



## NEW SEQUENCE OF EUP LEAF POINT INDUSTRIES IN SOUTHERN POLAND

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### INTRODUCTION

The Early Upper Palaeolithic site at Dzierzyslaw near Kietrz, Province of Opole, in Upper Silesia has been known for a long time in European prehistory. It was investigated for the first time by H. Lindner (1936) and provided a base for the geochronology of the Palaeolithic of the Central Europe in synthetic works of P. Woldstedt (1959), F. Zuner (1952), particularly for the place of the so-called "Pre-Solutrean" in the works of L.F. Zotz (1959) and G. Freund (1951). Investigations carried out in the years 1957-1962 by J. Kozłowski (1961, 1964a, b) established the Interpleniglacial age of this site and the affiliation of finds from the site with the Szeletian of the Moravian type. However, already in the course of investigations in 1962, when the excavated area was extended to the southern slope of the Czarna Góra hill, some elements appeared in the industry of the site which did not fit the Szeletian framework. This was subsequently confirmed by investigations in Southern Moravia. Among finds like this belonged: the only levalloisian core discovered in trench I/62 and a partially bifacial blade point from trench V/62 (Kozłowski 1964b, pl. II 1 and IV 6). It was later, after the so-called Bohunician (Valoch 1976) - a cultural unit different from the Early Upper Palaeolithic Szeletian - had been distinguished in Moravia that these finds came to be interpreted as an indication that the solifluctional deposits of the "Czarna Góra" hill could contain components of another than Szeletian EUP culture. Neither the Levalloisian technology nor blade leaf points are a characteristic feature of the Moravian-Upper Silesian group of the Szeletian.

Further exploration at Dzierzyslaw was conducted in 1989 in connection with the symposium of the UISPP (*Les industries à pointes foliacées du Paléolithique supérieur européen*). The profiles of the site at Dzierzyslaw were uncovered in order to be shown to the participants of the symposium. These and the rescue investigations conducted in the site by E. Foltyn in 1992 (1993a, b) enabled to distinguish two Early Upper Palaeolithic levels. New light was thrown on the stratigraphy of the site at Dzierzyslaw and new data concerning the evolution of the environment in the Interpleniglacial were obtained. At the same time the TL dates from the deposits in the profile at Dzierzyslaw changed the initial chronological interpretation, especially of the lower part of the profile (loess stratified below the solifluction series).

Figure 1 shows the location of trenches made in particular years. The investigations conducted in the years 1989-1993 covered an area of 127 sq m; besides trenches a number of boreholes was made in the vicinity of the site.

### DESCRIPTION OF THE SITE AND ITS GEOMORPHOLOGICAL SITUATION

The Dzierzyslaw I site is situated in the SE part of the Glubczyce Plateau which is the southernmost part of the Silesian Lowland. The Glubczyce Plateau rises from 260 to 300 m above sea level. It consists of three ridges separated by the valleys of the rivers Psina and Troja. The relief of the Plateau shows features of a slightly transformed glacial landscape. There are numerous knolls and rises and almost flat surfaces next to them.

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The flat areas are divided by a dense system of mostly dry dells. These small, usually short and relatively deep valleys with no clear signs of erosional activity are a specific feature of the landscape of the plateau (Jahn, 1968).

The main horizon in the structure of this region are fluvioglacial sands and gravels. This is overlain by loess of the last two glaciations (Jersak, 1991). The bedrock of the Quaternary is structured by the marine Badenian sediments mainly clays and marly clays with a level of evaporates (gypsum, anhydrites) or with gypsum nests (Alexandrowicz, Kleczkiwski, 1974). Only occasionally the Quaternary deposits lie directly on the Cretaceous or Lower Carboniferous (Kulm) formations. Sometimes they lie on the Pliocene sand and gravel series or on the Sarmatian clays interbedded by sand (Alexandrowicz, 1966; Dyjor *et al.*, 1978).

The site under discussion is situated on the top and on the southern slope of the Czarna Góra hill (288.4 m a.s.l.). The hill is located on the Kietrz-Scieborzyce road on the edge of an upland sloping to the east towards the Rozumicki valley (the Rozumicki river is a tributary of the Troja). The west slope of the Czarna Góra hill is cut by shallow periglacial dells flowing down towards the dry valleys of the Rozumicka river. This valley opens to SSE.

The denudation, solifluction, also eolian processes were the basic agents determining the formation of morphological surfaces of the Czarna Góra hill. The hill is a relatively low, elongated knoll. Its trunk is built by marls, marly clays, Pliocene gravels, and fluvioglacial sands and gravels developed on the Kulm (Alexandrowicz, 1966). All this is covered by the loess of the slope and subaerial facies. Only the top of the "Czarna Góra" is a loessless, sand-gravelly enclave. Boreholes and sand quarries ascertained the presence of variegated fossil depressions in the region of the Czarna Góra (Fajer *et al.*, 1993). The depressions were filled with products of the local denudation in various periods, and in the

present relief there is basically no evidence of them. Only on the culmination, in its eastern part, there are small, bowl-like depressions, the so-called "wymoki" (Maruszczak, 1954).

The Czarna Góra hill is one of the links in the chain of flat, horseshoe-shaped knolls stretching S and SE from the villages of Koberžice Hnevosice, Rozumice through Dzierżysław, Kietrz to SW and S to the villages of Trebom, Pietraszyn and Chuchelna.

#### STRATIGRAPHY OF THE SEDIMENTS

On the southern slope the bedrock - reached in the boreholes - is made of fine and medium-grained sands, rarely with coarser gravels. The sands are overlain by stratified loess, considerably sandy in the bottom and with thin laminae in the upper part : sometimes lighter dusty or sandy, sometimes darker loamy. The top of the loess is cut by an erosional furrow which extends at a considerable length following the slant of the palaeosurface covered by sand. The next layer is loess with a less or more marked stratification. It is strongly gleyey and slightly clayey in some parts and some evidence of pedogenic processes. The top part of this loess shows traces of load disturbances. In the closed depressions the loess is replaced by yellow silts. The primary stratification shows strong, repeated unpeaving and lengthening. The continuity of layers is often interrupted. Above this loess and silts is a level consisting of twin (bipartite) soil. A layer of dusty-clayey deposits, discontinuous, broken into packages, was covered with a grey pseudo-gley soil, with fine greenish tint containing numerous calcium-carbonate concentrations. Its base and top are marked at places by manganic-ferruginous ribbons or orstein covers. This layer is cut by strongly disfigured icewedge pseudomorphosis which is filled with a sediment built of organic components and a clayey fraction. In the profile this pseudomorphosis represents the older generation of structures of this type. A subarctic boggy soil developed on the silts has the same stratigraphic position as the

pseudo-gley soil. It is brown in colour, discontinuous, with intercalations of sand and silts. The whole deformation consisting of the boggy soils and the silts below is connected with the origin and desintegration of the siltpeaty palsa structure. Above those soils a complex solifluction developed: partly sheet-type and partly tongue-like solifluction. The components of the solifluction layer are: loess, sand-gravel, clayey material and reworked soil. On one of the tranches the base of the solifluction is of cylindrical type. It shows deformation connected with the underlying layer of irregular involutions, containing loess, sand, clay and soil lumps. These layers are strongly transformed by intensive postsedimentational processes and phases of erosion causing discontinuity. These features evidence a connection between the disturbances and the palsa degradation (Jahn, 1951). The set of solifluction sediments is covered by bipartite loess, yellow with brown tint, unstratified, with weakly discernible stratification in its lower part. In the stratified part of the layer traces of faint pedogenic processes can sometimes be observed. There are also sand and gravel lenses and root casts filled with iron precipitations. The matrix of this layer contains calcium-carbonate concretions and pebbles. The pebbles are mostly quartz, up to 3 cm in diameter. Younger generation ice wedge pseudomorphoses filled with yellow dusty deposit start in this layer reaching to a depth of 60 cm. The profile is topped by modern soil.

#### AN ATTEMPT AT PALEO GEOGRAPHICAL INTERPRETATION

The interpretation of the stratigraphy of the site presents some difficulties caused by the presence of various stratigraphic gaps. The combination of profiles (Kozłowski, 1964a, b, 1962; Foltyn, 1993a, b; Fajer *et al.*, 1993) enables to formulate the following interpretation:

- The base of the Quaternary sediments is constituted by fluvioglacial deposits of the Odra Glaciation with the

glacitectonic deformation underneath the ice-flow (uncovered in the profile of the upper part of the site - Kozłowski, 1964a). This was followed by loess sedimentation at the end of the Odra or beginning of the Warta Glaciation (unit 6) which was previously incorrectly attributed to the Early Vistulian. This chronology has been confirmed by TL dates which established the age of the sediments at  $180 \pm 35$  Ka (GD TL-348 for unit 6).

- In the main profile of the site a significant hiatus separates units 5 and 6; the hiatus corresponds to the Warta Glaciation and/or the last Interglacial (Eemian).

- It is possible that the erosional furrow which is cut in the top of the banded loess (unit 6) is the effect of erosional-denudational processes in the warmer events (before Vistulian).

- The beginning of the Vistulian is represented by stratified loess of the deluvial facies (unit 5) which provided the date of  $>100$  Ka (GD TL-350). This date corresponds to the first cooler event of the Vistulian. The presence of Eemian soil was established only within below stratified loess dells outside the area of the site; the dells were probably formed during the Ohe Interstadial or at the beginning of the Warta glaciation. The Eemian soil is of lessivé type (A<sub>1</sub>-A<sub>2</sub>-A<sub>3</sub>-B horizons) with the Upper part cut by erosion.

- Loess of Pleniglacial I is poorly marked in the main area of the site. It is possible that this loess was included in the pedogenesis of unit 4 which provided the date of  $> 74$  Ka (GD TL-351) corresponding to the beginning of Pleniglacial I. The yellow silts occurring in the boggy, seasonally dry depressions are a counterpart of this loess.

- During the Interpleniglacial two types of soil were formed depending on the degree of moisture in the bedrock and

type of vegetation : subarctic boggy soil in the waterlogged depressions, and pseudo-gley soil in other areas. The latter soil, corresponding to the Komorniki soil complex, is synchronous with the Moershoff+Hengelo Interstadials (cf. Mojski, 1985; Lindner, 1991).

- Later cool oscillations caused the development of permafrost and, probably, eolian processes. In this period palsas structures were formed and ice-wedge polygons on dry surfaces.

- After the degradation of these structures, simultaneously with the accumulation of loess (unit 2) solifluction processes were activated in the moist conditions of Pleniglacial II. The loess was slope-washed and mixed with sand, gravels and clays at the foot of the slopes; soils situated lower were intensively translocated, deformed or destroyed.

- During the dry phase of Pleniglacial II sedimentation of eolian loess continued undisturbed. At that time intensive cryogenic processes took place which are observable as ice-wedge pseudomorphoses.

- In the Holocene brown soils developed on the loess.

#### STRATIGRAPHIC POSITION OF FINDS

Investigations of recent years suggest that the most important deposit containing the lower level of artefacts are the subarctic boggy soil and flows of pseudo-gley soil (unit 4). Their translocation is the result of periglacial processes taking place after the human occupation of the lower culture level. In spite of this translocation the relative position of finds in unit 4 has not been disturbed and the scatter-pattern of artefacts can be regarded as original. Some artefacts from the lower level discovered in the solifluction series were preserved in the packets and lumps of soil translocated by cryogenic processes.

Earlier excavation yielded Early Upper Palaeolithic finds from the solifluction series only (Kozłowski, 1964a,b, 1962). The state of preservation of these finds differs from the condition of artefacts discovered in the lower layer. They are patinated, strongly worked by wind and affected by frost. They must have remained on the surface of sandy-cleyey sediments for a long time, exposed to the influence of severe weather conditions. On the same surface large erratic boulders appeared apparently not distributed randomly within the site, but forming a generally circular dwelling structure (Kozłowski, 1964a).

The date for these finds should be contained between the denudation processes at the end of the Interpleniglacial and the onset of solifluction at the beginning of Pleniglacial II (Kozłowski, 1964b). The presence of charcoals of *Pinus silvestris* in the upper layer seems to be an important chronological indicator (Kozłowski, 1964b). This could mean that clusters of coniferous forest were part of the vegetation at that time.

From the point of view of archaeological sequence two upper palaeolithic levels can be distinguished at Dzierzyslaw I site :

1). Lower level - associated with the Interpleniglacial soils (Moershoff+Hengelo Interstadials).

2) Upper level - represented by a camp from the Late Interpleniglacial period, partially destroyed by solifluction (Kozłowski, 1983).

#### LITHIC FINDS FROM THE LOWER HORIZON

On the basis of stratigraphic data and horizontal distribution some artefacts from the 1962 excavations from trenches I/62 and II/62 were added to the materials uncovered in 1989-1992 (Kozłowski, 1964b). At present the inventory is made up of 1004 artefacts namely :

cores and fragments - 25 specimens

flakes and fragments, waste - 794 specimens

blades and fragments - 119 specimens

tools - 66 specimens

Cores - single platform cores predominate, namely : blade cores - six specimens, three blade-flake core, two flake cores. In the group of double-platform cores blade-flake specimens are more numerous (4 sp.). Among other core types there are two interesting flake cores resembling Levalloisian flake cores with bilateral preparation. Two discoidal cores were also found and a core with changed orientation. Five initial cores should also be mentioned.

Cores are usually unprepared or the preparation is limited to the platform or to one side, exceptionally to the pre-flaking surface.

Only one core is characterized by almost complete preparation : on the core back, the striking platform and the pre-flaking surface.

The majority of specimens were exploited in a minimal degree. The reduction was limited to detaching only one or two sets of blades or flakes.

Retouched tools are represented by:

Leaf points - one of the most numerous groups including 10 specimens. The discovery of two Jerzmanowice leaf points *à face plane* with partial ventral and dorsal retouch should be stressed. There are two unifacial flake leaf points, fragments and an unfinished bifacial leaf point and one Mousterian point. Bifacial leaf points are made on fragments of flat flint nodules; they were shaped by invasive retouch from thick cortical side or thermal fracture.

Retouched blades are the next groups, as numerous as leaf points. The specimens are one-sided (3), two-sided (4)

and two-sided with alternate retouch (2). There was one pointed retouched blade with convergent sides. Half of the specimens are finely retouch.

The typology of side-scrapers distinguished : simple convex side-scrapers (2 specimens), one simple concave side-scrapers, double convergent convex and double convergent *déjeté* specimens (2), transversal convex side-scrapers, bifacial side scrapers (2 specimens). Two of the side-scrapers are made on damaged bifacial points.

Among burins there are : three burins on break, two single-blow burins and one mesial burin on a retouched truncation. In addition, a multifaceted-dihedral-angle burin was found.

The next typological group are truncated pieces including : two microlithic truncated pieces of which one has a transversal truncation, the second and oblique truncation. The third specimen is a larger truncated piece with an oblique truncation and with additional ventral retouch on one side.

It is characteristic that there are not many end-scrapers and that they are not obvious forms. The typical specimen is a nosed-carinated end-scrapers. There are two more specimens. The first is made on a flake, wider rather than long, with the steep front, transitional to side-scrapers. The second specimen is basically a flake with a type of a natural front, with use-wear retouch.

Other tool groups are also represented : perforators/borers (2 specimens), notched tools (3 specimens), denticulated tools (4 specimens), raclettes (3 specimens), retouched flakes (5 specimens), splinters (3 specimens) and others (5 specimens).

To sum up the assemblage from the lower horizon is characterized by the Levalloisian and blade-flake technique, the tool kit representing the Upper Palaeolithic

types (end-scrapers, burins, retouched blades, perforators) and the Middle Palaeolithic types (side-scrapers, notched and denticulated tools) which are accompanied by leaf points, both unifacial (on flakes and blades) and bifacial. An analogous tool kit with the Levalloisian technique were recorded so far only in the Bohunician in Moravia (Oliva, 1985; Svoboda, 1987, 1990).

When the attribution of the lower horizon from Dzierzyslaw site I is discussed, it should also be mentioned that the neighbouring site Dzierzyslaw 8 which is a workshop type site yielded several pre-cores made from quartzite from Drahany Upland. Earlier, these pre-cores had been regarded as Szeletian by J.K. Kozłowski (1964a). New studies of the workshops from the Drahany Upland conducted by J. Svoboda suggest that quartzites in that region were primarily exploited by the Bohunician groups and not Szeletian (Svoboda, 1987). It is possible, therefore, that the workshops at Dzierzyslaw 8 are also Bohunician. Unfortunately the site has been almost totally destroyed and further exploration is not possible.

#### LITHIC FINDS FROM THE UPPER HORIZON

Table 2 provides quantitative comparison of finds from the Lower and the Upper horizon. The description of finds from the solifluction series building the upper horizon of the site is contained in earlier works by J.K. Kozłowski (1961, 1964a, b). Our remarks in this place will be limited to pointing to certain significant differences in the upper horizon. In respect of technology the upper horizon does not contain Levalloisian technique, but it is characterized by flakes and blade production from single-platform or polyhedral-spherical cores. The latter cores are missing in the lower level. The upper level has a more strongly blade character where the lower level is clearly flake one in its general character. The ratio of blades in the upper level is twice as high as in the lower one. In respect of the frequency of major tool classes the upper level contains

a considerable proportion of end-scrapers and side-scrapers, the ratio of notched and denticulated tools are smaller. The proportion of leaf points in the two levels is similar but their types differ. In the upper level there are bifacial points of the Szeletian type, in the lower level these are blade points *à face plane*.

Taking into consideration the characteristic features of its lithic industry the upper level at Dzierzyslaw I shows parallels with the Moravian Szeletian. A broader justification of this attribution was presented in earlier works by J.K. Kozłowski (1961, 1964a, b).

#### THERMOLUMINESCENCE DATING OF LOESS DEPOSITS

##### *Sample preparation*

All the samples underwent the standard pretreatment procedures, including moisture content measurements, drying and separation of ca. 0,5 kg portions for radionuclides (*i.e.* U, Th, K) determinations.

Water content was measured for a few gram subsample collected separately. It was weighed in natural state (Mw - mass wet) and then after prolonged drying at 95°C. Drying was terminated when two subsequent weighings, with a 24h interval between, gave the same readout (Md - mass dry). Relative water content was determined according to the expression :

$$h = \frac{Mw - Md}{Md} \quad (1)$$

From the remaining portions of the samples material 90-100µm quartz grains were extracted in the following way. Sampled material was subsequently treated with 4% HCl and 2% NaOH solutions for 48h, at an ambient temperature each time. HCl treatment removes carbonates, so when their content was particularly high

the acidity of the solution was controlled and fresh acid added when necessary.

The whole procedure very effectively removes carbonates and other unstable components as well as soluble organic matter fractions. Sample was washed with distilled water several times after each step of chemical treatment. After final washing and drying at 40°C, grains of the chosen granulometric fraction were sieved out and etched with 40% HF (concentrated hydrofluoric acid) for 60 minutes at an ambient temperature. Finally, grains were washed with diluted HCl for several minutes to remove fluorine components from the grains surface, washed with distilled water and dried at the temperature 40°C.

#### *Annual dose assessment*

All samples were radiometrically analyzed by means of the multichannel gamma scintillation spectrometer. Concentrations of U, Th and K radioisotopes were derived from the recorded spectra assuming the secular equilibrium state and converted to the values of annual doses for each sample. An attenuation effect of water contained in sediment and that of etching were both taken into account. Also an appropriate allowance for an annual cosmic ray doses was made.

Table 3 gives the obtained results of radioactivity and water measurements and calculated effective annual doses.

#### *Thermoluminescence measurements*

Thermoluminescence measurements were possible for 7 samples only. In the case of sample Dzierżysław 5 and Dzierżysław 8 the amount of quartz grains extracted was insufficient to perform absorbed dose determination and TL was not measured.

Thermoluminescence of prepared quartz grains was measured by a microcomputer controlled apparatus. Emitted light was recorded in the wavelength region of 300 - 470 nm (limited

by the colour glass filter set) by the M12FVC51 electron photomultiplier tube. 5 mg grain portions were linearly heated with the rate 10°C/s up to 450°C. The background measured during the second heating was automatically subtracted and net TL values integrated over 10 intervals were stored for further calculations.

Figures 1 and 4 present examples of recorded TL glow curves. Natural TL glow curves for all the samples measured consist of two main peaks at 260°C and 340°C. The relation of these two peaks distinguishes two types of the glow curve shape, called A and B. For type A the lower temperature peak (at 260°C) dominates over the higher temperature peak (at 340°C). And for type B the higher temperature peak (at 340°C) dominates over the lower temperature peak (at 260°C). Four samples, Dzierżysław 1, 2, 3, 4, exhibit type A of TL glow curve shape, and three others, Dzierżysław 6, 7, 9, type B.

This phenomenon is probably due to the different origin of quartz grains incorporated in loess sediments and indicates that two sources of original material existed in the past supplying quartz grains of different properties.

#### *Absorbed dose assessment*

For all samples equivalent absorbed doses (ED) were obtained by means of the regeneration method. Natural TL was bleached with the laboratory LRFM-125W lamp (a mercury lamp with a luminescent screen converting UV emission into day light) for two different length of time : 180 and 360 minutes. The longer time corresponds to ca. 10 hours of intensive insolation. Grains were then irradiated with beta rays from 90-Sr source or gamma rays from 60-Co source. Typically there were four regeneration doses for each bleaching time and for each sample. Results of TL measurements were fitted with an exponential function :

$$-A*ED$$

$$TL(D) : C - B*e \quad (2)$$

where : TL(D) - intensity of thermoluminescence emitted from grains irradiated with a regeneration dose D; A, B, C - function parameters (note that the difference C-B estimates the initial TL level and C its saturation level intensity).

The three parameters A, B, C were found using the nonlinear least square regression technique (an algorithm for fitting the function (2) will be published separately). ED values were then calculated according to the formula :

$$-A*ED$$

$$NTL = C - B*e \quad (3)$$

Giving finally :

$$ED : -*1n \left[ \frac{B}{C - NTL} \right] \quad (4)$$

Where : NTL - natural TL intensity; ED - equivalent dose to be found; others as above.

Computer calculations of ED were repeated for subsequent glow curve temperature intervals (10°C width), from 200° to 450°C. Basing on these calculations the plateau tests were constructed for each sample and for each bleaching time. Results which formed better plateau were chosen for further processing. For final calculations, glow curves were integrated over the plateau region and regression calculations were repeated.

Table 4 presents the obtained results. Plateau region is given in a "plateau" column. No region is given when plateau was unsatisfactory and ED value was calculated for the higher temperature peak.

### Dating results

TL results indicate the three probable periods of loess formation in the area of interest. Because of the limited number of dates obtained the more detailed reconstruction of past processes is not possible. These periods are : the older one which ended before the Eemian interglacial; the middle one, around 80-100 ka B.P.; and the younger around 20 ka B.P.

Slope processes which were active in the past could mix the older loess with younger in such a way that it was incorporated in the form of lumps of unweathered and unbleached material into younger layers. This is the most probable explanation of the distribution of TL dates in the loess profile. Similar effects were observed in TL dating of Vistulian loess deposits in Western Pomerania (Bluszcz, Kozarski & Nowaczyk, 1993).

Additionally, TL measurements suggest two types of quartz grains incorporated in loess sediments. These two types differ in their glow curve shapes. This may indicate two sources of aeolian material.

### CONCLUSIONS

The new investigations into the Dzierżysław I site have enabled us to formulate important conclusions, significant for the knowledge of the Palaeolithic in southern Poland.

1. The lower loess level (unit 6), now dated at the end of the Odra or beginning of Warta Glaciation yielded, already in the excavations in 1962, a flake from a discoidal core with denticulated retouch (Kozłowski, 1986 4b, pl. IV 8) and two chips during the recent excavations which could constitute the first trace of settlement in Upper Silesia before or immediately after the Ohe (Lublin) Interstadial.

2. For the first time in southern Poland the Interpleniglacial pseudo-gley soil (unit 4) yielded artefacts affiliated with the Bohunician - a culture known so far mainly from southern and central Moravia. The radiometric dates from Moravia place the Bohunician in the early phase of the Interpleniglacial between  $> 42000$  and  $38000$  years B.P.

3. The solifluction series yielded finds which in terms of typology and technology are related to the Moravian Szeletian. The  $^{14}C$  dates from Vedrovice in Moravia place the non-initial phase of the Moravian Szeletian at about  $39\ 500$  years B.P. (Valoch, 1990). At Dzierżysław the stratigraphic position places the upper culture level in the younger part of the Interpleniglacial. It is possible that the loess grains samples from - regretfully - the secondary deposit which gave the date of  $36\ 500 \pm 5500$  (GDT1-349) chronologically correspond to this solifluction series, i.e. : to the upper culture level. The other quartz grains sampled from this series, however, gave the dates suggesting that they come from older loess of the Odra and of the end of the Warta Glaciation and their TL signal was not zeroed during the redeposition.

The presence of superposition of two EUP industries with leaf points and the occurrence of the Bohunician for the first time in southern Poland are undoubtedly the most interesting results of the new investigations in Dzierżysław.

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**TAB. 1. Stratigraphy and chronology of the Last Glacial**

| Biostratigraphical units in the north-central Europe (after:) |                                   | Stratigraphy of loess in Poland (after:)   |                           | Stratigraphy of loess in the Głubczyce Plateau (after:)   |   | Sites with dates in the Głubczyce PL.  |  |
|---|-----------------------------------|--|---------------------------|---|---|--|--|
| T. van der Hammen et al. 1967                                 | K. Behre 1989                     | H. Maruszczak 1991   | J. Jersak 1991            | J. Butrym et al. 1984   | Z. Czeppe et al. 1963<br>J. Jersak 1991 | TL (after:)<br>J. Butrym et al. 1984   |  |
| Upper Pleniglacial  |                                   | upper younger loess (TL 28-15/12 ka)   | younger loess IIB         | upper loess (TL 27-12 ka)<br>upper solifluction (TL 19-12 ka)<br>lower solifluction (TL 27-24 ka) |   | KIETRZ: 12±0.8 ka<br>GŁOGÓWEK: 19±2.3 ka   |  |
| Middle Pleni-glacial (=Inter pleni-glacial)                   | DENEKAMP<br>HENGELO<br>MOERSHOOFD | Upper Interpleni-glacial soil (TL 32-28 ka)<br>middle younger loess (TL 50-32/28 ka)   | Kormorniki soil complex   | gleyed loess (TL 53-27 ka)  | GŁOGÓWEK: 28000±900                     | GŁOGÓWEK: 24±3.0 ka<br>KRZANOWICE: 24±3.5 ka<br>GŁOGÓWEK: 27±3.2 ka<br>KRZANOWICE: 27±4.0 ka |  |
| Lower Pleniglacial  | GLINDE<br>OEREL<br>ODDERADE       | Lower Interpleni-glacial soil (TL 55-50 ka)<br>lower younger loess (TL 80/75-55 ka fossils soils (TL 80-75 ka)<br>lowest younger loess (TL 100-80/75 ka) | younger loess IIA         |   |   | KIETRZ: 27±4.0 ka<br>GŁOGÓWEK: 29±3.5 ka   |  |
| BRÖRUP AND AMERSFOORT   | BRÖRUP AND AMERSFOORT             | interstadial soil horizons (TI 115/110-100 ka)   | soil complex Nietulisko I | silt like (TL 57-44 ka)<br>"lower" loess (TL 66-55 ka)  | RACIBÓRZ-OCICE: >52000                  | GŁOGÓWEK: 46±6.0 ka<br>GŁOGÓWEK: 55±7.0 ka<br>GŁOGÓWEK: 66±8.5 ka                            |  |
| (Eemian)  | (Eemian)                          | interglacial soil (TL 130/125-115/110 ka)  |                           | interglacial soil   |   |  |  |

Tableau 2. Retouched tools from lower and upper horizons

| LOWER HORIZON |                             | UPPER HORIZON |
|---------------|-----------------------------|---------------|
| 10            | Leaf points                 | 12            |
| 8             | side-scrapers               | 13            |
| 4             | denticulated tools          | 2             |
| 3             | notched tools               | 2             |
| 8             | retouched flakes, raclettes | 8             |
| 7             | burins                      | 7             |
| 3             | truncated pieces            | 2             |
| 10            | retouched blades            | 9             |
| 3             | end-scrapers                | 16            |
| 2             | perforators/borers          | 2             |
| 3             | splinters                   | 3             |
| 5             | others                      | 0             |

Tableau 3. Samples Dzierżysław. Radioactivity measurements

| SAMPLE NO | LAB NO   | U ACTIVITY | THE IN (BQ/KG) | K        | WATER (%) | ANNUAL DOSE (Gy-ka) |
|-----------|----------|------------|----------------|----------|-----------|---------------------|
| 1/89      | GdTL-341 | 21.2 ± 0.9 | 28.6 ± 0.4     | 351 ± 4  | 10.3      | 2.13 ± 0.14         |
| 2/89      | GdTL-346 | 24.1 ± 0.8 | 35.1 ± 0.4     | 433 ± 4  | 10.8      | 2.54 ± 0.16         |
| 3/89      | GdTL-347 | 39.2 ± 0.6 | 37.0 ± 1.4     | 514 ± 6  | 12.3      | 3.02 ± 0.19         |
| 4/89      | GdTL-348 | 27.2 ± 1.0 | 32.3 ± 0.4     | 412 ± 5  | 12.6      | 2.43 ± 0.16         |
| 5/89      | -        | 42.7 ± 0.8 | 41.0 ± 1.6     | 603 ± 8  | 12.6      | 3.40 ± 0.21         |
| 6/89      | GdTL-349 | 36.0 ± 1.6 | 37.1 ± 0.5     | 537 ± 6  | 14.8      | 2.96 ± 0.18         |
| 7/89      | GdTL-350 | 79.8 ± 2.7 | 0.00 ± 0.7     | 415 ± 14 | 12.0      | 2.77 ± 0.20         |
| 8/89      | -        | 36.9 ± 1.4 | 39.2 ± 0.6     | 626 ± 6  | 15.3      | 3.25 ± 0.20         |
| 9/89      | GdTL-351 | 32.2 ± 1.3 | 36.7 ± 0.6     | 516 ± 6  | 14.8      | 2.83 ± 0.18         |

NEW SEQUENCE OF EUP LEAF POINT INDUSTRIES  
IN SOUTHERN POLAND

Table 4. Samples Dzierżysław. TL measurements

| LAB. NO  | PLATEAU<br>(C) | ED<br>(GY) | ANNUAL DOSE<br>(GY-KA) | TL AGE<br>(KA BP) |
|----------|----------------|------------|------------------------|-------------------|
| GdTL-341 | -              | 500 ± 110  | 2.13 ± 0.14            | 240 ± 50          |
| GdTL-346 | -              | 320 ± 50   | 2.54 ± 0.16            | 125 ± 55          |
| GdTL-347 | 280-350        | 65 ± 7     | 3.02 ± 0.19            | 22 ± 3            |
| GdTL-348 | -              | 435 ± 75   | 2.43 ± 0.16            | 180 ± 35          |
| GdTL-349 | 270-310        | 108 ± 15   | 2.96 ± 0.18            | 36.5 ± 5.5        |
| GdTL-350 | 260-350        | ≥ 300      | 2.77 ± 0.20            | ≥ 100             |
| GdTL-351 | 280-400        | > 220      | 2.83 ± 0.18            | > 75              |

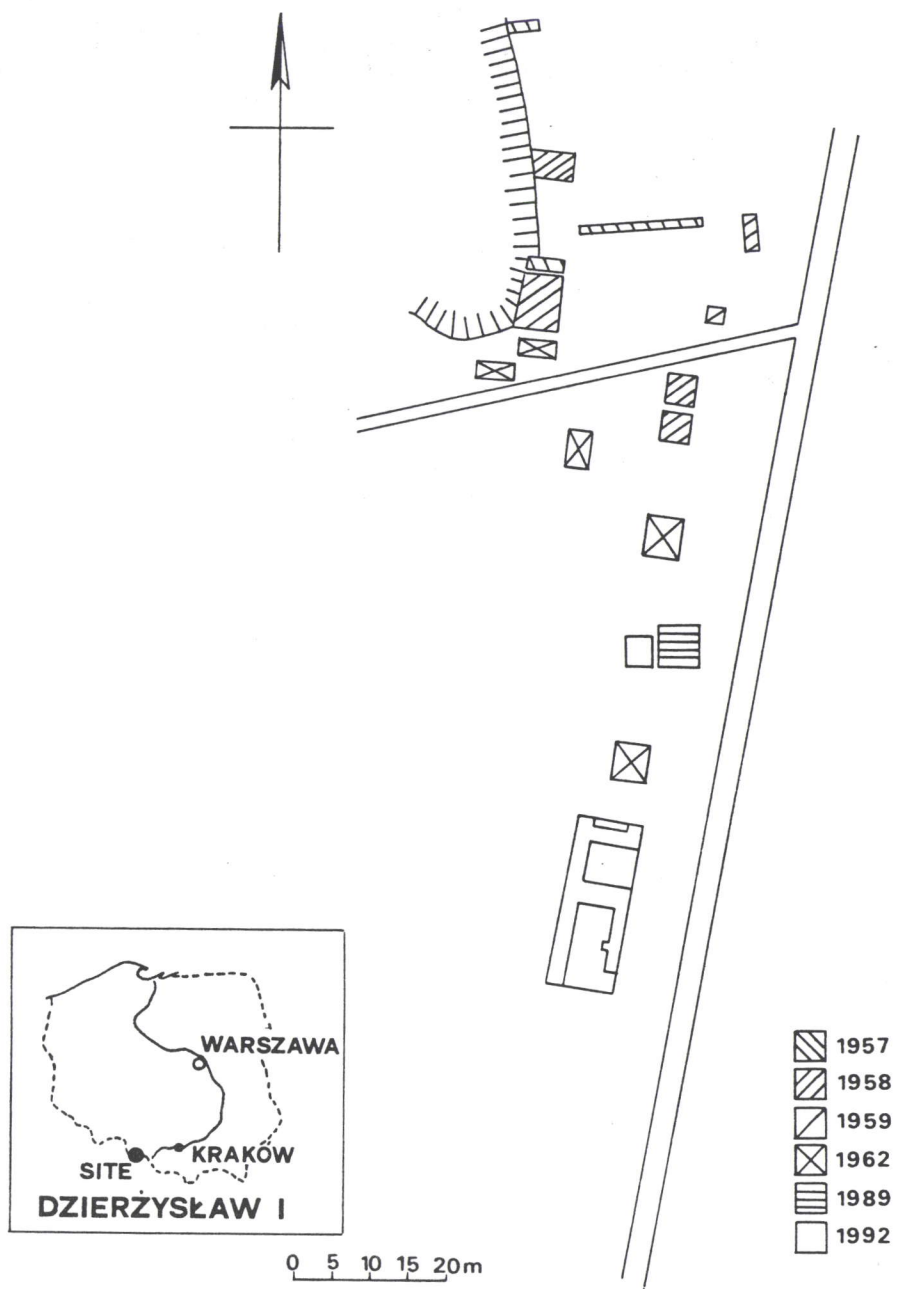


Figure 1 : Dzierżysław, site I. Map of trenches. Drawn by E.M. Foltyn.

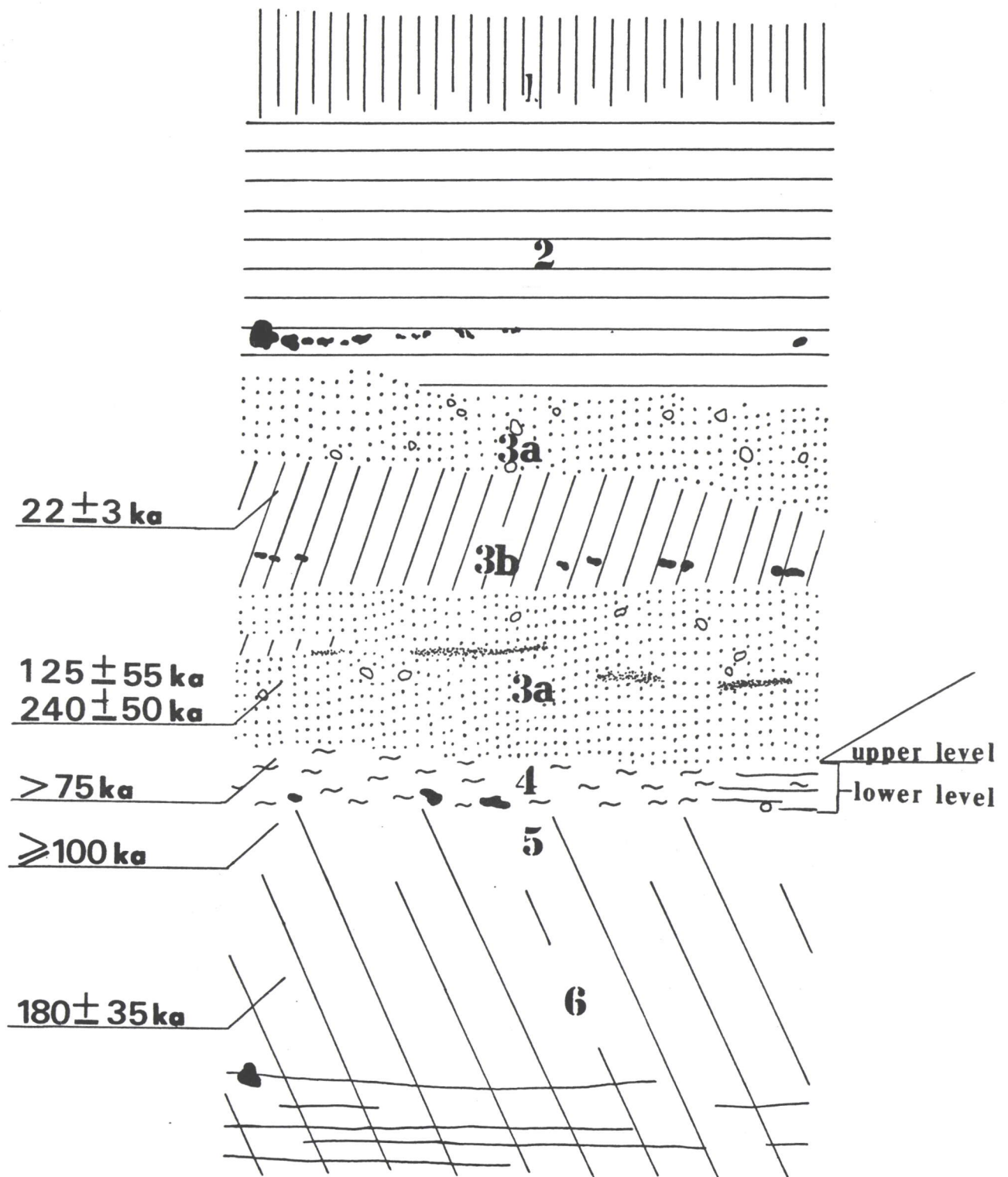


Figure 2 : Dzierżysław, site I. Trench I/89 - profile of wall W :  
 1 - brown soil; 2 - nonstratified loess; 3 - solifluction (a - sand and gravel; b - loamy material); 4 - pseudo-gley soil;  
 5 - stratified loess; 6 - banded loess. Drawn by E.M. Foltyn.

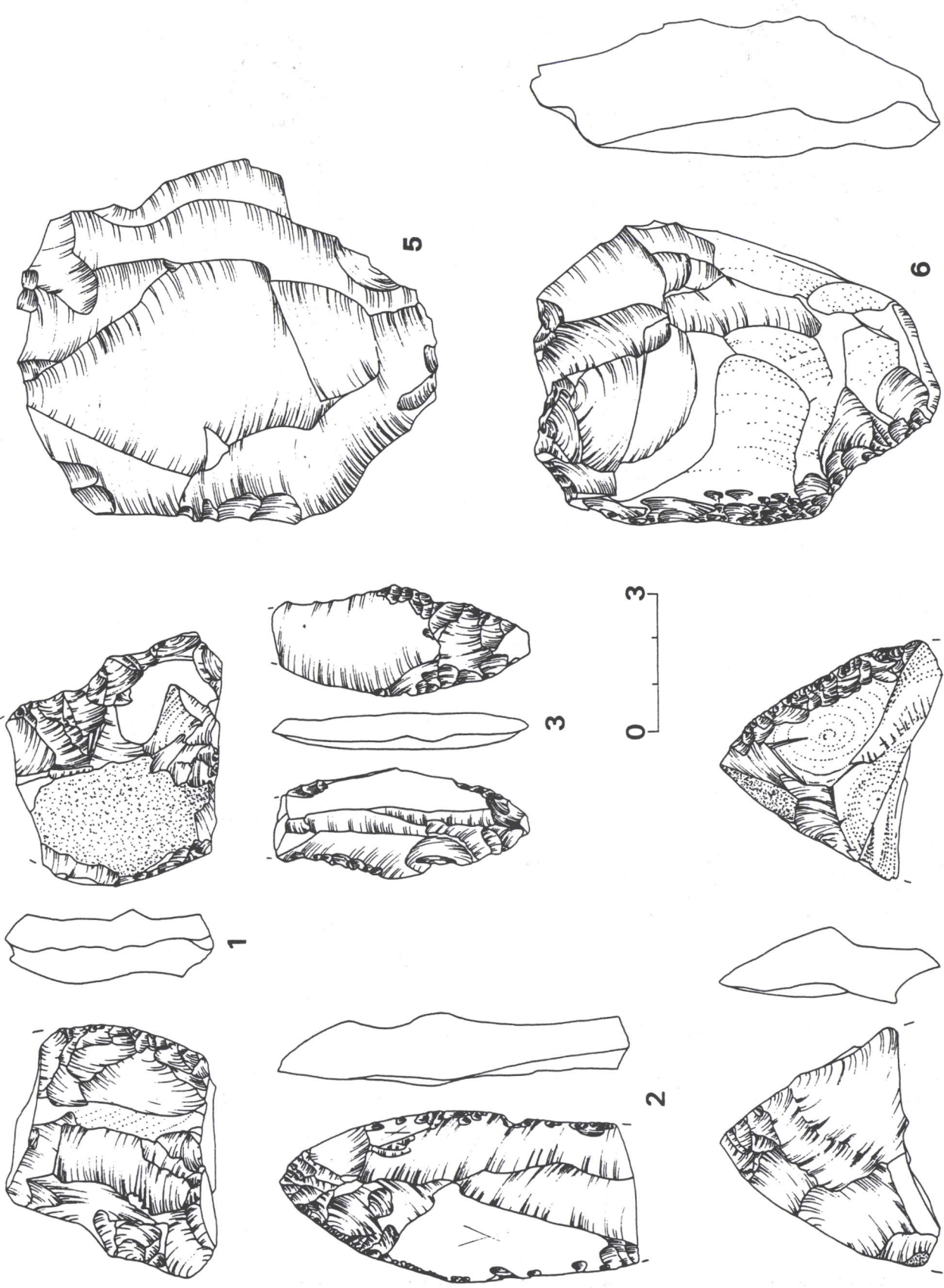


Figure 3 : Dzierżyszów, site 1. Lower level - flint artefacts :  
 1 - bifacial leaf points; 2 - retouched blade; 3 - Jerzmanowice leaf point; 4 - side-scraper with Quina-type retouch made of damaged Szeletian point; 5, 6 - cores. Drawn by E.M. Foltyn.

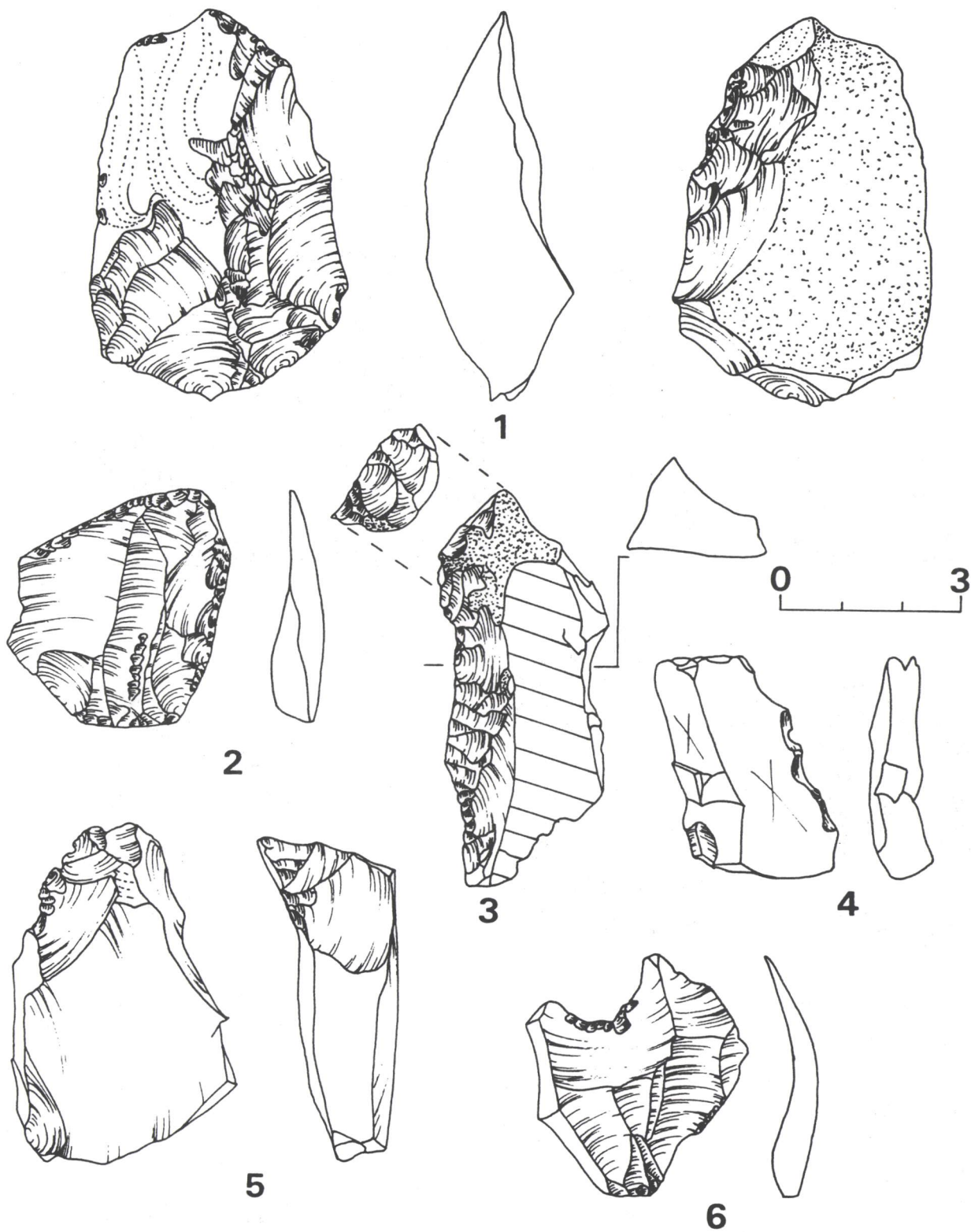


Figure 4 : Dzierżysław, site I. Lower level - flint artefacts : 1-3 - side-scrapers; 4 - denticulated tool; 5 - end-scraper; 6 - notched tool. Drawn by E.M. Foltyn.

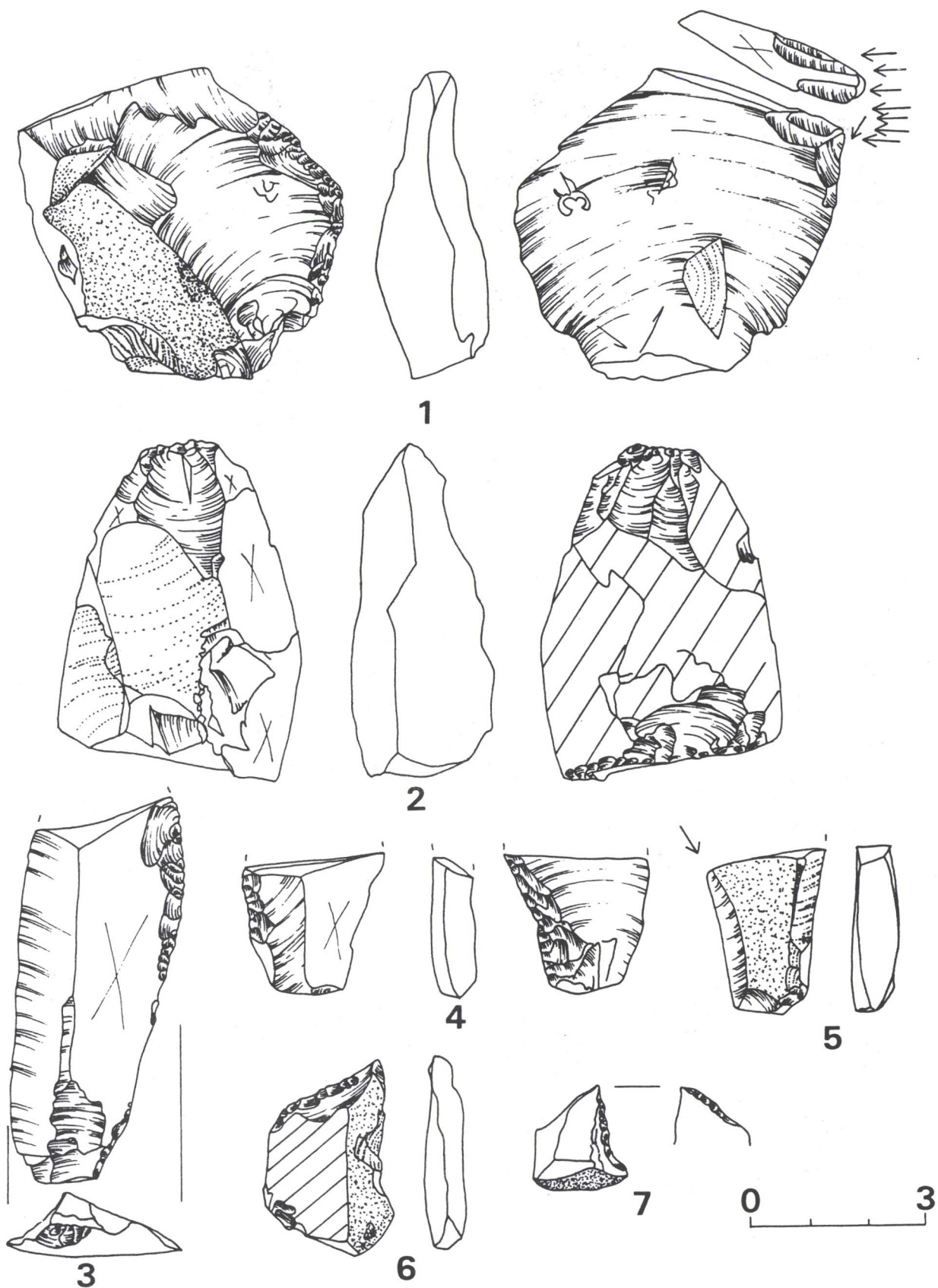


Figure 5 : Dzierżyślów, site 1, Lower level - flint artefacts : 1 - burin made of side-scaper; 2 - splintered piece; 3-4 - retouched blades; 5 - burin; 6 - truncated piece; 7 - perforator. Drawn by E.M. Foltyn.

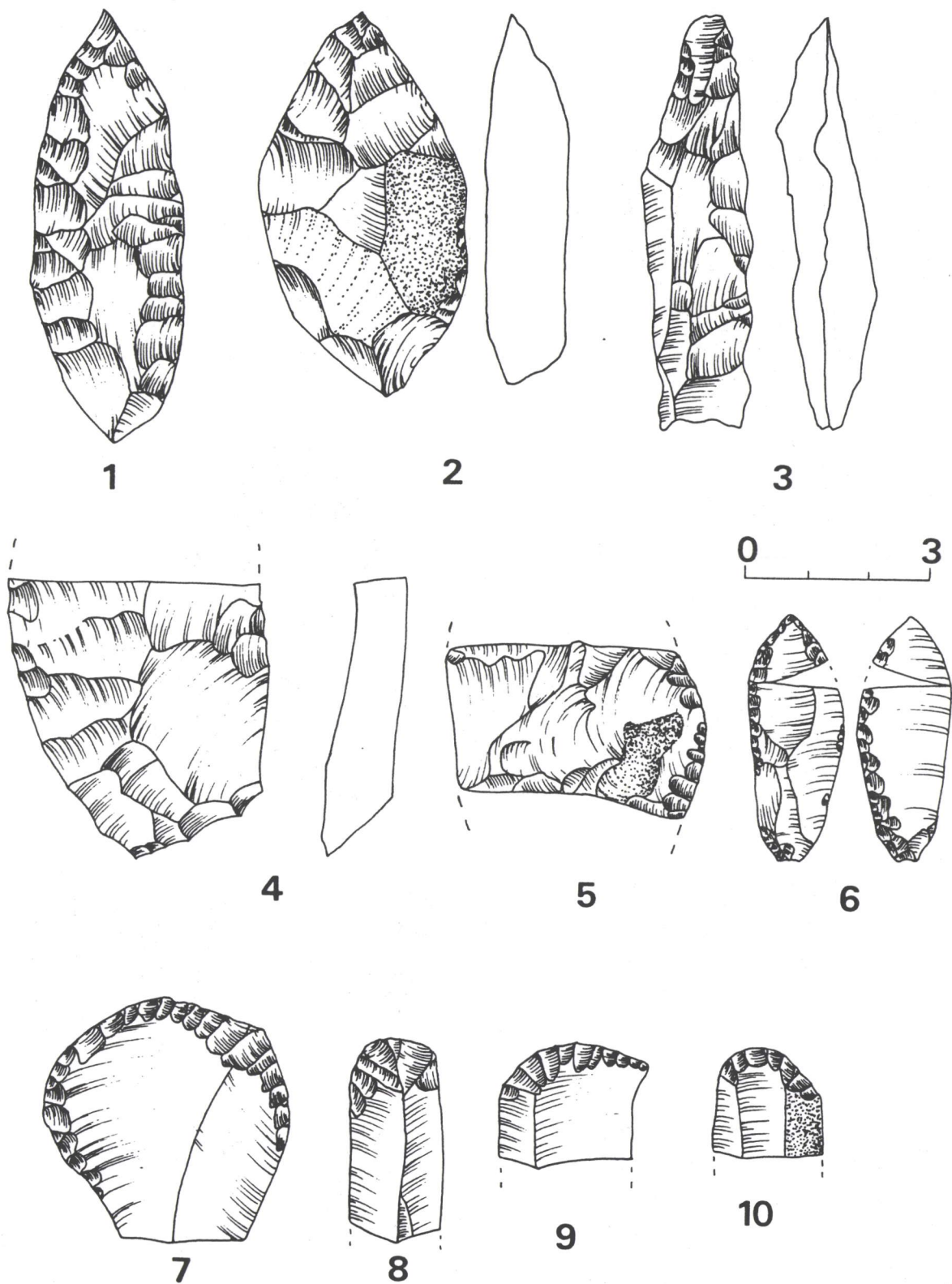


Figure 6 : Dzierżysław, site I. Upper level - flint artefacts : 1-5 - Szeletian leaf points; 6 - blade leaf point à face plane possibly from lower level; 7-10 - end-scrapers. Drawn by E.M. Foltyn.

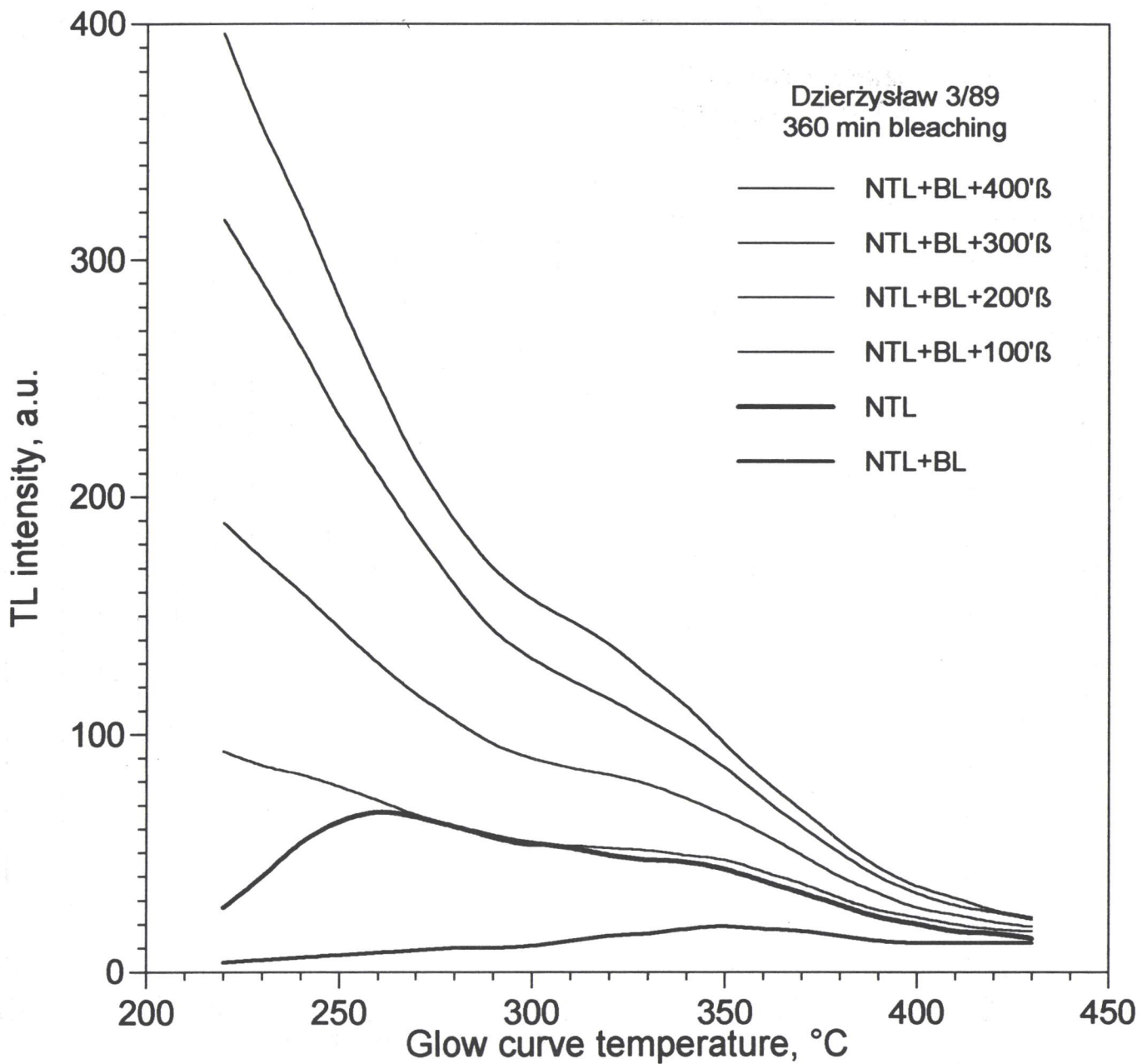


Figure 7 : Dzierżysław 3/89. TL glow curves. These are the typical examples of the type a glow curves. The low temperature peak (260 c) dominates over the high temperature one (340). Glow curves recorded for natural grains and bleached natural grains are plotted with thick solid lines, and regeneration glow curves are plotted with fine lines.

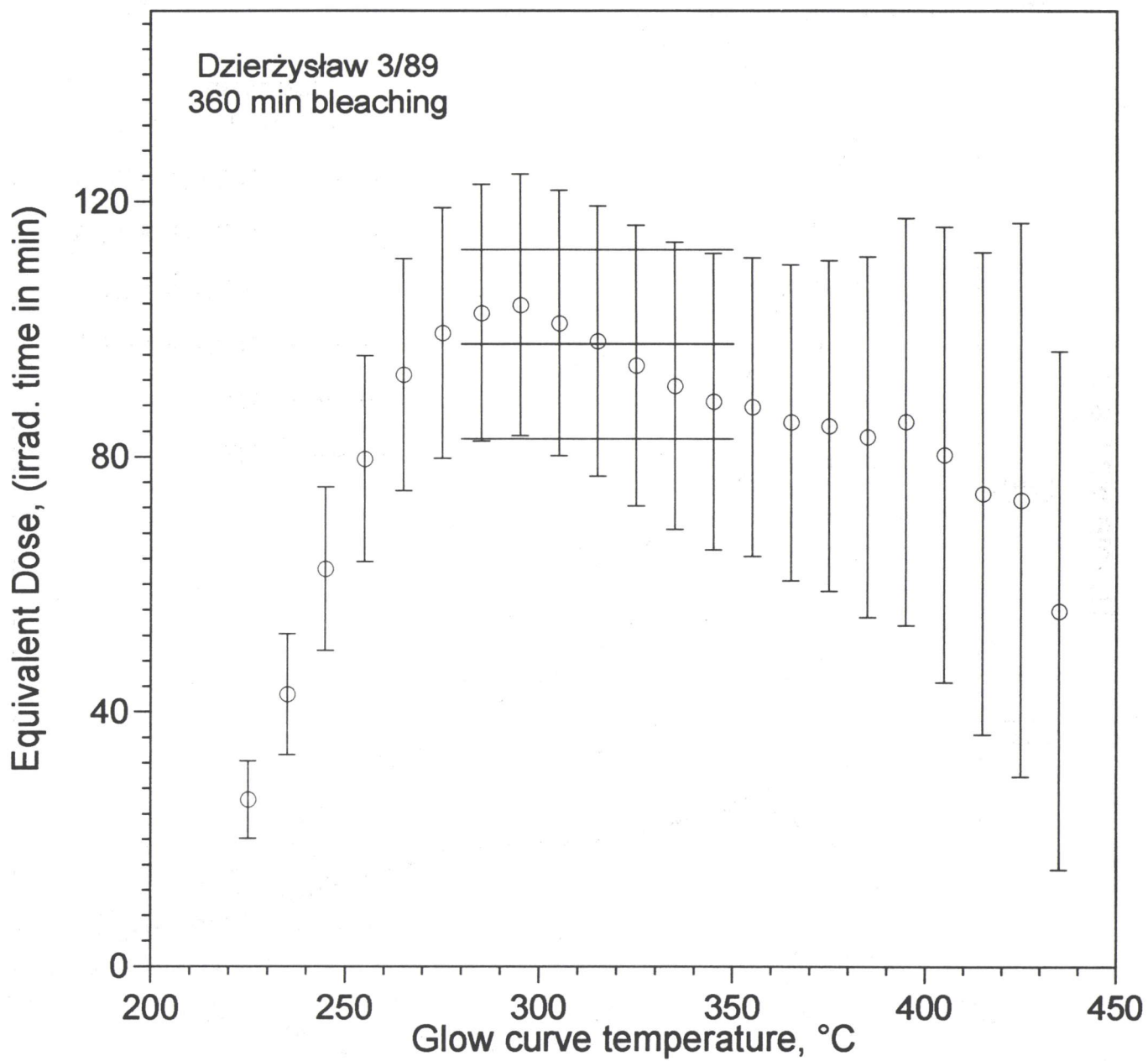


Figure 8 : Dzierzysław 3/89. Results of the plateau test plotted for the longer bleaching time (6 hours). The plateau region chosen for final calculations is indicated by horizontal lines. The thick horizontal line indicates ED value and fine lines indicate  $\pm$  error intervals.

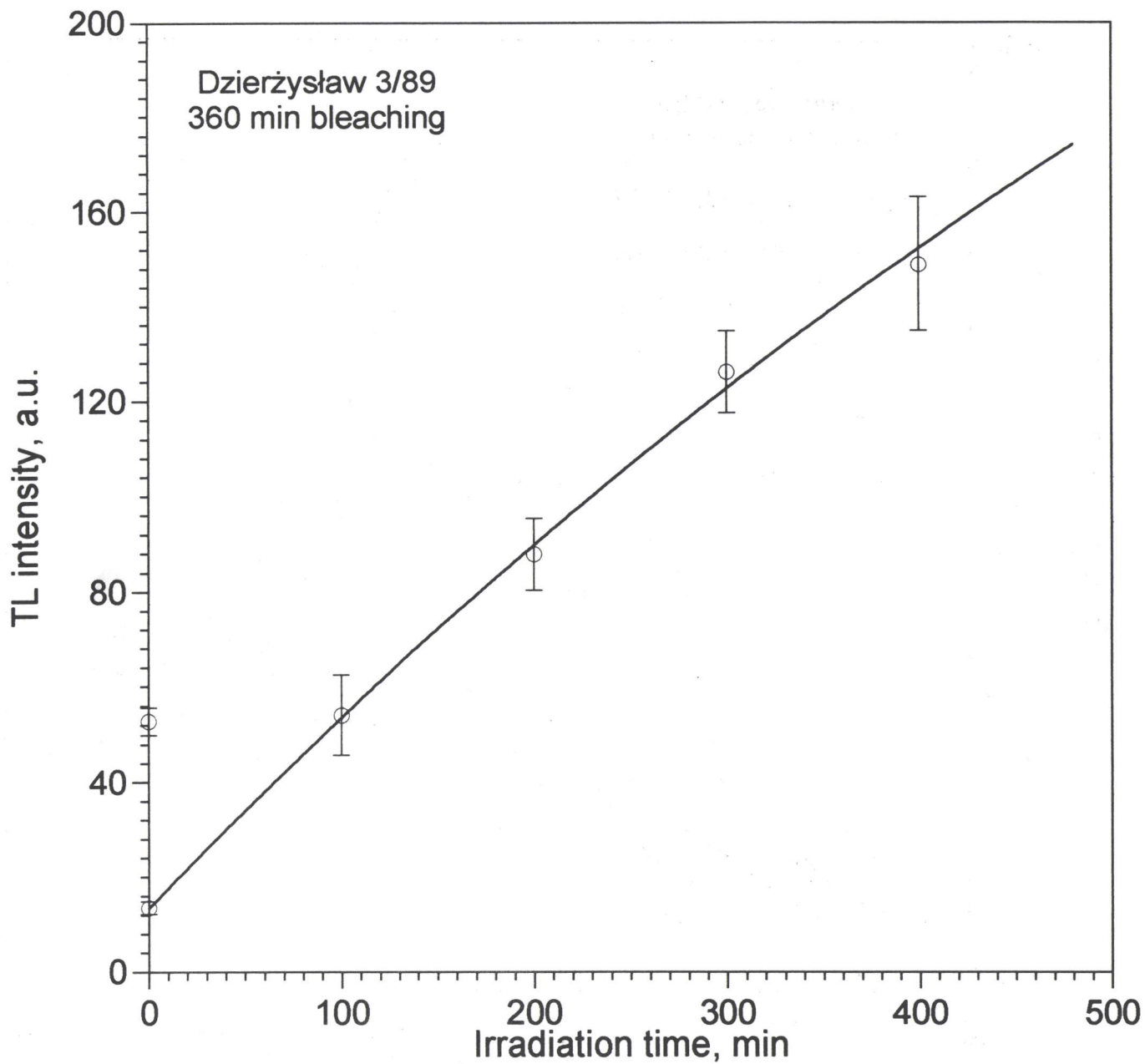


Figure 9 : Dzierżysław 3/89. TL signal growth vs laboratory dose (expressed here in minutes of beta irradiation). TL signal is averaged over the plateau region. The saturating exponential function is fitted to experimental data.

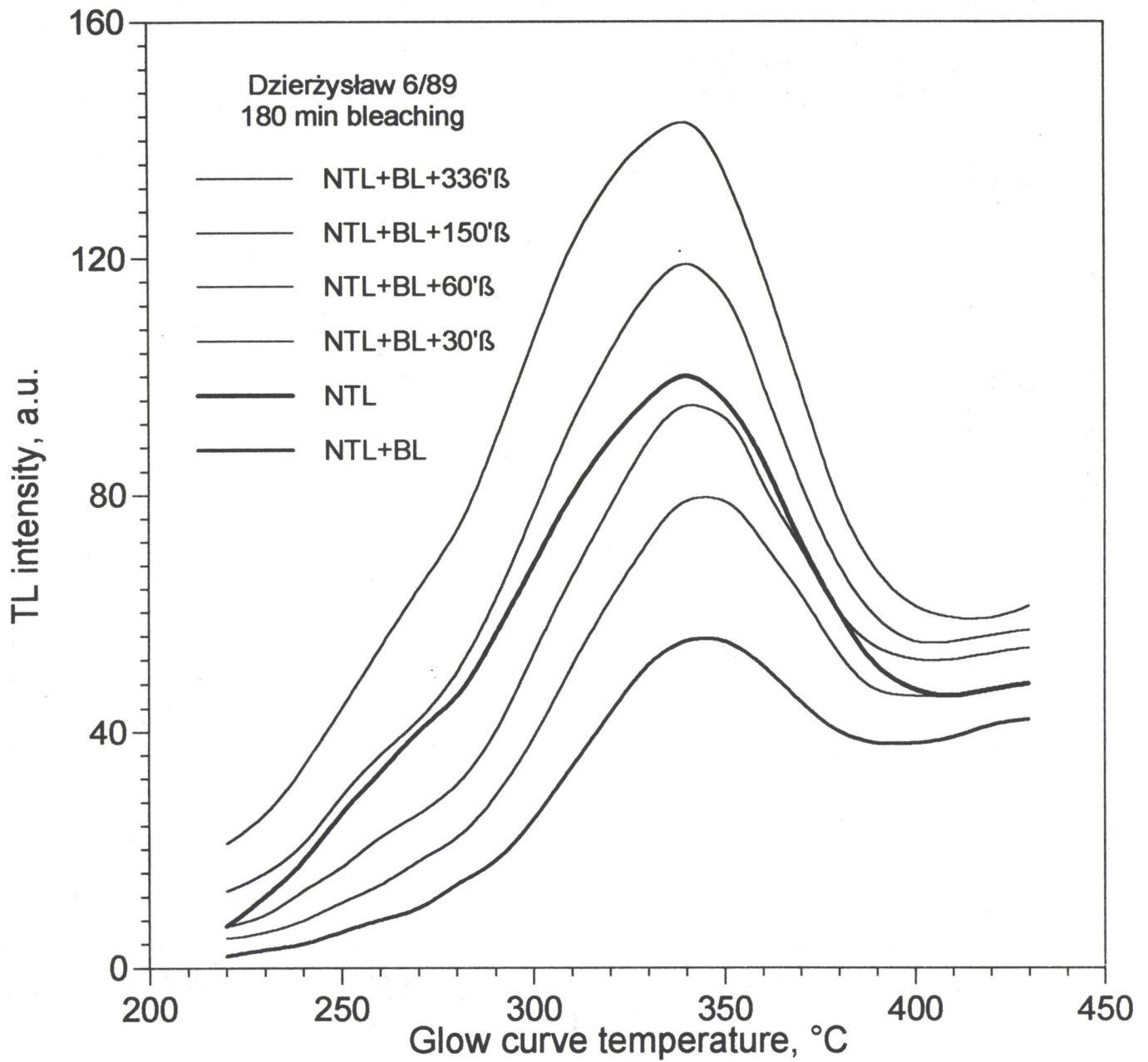


Figure 10 : Dzierżysław 6/89. TL glow curves. These are the typical examples of type B glow curves. The high temperature peak (340°C) dominates over the low temperature one (260°C). Glow curves recorded for natural grains and bleached natural grains are plotted with thick solid lines, and regeneration glow curves are plotted with fine lines

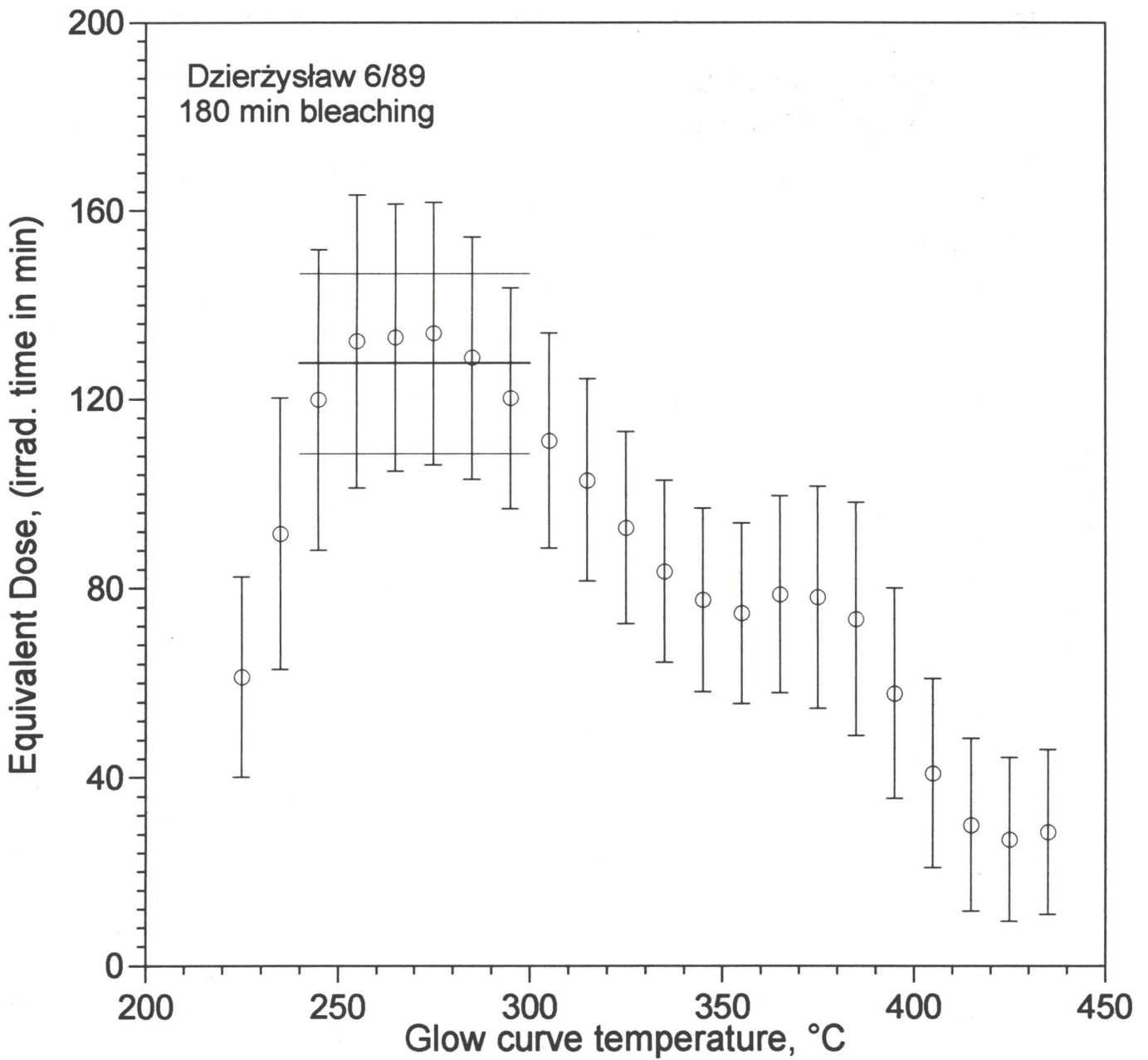


Figure 11 : Dzierżysław6/89. Results of the plateau test plotted for the shorter bleaching time of 3 hours. The plateau region chosen for final calculations is indicated by horizontal lines. The thick horizontal line indicates ED value and fine lines indicate  $\pm$  error intervals.

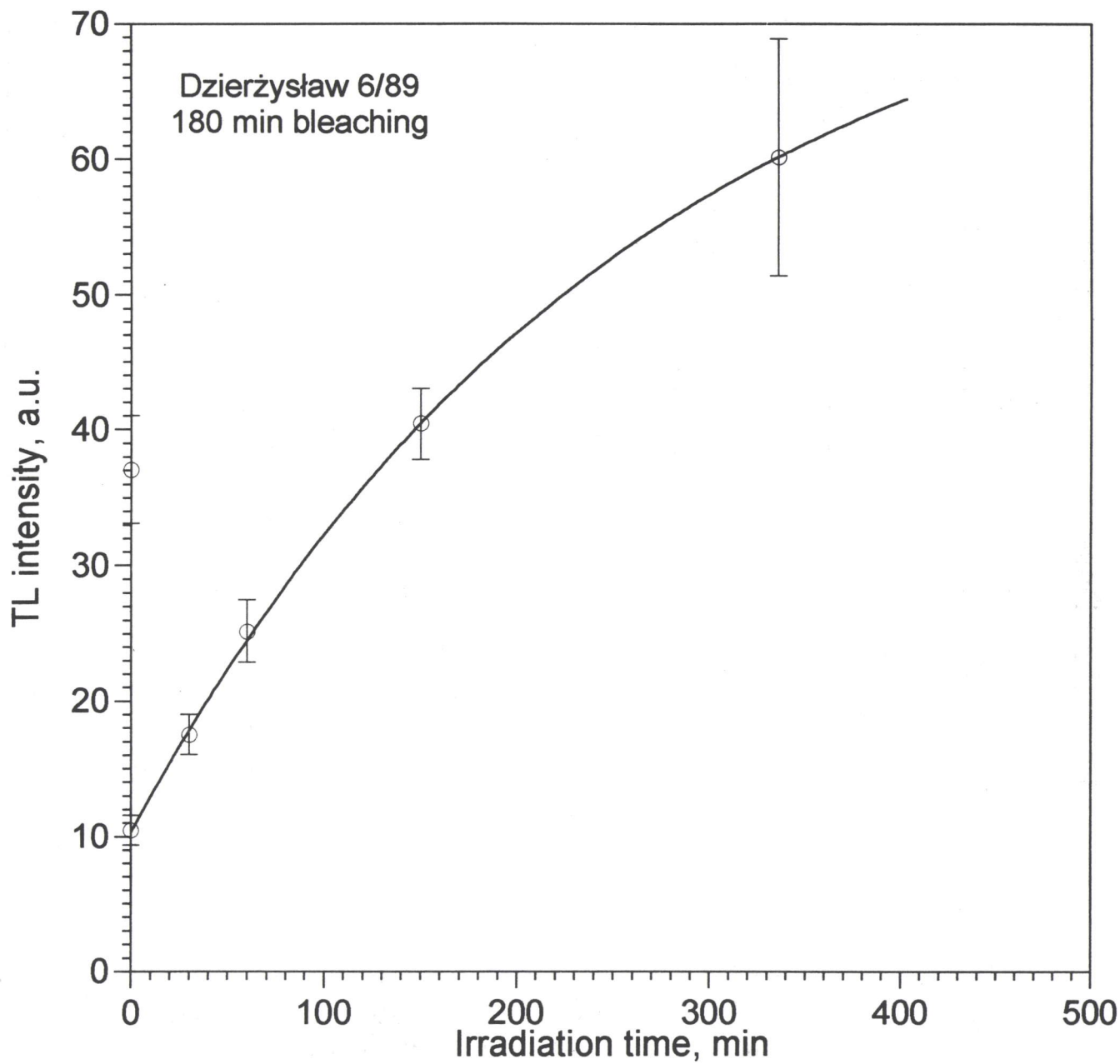


Figure 12 : Dzierżysław 6/89. TL signal growth vs laboratory dose (expressed here in minutes of beta irradiation). TL signal is averaged over the plateau region. The saturating exponential function is fitted to experimental data. Another difference between types A and B is seen in this figure : TL growth curve saturates much faster for the type B than for the type A.