warta, Vistula, and Holocene stages. Most of these terraces is overlain by solifluction, washout and/or loess-like deposits. The convex-concave slopes of interfluvial ridges are modelled by numerous landslides, landslumps and landslips, some of them showing manifestations of recent activity.

SOLIFLUCTION-DELUVIAL (WASHOUT) DEPOSITS

These covers are widespread throughout the Rożnów Foothills, occurring at talus feet and within dellen. Their thickness ranges from 2–3 to 5–8 m.

Solifluction covers, 2–6 m thick, overlie and/or intertongue with alluvia of terraces formed during glacial stages. These are sandy, sand-clayey, and sand-silty loams, clays and sandy silts, containing fragments of disintegrated shales and/or flat, angular sandstone scraps, 2–5 to 8–15 (20–30) cm in diameter, aligned parallel to the slope surface. They occur within near-slope parts of fluvial covers, as-

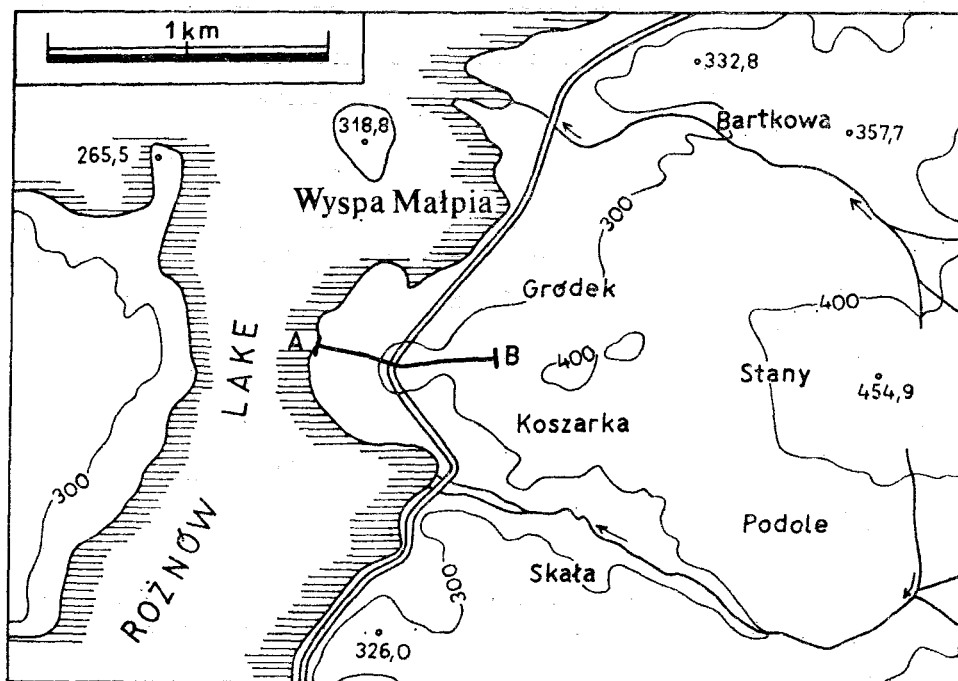


Fig. 2. Topographic sketch of the Gródek area

Ryc. 2. Szkic topograficzny rejonu Gródka nad Dunajcem

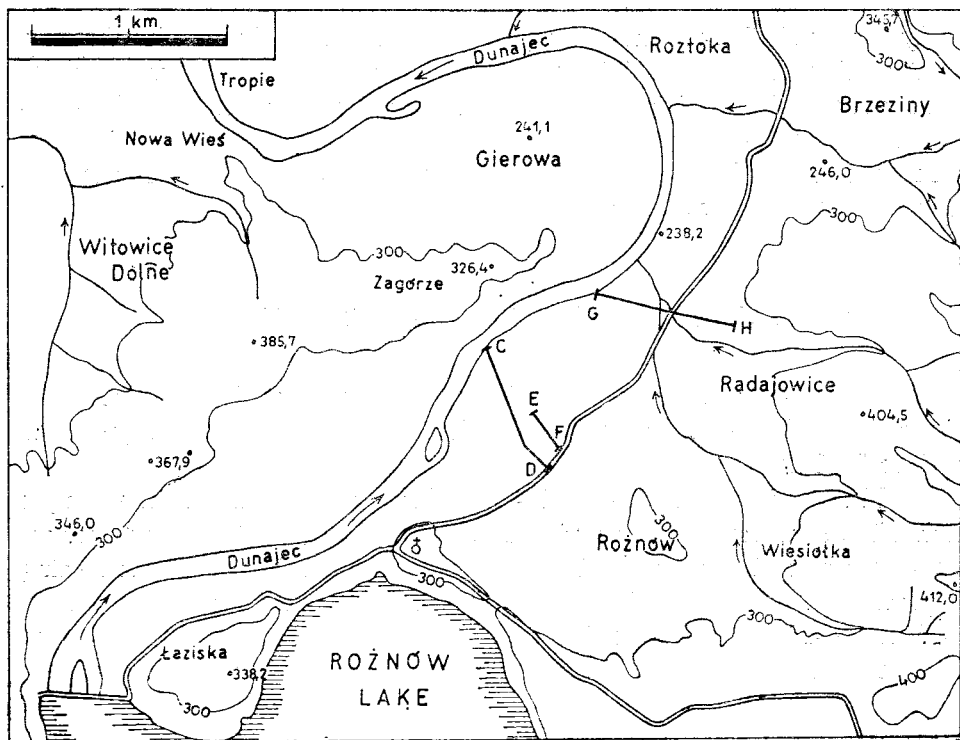


Fig. 3. Topographic sketch of the Rożnów area

Ryc. 3. Szkic topograficzny rejonu Rożnowa

sociated with the Narewian, Nidanian, Sanian, Odranian, Wartanian, and Vistulian stages.

The oldest TL-dated solifluction loams comprise deposits occurring on top of a gravel series of the South-Polish terrace at Gródek (Figs. 2, 4). These deposits date back to the Odra glacial stage. Solifluction covers are best exposed at Rożnów, overlying a gravel series of the Odranian terrace (Figs. 3, 5). The section discloses a 2—3 m thick solifluction deposits, overlying 2—4 m thick gravels of the Dunajec river terrace, resting on a 16—18 m high rock socle, built up from the Godula beds (Fig. 4, section D). The gravel series is here overlain by (from the bottom upwards):

- 0.00—0.60 m very fine-grained sands with angular sandstone debris, 2 cm in diameter
- 0.60—0.86 very fine to fine-grained, light-brown sands with a subordinate amount of angular debris of the Godula sandstones, 0.4—1.5 (3) cm in diameter
- 0.86—1.06 dark-yellow, fine-grained sands bearing infrequent sandstone debris, ϕ 0.5—4 cm, and small shale fragments, 0.5—1.5 cm in diameter

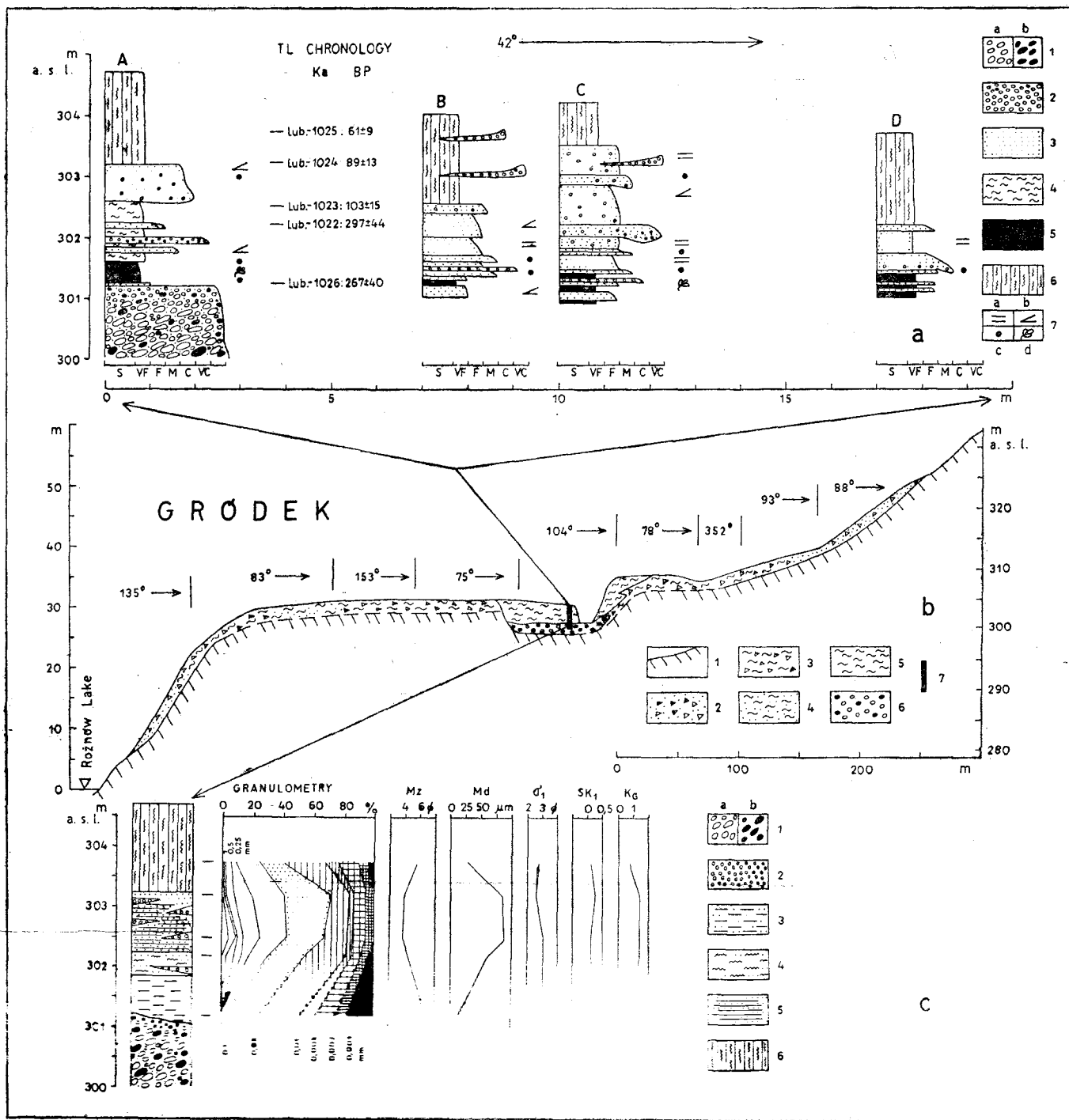


Fig. 4. Section across the Dunajec valley side at Gródek. a — sedimentological logs: 1 — fluvial gravels (flysch-derived, Tatra-derived), 2 — fine quartz gravel, 3 — sands, 4 — loams, 5 — silts, 6 — loess, 7 — sedimentary structures: a — parallel lamination, b — cross-lamination, c — Fe-Mn concretions, limonitic hardpans, d — plant intergrowths; b — cross-section: 1 — rock socle, 2 — waste-cover rock debris and sands, 3 — solifluction loams bearing angular rock debris, 4 — sandy loams, 5 — sand-silty loams, 6 — fluvial gravels, 7 — localization of the section shown in diagram (c). Lithological log (c): 1 — fluvial gravels (flysch-derived, Tatra-derived), 2 — fine quartz gravel, 3 — muds, 4 — sandy silts, 5 — laminated sands, 6 — loess

Ryc. 4. Przekrój przez prawe zbocze doliny Dunajca w Gródku. a — profile sedimentologiczne: 1 — żwiry rzeczne (fliszowe, tatrzańskie), 2 — drobny żwir kwarcowy, 3 — piaski, 4 — gliny, 5 — pyły, 6 — less, 7 — struktury sedimentacyjne: a — laminacja pozioma, b — laminacja przekątna, c — konkretcje Fe-Mn oraz naloty limonityczne, d — przerosty roślinne; b — przekrój: 1 — cokół skalny, 2 — rumosz i piaski zwietrzelinowe, 3 — gliny soliflukcyjne z rumoszem, 4 — gliny piaszczyste, 5 — gliny piaszczysto-pylaste, 6 — żwiry rzeczne, 7 — lokalizacja przekroju przedstawionego na diagramie (c). Profil litologiczny (c): 1 — żwiry rzeczne (fliszowe, tatrzańskie), 2 — drobny żwir kwarcowy, 3 — muły, 4 — pyły piaszczyste, 5 — laminowane piaski, 6 — less

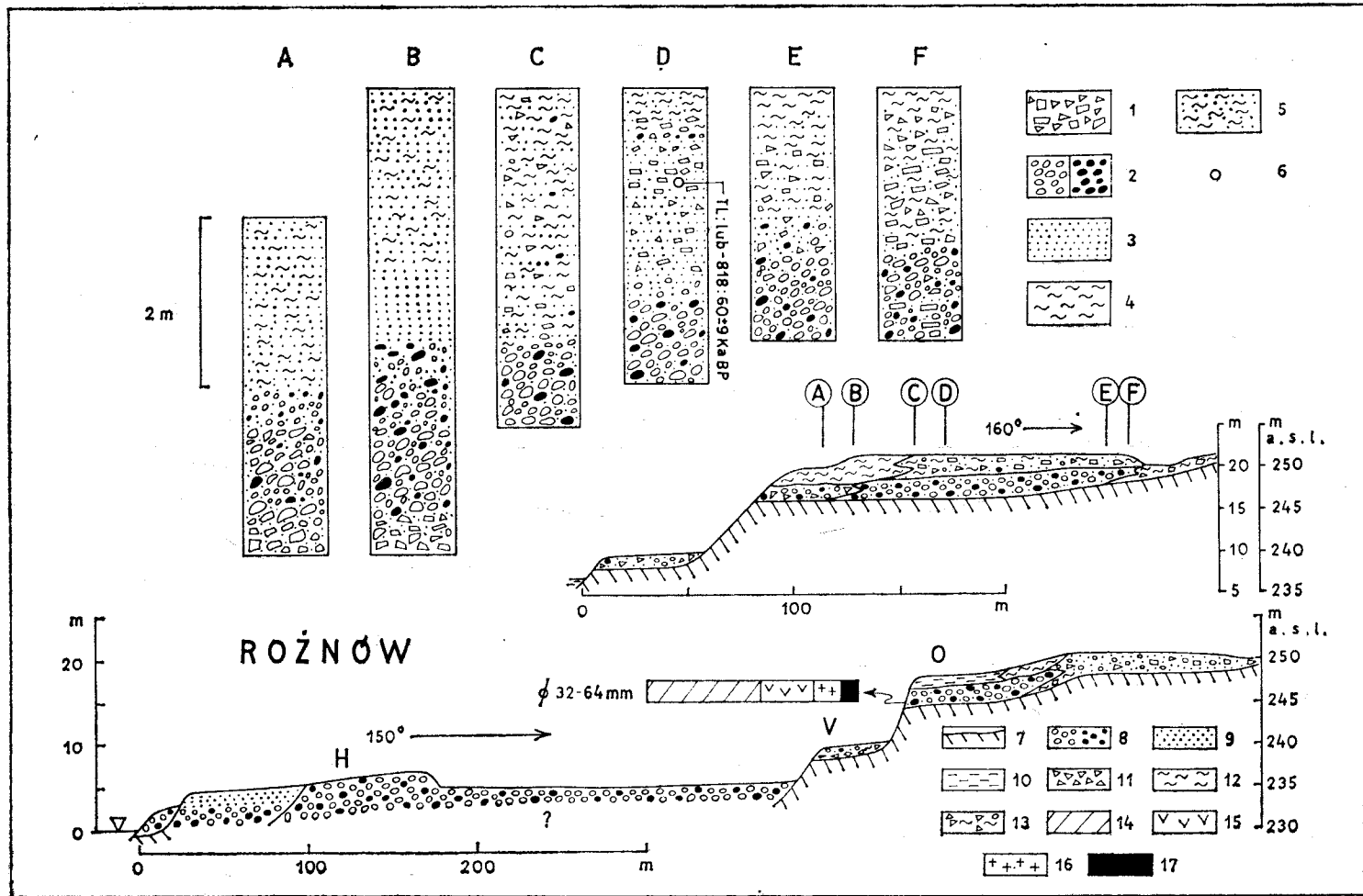


Fig. 5. Sections across the right Dunajec valley side at Rożnów (C—D: lower, E—F: upper). Lithological logs: 1 — rock debris, 2 — fluvial gravels (flysch-derived, Tatra-derived), 3 — sands, 4 — loams, 5 — sandy loams, 6 — TL-dated samples. Cross-sections: 7 — rock socle, 8 — fluvial gravels (flysch-derived, Tatra-derived), 9 — sands, 10 — muds, 11 — angular rock debris, 12 — washout loams, 13 — solifluction loams bearing debris; Petrographic composition: 14 — sandstones, 15 — quartzites, 16 — granites, 17 — others

Ryc. 5. Przekroje przez prawe zbocze doliny Dunajca w Rożnówie (C—D: dolny, E—F: górny). Profile litologiczne: 1 — rumoszcz skalny, 2 — żwiry rzeczne (fliszowe, tatrzańskie), 3 — piaski, 4 — gliny, 5 — gliny piaszczyste, 6 — próby datowane TL. Przekroje: 7 — cokół skalny, 8 — żwiry rzeczne (fliszowe, tatrzańskie), 9 — piaski, 10 — muły, 11 — rumoszcz skalny, 12 — gliny deluwialne, 13 — gliny soliflukcyjne z rumoszczem. Skład petrograficzny: 14 — piaskowce, 15 — kwarcyty, 16 — granity, 17 — inne

- 1.06—1.20 m dark-yellow fine-grained sands, TL-dated at 60 ± 9 ka BP (Lub-818)
- 1.20—1.64 poorly cemented, dark-yellow fine-grained sands with angular sandstone fragments, ϕ 0.2—1 to 3—6 cm, and shale clasts, ϕ 0.5—2 cm, aligned parallel to the slope surface
- 1.64—1.70 grey and yellow silty loams, cemented, rusty at places, non-calcareous, bearing isolated, 4—5 cm in diameter, well-rounded and moderately weathered granitic pebbles, mixed with angular debris, ϕ 0.3—3 cm
- 1.70—1.90 grey, yellow and rusty when weathered, silty loams with shale fragments, 2—5 cm in diameter, and fine sandstone debris, ϕ 0.3—1 to 2—6 cm, aligned parallel to the slope surface
- 1.90—2.20 dark-yellow silt-sandy loams.

On the right side of the Dunajec valley at Rożnów-Radajowice (Fig. 6, section A), there crop out solifluction deposits that mantle a gentle slope, surrounding the erosion-accumulational Odranian terrace:

- 0.00—0.50 m fine angular sandstone debris, 0.5—2 cm in diameter, interspersed within dark-brown sandy loams
- 0.50—0.85 light-bluish, fine-grained sands bearing infrequent fragments of the Godula sandstones, ϕ 0.2—0.5 to 2—5 cm, aligned parallel to the slope surface. Sands are poorly cemented by CaCO_3 and show numerous plant intergrowths
- 0.85—1.05 carbonate-cemented, fine-grained and silty sands, containing numerous sandstone fragments, 1—6 cm in diameter, averaging at 4 cm, aligned parallel to each other
- 1.05—1.30 light-brown sandy loams bearing infrequent sandstone fragments, ϕ 2—4 cm, some of them being partly rounded
- 1.30—1.35 light-brown, fine-grained and silty sands bearing infrequent, parallel oriented, sandstone debris, 1—4 cm in diameter
- 1.35—1.50 brown sandy loams, containing fine angular debris, ϕ 0.5—3 cm, aligned parallel to the slope surface.

TL ages of solifluction loams at Rożnów point to the older pleniglacial of the last cold stage (Lub-816: 51 ± 7 ka BP, Lub-818 60 ± 9 ka BP). These deposits occur, most frequently, on slopes built up from poorly resistant shale and shale-sandstone flysch complexes.

Washout (deluvial) deposits mantle talus feet and encroach upon river terraces, their thickness ranging from 5 to 8 m.

The 2—4 m thick gravel series of the South-Polish stage at Gródek, occurring at an altitude of 298 m a.s.l. (26 m above the Rożnów Lake

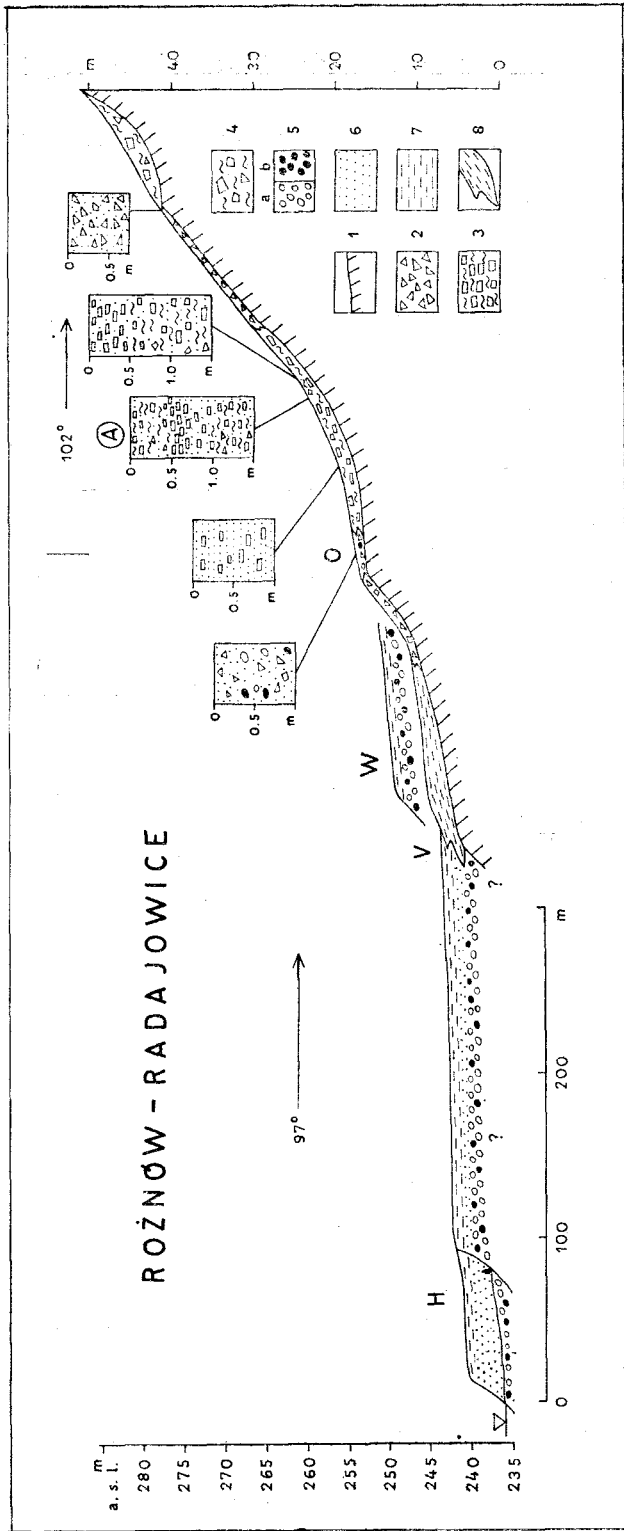


Fig. 6. Section across the right Dunajec valley side at Rożnów-Radajowice (cf. Fig. 3, G—H). 1 — rock socle, 2 — angular rock debris, 3 — solifluction cover, 4 — landslide colluvia, 5 — fluvial gravels (a — flysch-derived, b — Tatra-derived), 6 — sands, 7 — muds, 8 — alluvial fan deposits. Letter symbols: O — Odranian stage, W — Wartanian stage, V — Vistulian stage, H — Holocene

Ryc. 6. Przekrój przez prawe zbocze doliny Dunajca w Rożnowie-Radajowicach (por. Ryc. 3 G—H). 1 — cokół skalny, 2 — rumosz ostrokrawędzisty, 3 — pokrywy soliflukcyjne, 4 — kolumnia osuwiskowa, 5 — kolumnia osuwiskowa, 5 — żwiry rzeczne (a — flyszowe, b — tatrzańskie), 6 — piaski, 7 — muły, 8 — osady stożków napływowych. Symbole literowe — piętra: O — Odra, W — Warta, V — Wisła, H — holocen

average level), is covered by solifluction-washout deposits, attaining 5 m in thickness (Figs. 2, 4):

- 0.00—1.20 m series composed of well to moderately rounded pebbles, densely packed and strongly limonitized. Their petrographic inventory includes the Magura, Cieżkowice and Krosno sandstones, alongside with strongly weathered, Tatra-derived granites and very well rounded and well-preserved Werfenian quartzites. Pebbles derived from flysch complexes are very poorly rounded, flat and discoidal; they reveal poorly developed imbrication and poor sorting measures. The pebbles are 5—10 to 15—16 cm in diameter and rest within fine gravel, ϕ 1—2 cm, and coarse- to medium-grained sands, being mixed with fine weathered granitic debris
- 1.20—1.21 Fe-Mn hardpan
- 1.21—1.25 light-yellow, very fine-grained and silty sands, dated by the TL method at 267 ± 40 ka BP (Lub-1026)
- 1.25—1.27 sands as above, strongly ferruginous
- 1.27—1.33 grey sandy muds, rusty when weathered, bearing plant intergrowths
- 1.33—1.35 ferruginous sandy muds
- 1.35—1.60 light-grey sandy muds
- 1.60—2.60 silt-sandy loams with infrequent intercalations of fine- to medium-grained sands and fine, angular sandstone and quartz debris, 0.5 to 1.5 cm in diameter.
TL dates: 2.25 m Lub-1022 297 ± 44 ka BP
2.50 m Lub-1023 103 ± 15 ka BP
- 2.60—3.20 coarse- to medium-grained sands with isolated quartz grains, ϕ 0.2—1 cm, derived from the Cieżkowice sandstones exposed higher upslope
- 3.20—4.70 sand-silty, cemented loess-like deposits, TL dated at:
3.20 m Lub-1024 89 ± 13 ka BP
3.75 m Lub-1025 61 ± 9 ka BP.

A peculiar TL-date inversion, found in the lower part of the section, may result from a too short downslope transport route of the clastic material.

On the left side of the Dunajec river valley at Rożnów, shortly north of the water-dam (Fig. 1), there occurs a 16 m high bench situated beneath a landslide slope, covered by 3.5 m thick deluvia. These are light-brown sandy loams, underlain by angular debris of the Istebna sandstones. Higher upslope (250 m a.s.l., 26 m above the Dunajec river bed), these loams pass gradually into grey, yellow-rusty when weathered, cemented sandy silts, dated at 42 ± 6 ka BP (Lub-819).

South of the meander hill at Rożnów (Fig. 1), at the outlet of a small

gully, the following section of washout deposits (290 m a.s.l.) has been found (from the bottom upwards):

- | | |
|-----------|---|
| 0.0—2.5 m | regolith cover composed of loams and sandstone debris, overlying exposures of the Godula beds |
| 2.5—3.0 | light-brown, very fine-grained sands, bearing infrequent angular debris, 3—5 cm in diameter |
| 3.0—4.3 | light-brown sandy loams |
| 4.3—4.9 | very fine-grained sands, horizontally laminated, grey, yellow and rusty when weathered, muscovitic. Some of laminae strongly cemented with limonite. Numerous carbonate concretions, 1—4 cm in diameter, also visible. TL date: 71 ± 10 ka BP (Lub-817) |
| 4.9—6.3 | sands as above, strongly limonitized |
| 6.3—8.0 | light-yellow, very fine-grained and silty sands. |

Lower parts of valley sides of gullies dissecting the left side of the Wiesiółka stream valley at Rożnów, are mantled by 3—4 m thick, light-grey sands and sandy silts, dated at the bottom at 51 ± 7 ka BP (Lub-816), and covered by 0.5—1 m thick layer of dark-yellow sandy loams.

The described washout deposits occur either on top of solifluction loams (Figs. 4, 5) or overlie fluvial series (Fig. 7). At some places, they also over- and underlie loess-like sediments. Deluvial covers are represented by vari-grained sands, silty sands, sandy and sand-silty loams, as well as sandy silts (Figs. 8, 9). These deposits are usually poorly sorted and contain a relatively small amount of silt (12—16%).

AGE IMPLICATIONS

Washout covers mantle fluvial deposits laid down during the Narewian (Trąbki), Sanian (Gródek), Odranian (Rożnów), Wartanian (Roztoka), and Vistulian (Sienna) stages. In the light of thermoluminescent datings, deluvia occurring on top of older gravel series are usually Early Vistulian in age (Gródek), and may be correlated with the lowest and lower younger loess horizons (Maruszcak 1980, 1985). Washout deposits of the Rożnów area (Fig. 10), in turn, are older Vistulian pleniglacial in age and may refer to the lower younger loess horizon. Interpleniglacial age, however, is characteristic for deluvial covers that overlie solifluction series at Rożnów-Roztoka (cf. Alexandrowicz, Zuchiewicz in print), whereas sandy loams occurring immediately above the Sanian gravels at Marcinkowice (Fig. 10, cf. also Butrym, Zuchiewicz, in print), seem to represent the Wartanian.

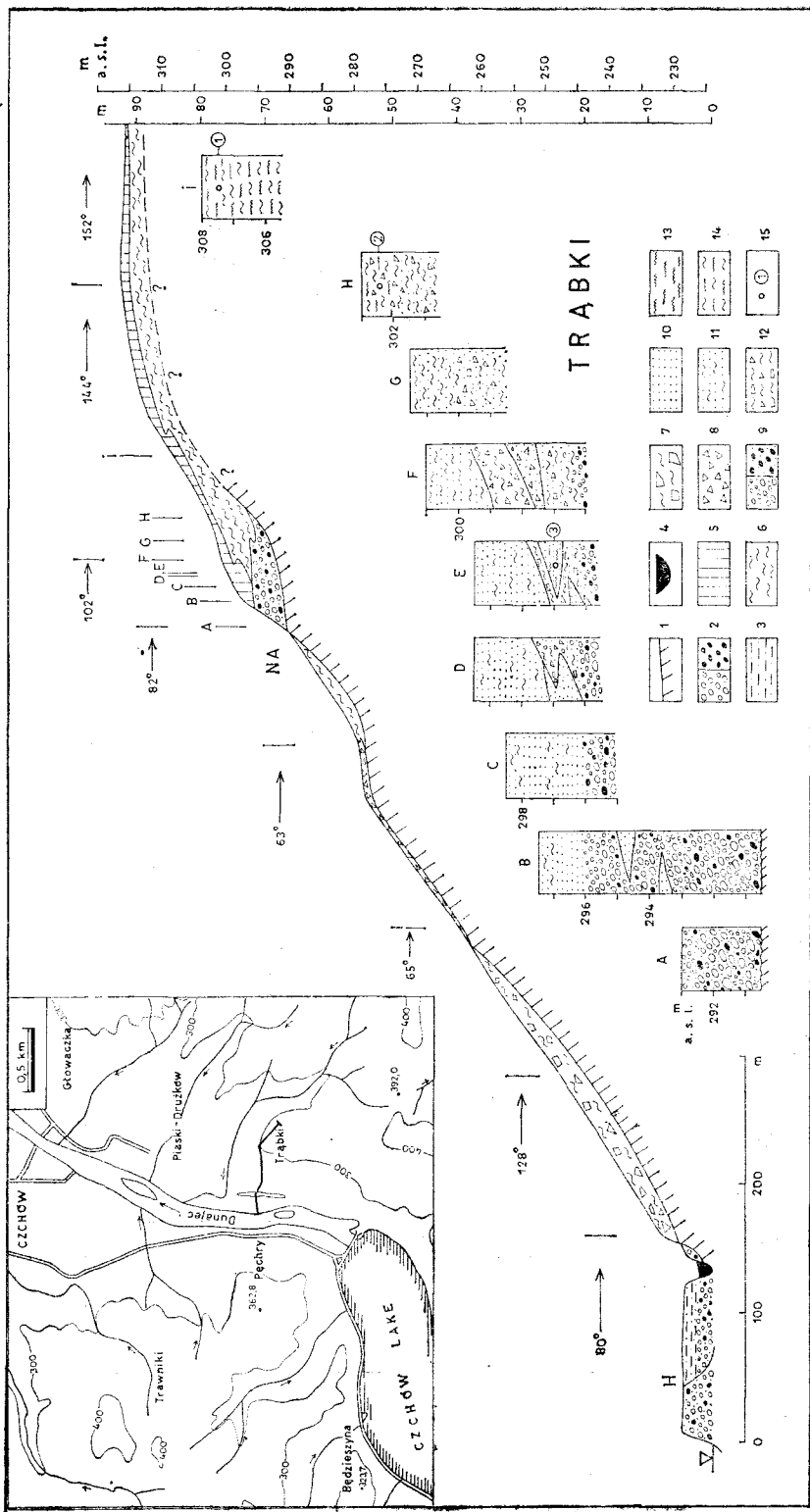


Fig. 7. Section across the right Dunajec valley side at Trąbki, south of Czchów. Cross-section: 1 — rock socie, 2 — fluvial gravels (flysch-derived, Tatra-derived), 3 — muds, 4 — oxbow lake deposits, 5 — silt-sandy washout covers, 6 — solifluction loams, 7 — landslide colluvia, 8 — angular rock debris; Lithological logs: 9 — fluvial gravels and sands (flysch-derived, Tatra-derived), 10 — sands, 11 — loamy sands, sandy loams, 12 — solifluction loams bearing rock debris, 13 — silts, 14 — silty loams, 15 — sampling sites. Stages: NA — Narewian, H — Holocene

Ryc. 7. Przekrój przez prawe zbocze doliny Dunajca w Trąbkach na południe od Czchowa. Przekrój: 1 — cokół skalny, 2 — żwiry rzeczne (fliszowe, tatrzańskie), 3 — muły, 4 — osady jezior starorzecznych, 5 — deluwia pylasto-piaszczyste, 6 — pokrywy soliflukcyjne, 7 — koluwia osuwiskowe, 8 — rumosz ostrokrawędzisty. Profile litologiczne: 9 — żwiry i piaski rzeczne (fliszowe, tatrzańskie), 10 — piaski, 11 — piaski gliniaste i gliny piaszczyste, 12 — gliny soliflukcyjne z rumoszem, 13 — pyły, 14 — gliny pylaste, 15 — lokalizacja prób. Piętra: NA — Narew, H — holocen

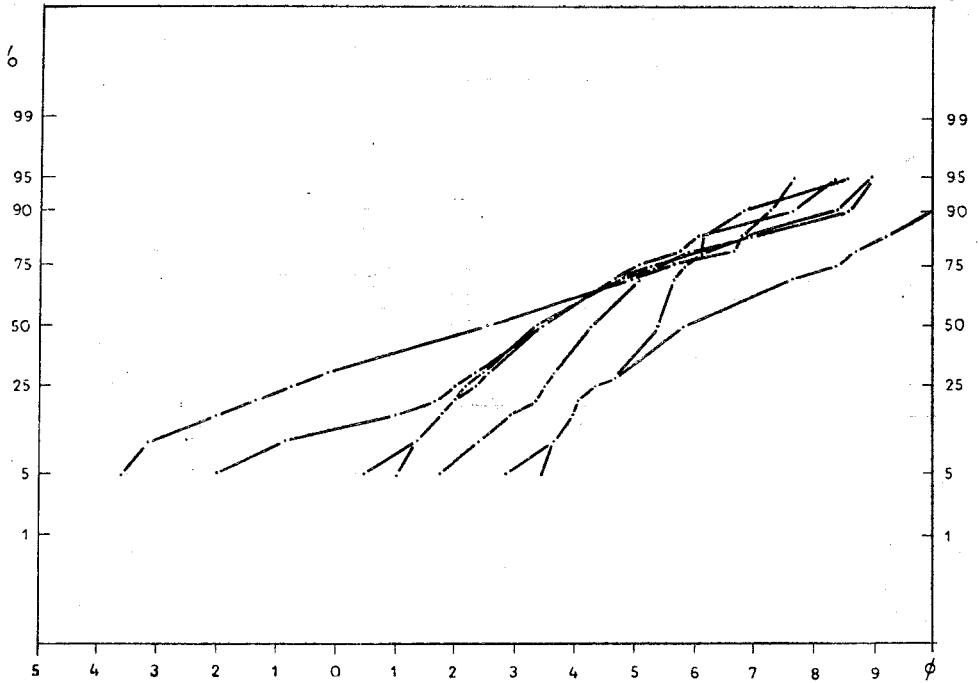


Fig. 8. Diagrams showing grain-size parameters of washout (deluvial) covers occurring in the Rożnów Foothills

Ryc. 8. Diagramy uziarnienia pokryw deluwialnych Pogórza Rożnowskiego

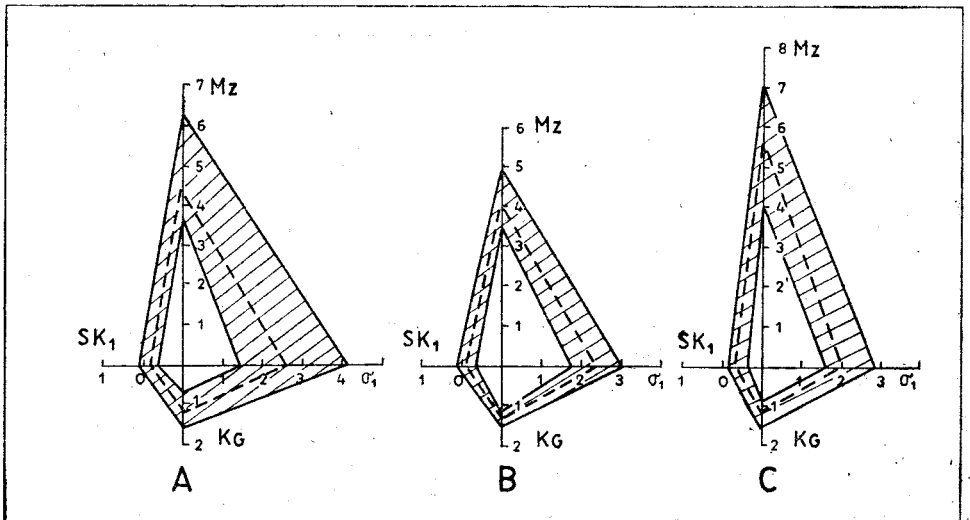


Fig. 9. Grain-size parameters of the washout (A), solifluction (B) and loess-like (C) covers

Ryc. 9. Parametry uziarnienia pokryw deluwialnych (A), soliflukcyjnych (B) i les-sopodobnych (C) Pogórza Rożnowskiego

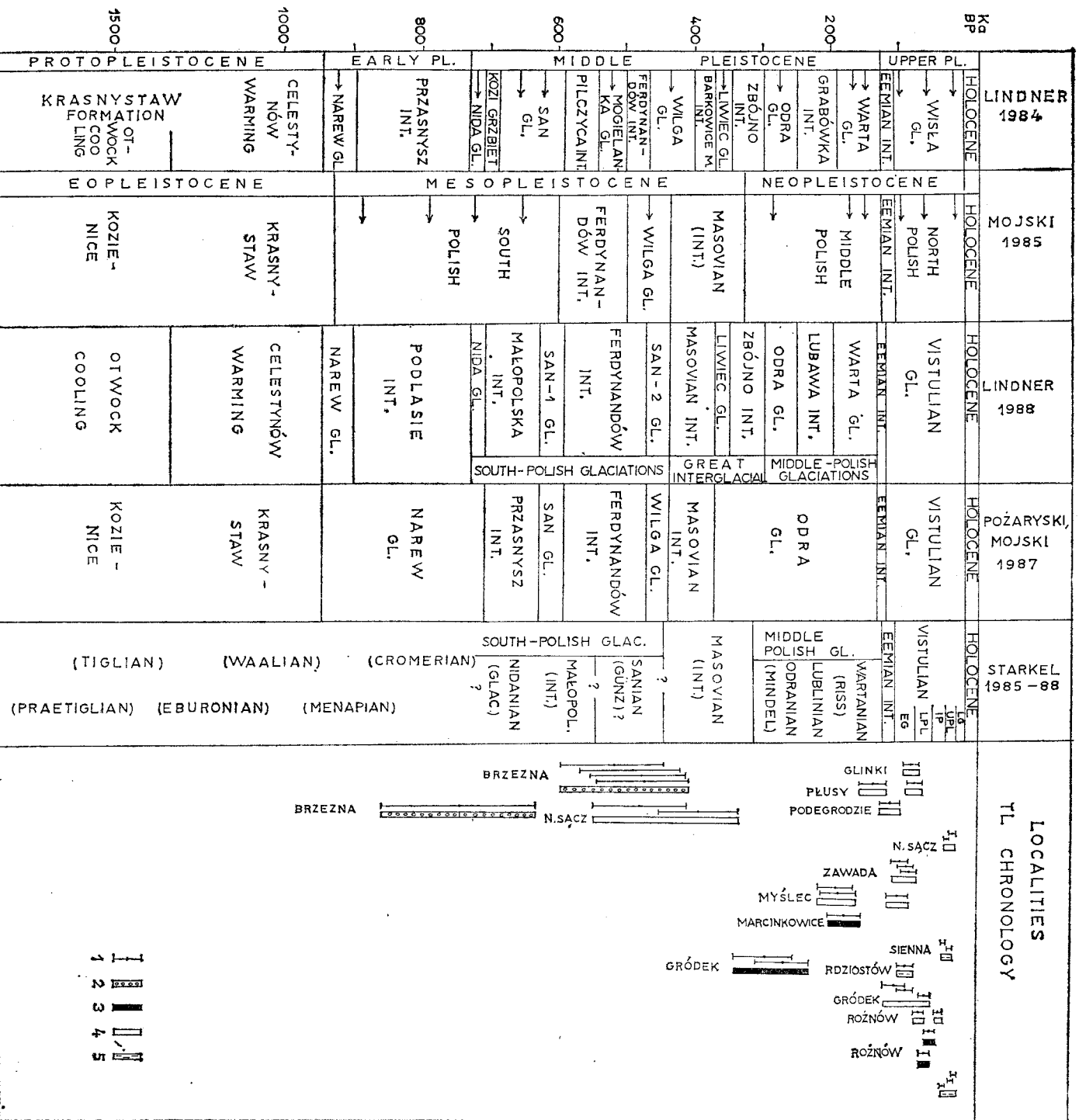


Fig. 10. Stratigraphic table showing the position of TL-dated deposits of the Rożnów Foothills and the Nowy Sącz Basin. 1 — stratigraphic range, 2 — fluvial covers, 3 — solifluction deposits, 4 — washout (deluvial) covers, 5 — loess-like deposits

Ryc. 10. Pozycja dat TL osadów czwartorzędowych Pogórza Rożnowskiego i Kotliny Sąddeckiej na tle tabeli stratygraficznej. 1 — zasięg stratygraficzny, 2 — osady rzeczne, 3 — pokrywy soliflukcyjne, 4 — pokrywy deluwialne, 5 — osady lessopodobne

CONCLUDING REMARKS

TL age determinations of solifluction and deluvial deposits do not provide convincing results. In most cases, TL ages seem to be considerably older than those expected from geologic and geomorphic analyses of deluvial covers. The latter refer, most probably, to the late pleniglacial times of the last cold stage (Vistulian), as do loess-like deposits at Sienna and Roztoka (Butrym *et al.*, in print; Butrym, Zuchiewicz, in print; Alexandrowicz, Zuchiewicz 1988, in print). As far as solifluction covers are concerned, the short transport of the clastic material down the slope makes proper TL determination difficult. We are of the opinion that further detailed studies, including palynological and magnetostratigraphic ones, are required to obtain more reliable results.

Institute of Earth Sciences
M. Curie-Skłodowska University
Department of Physical Geography
 19 Akademicka Str.
 20-033 Lublin

Institute of Geological Sciences
Jagiellonian University
 2A Oleandry Str.
 30-063 Kraków

REFERENCES

- Alexandrowicz S. W., Zuchiewicz W., 1988. *Stanowisko pokryw gliniastych z malakofauną w Siennej nad Jeziorem Rożnowskim*. Spraw. z pos. Kom. Nauk, PAN, Oddz. Kraków, 30, 1—2, 1986, 340—342, Kraków.
- Alexandrowicz S. W., Zuchiewicz W., in print. *Profil i malakofauna pokryw gliniastych w Roztoce koło Rożnowa*. Spraw. z pos. Kom. Nauk. PAN, Oddz. Kraków.
- Butrym J., Krysowska-Iwaszkiewicz M., Zuchiewicz W., in print. *The loess section at Sienna, Rożnów Foothills, West Carpathians* [in:] Maruszczak H. (ed.), *Podstawowe profile lessowe Polski*, UMCS, Lublin.
- Butrym J., Zuchiewicz W., 1985. *Results of TL datings of Quaternary sediments from the Nowy Sącz Basin, West Carpathians*. *Przegląd Geol.*, 3, 126—136, Warszawa.
- Klimaszewski M., 1937. *Morphologie und Diluvium des Dunajec-Tales von den Pieninen bis zur Mündung*. *Prace Geogr. Inst. Geogr. UJ*, 18, 1—54, Kraków.

- Klimaszewski M., 1948. *Polish West Carpathians in the Ice Age*. Acta Geogr. Univ. Wratisl., Ser. B, 7, 1—236, Wrocław.
- Klimaszewski M., 1961. *Through the Dunajec valley into the Tatras*. Guide-book of excursions, pt. III, South Poland, VIth INQUA Congress, 1—218, Łódź.
- Klimaszewski M., 1967. *Polskie Karpaty Zachodnie w okresie czwartorzędowym* [in:] Galon R., Dylík J. (eds.), *Czwartorzęd Polski*, 431—497, Warszawa.
- Kozikowski H., 1953. *Geological structure of the region of Kłęczany-Pisarzowa*. Biul. Inst. Geol., 85, 1—81, Warszawa.
- Lindner L., 1984. *An outline of Pleistocene chronostratigraphy in Poland*. Acta Geol. Polonica, 34, 1—2, 27—49, Warszawa.
- Lindner L., 1988. *Glacial and interglacial units in the Pleistocene of the Miechów Upland and Nida Basin*. Przegląd Geol. 3, 140—148, Warszawa.
- Maruszczak H., 1980. *Stratigraphy and chronology of the Vistulian loesses in Poland*. Quaternary Studies in Poland, 2, 57—76, Poznań.
- Maruszczak H., 1985. *Guide-book of the International Symposium: „Problems of the Stratigraphy and Palaeogeography of Loesses”*, Poland 6—10th Sept. 1985, UMCS, 1—195, Lublin.
- Mojski J. E., 1985. *Quaternary. Geology of Poland*, vol. 1, pt. 3b, *Stratigraphy*, Geol. Inst., 1—244, Warszawa.
- Pożaryski W., Mojski J. E., 1987. *Pleistocene of the Middle Vistula river gorge in the light of the new stratigraphy of Quaternary*. Przegląd Geol., 3, 117—123, Warszawa.
- Sokołowski S., 1935. *Geologie des Dunajec-Tales zwischen Tropie und Kurów*. Kosmos, 40, Ser. A, 2, 49—93.
- Starkel L., 1972. *Karpaty Zewnętrzne* [in:] M. Klimaszewski (ed.), *Geomorfologia Polski*, vol. 1, 52—115, Warszawa.
- Starkel L., 1985. *Controversial opinions on the role of tectonic movements and climatic changes in the Quaternary evolution of the Polish Carpathians*. Studia Geomorph. Carpatho-Balcanica, 19, 45—60, Kraków.
- Starkel L., 1988. *Remarks on the Quaternary stratigraphy of the Polish Carpathians and their foreland*. Quaternary Studies in Poland, 8, 49—59, Poznań.
- Szajnocha W., 1902. *Atlas geologiczny Galicji. Tekst do zeszytu 11: Wadowice, Bochnia, Wieliczka, Nowy Sącz*. Kom. Fizjogr. AU, 1—118, Kraków.
- Uhlig V., 1888. *Ergebnisse geologischer Aufnahmen in den west-galizischen Karpathen*. Jahrbuch der geol. Reichsanstalt, 38, 85—264.
- Zuchiewicz W., 1983. *Quaternary evolution of valleys in the Dunajec drainage basin, Polish Western Carpathians*. Studia Geomorph. Carpatho-Balcanica, 16, 27—49, Kraków.
- Zuchiewicz W., 1984. *The Late Neogene-Quaternary tectonic mobility of the Polish West Carpathians. A case study of the Dunajec drainage basin*. Ann. Soc. Geol. Polon., 54, 133—189, Kraków.
- Zuchiewicz W., Butrym J., 1990. *Stratigraphy of Quaternary deposits of the Rożnów Foothills, Polish West Carpathians*, Studia Geomorph. Carpatho-Balcanica, 24, Kraków.

STRESZCZENIE

J. Butrym, W. Zuchiewicz

Nowe stanowiska utworów soliflukcyjno-deluwialnych na Pogórzu Rożnowskim w Zewnętrznych Karpatach Zachodnich

Artykuł omawia szereg nowych stanowisk utworów soliflukcyjno-deluwialnych występujących na obszarze Pogórza Rożnowskiego u podnóży stoków oraz wkraczających na terasy rzeczne lub zalegających się z różnowiekowymi aluwiami terasowymi doliny Dunajca. Niektóre z tych utworów były datowane metodą termoluminescencji. Uzyskane daty (piętro Odry — starszy pleniglacjał piętra Wisły) budzą jednakże szereg wątpliwości.

РЕЗЮМЕ

Е. Бутрым, В. Зухевич

НОВЫЕ МЕСТОНАХОЖДЕНИЯ СОЛИФЛЮКЦИОННО-ДЕЛЮВИАЛЬНЫХ ОБРАЗОВАНИЙ НА РОЖНОВСКОМ ПРЕДГОРЬЕ ВО ВНЕШНИХ ЗАПАДНЫХ КАРПАТАХ

В статье рассматривается ряд новых местонахождений солифлюкционно-делювиальных образований, выступающих на территории Рожновского предгорья у подошвы склонов и распространяющихся на речные террасы или же соприкасающихся с разновозрастными террасообразными аллювиями долины р. Дунаец. Некоторые из этих образований датировались по методу термолуминесценции. Полученные даты (ярус Одры — старший пленигляциал яруса Вислы) вызывают, однако, ряд сомнений.