

# SBORNÍK NÁRODNÍHO MUSEA V PRAZE

## ACTA MUSEI NATIONALIS PRAGAE

Volumen XVI. B (1960) No. 1—2

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O T A K A R K U M P E R A — F E R D I N A N D P R A N T L —  
B O H U S L A V R Ú Ž I Č K A :

### Revise čeledi Nuculanidae z ostravsko-karvínské pánve (Pelecypoda)

### Revision of the Nuculanidae from the Ostrava-Karviná District (Pelecypoda)

#### ÚVOD

(Předloženo — Presented 29. II. 1960)

Nuculanidní mlží tvoří ve spodním i v produktivním karbonu česko-slovenské části hornoslezské předhlubně (OKR) velice zajímavou, tvarově dosti pestrou skupinu, v níž někteří autoři rozlišovali několik druhů. Byl to především F l e m i n g ú v druh *attenuata*, který řadili buď k rodu *Nuculana* nebo *Leda*, dále *Nuculana* (nebo *Leda*) *sharmani* a konečně druh *Nuculana* (nebo *Leda*) *stilla*. Tyto různé druhy byly různě chápány a nebyly detailněji zpracovány, což mělo za následek, že v geologické praxi v ostravsko-karvínském revíru byly např. všechny protáhlé typy taxodontních mlžů označovány jako *Nuculana* (nebo *Leda*) *attenuata*. Z tohoto důvodu jsme podrobili pečlivé revisi všechny dosavadní sběry nuculanidních mlžů z OKR. Při revisní práci jsme obecně používané popisné metody doplnili metodami biometricko-statistickými, jimž v této práci věnujeme samostatnou část.

Revise nuculanidních mlžů ukázala, že jde o společenstvo tvořené několika samostatnými druhy, které náležejí dvěma rodům: *Polidevcia* Č e r n y š e v a *Phestia* Č e r n y š e v, pro které současně navrhujeme zvláštní podčeleď *Polidevciinae nov. subfam.* Zástupci prvně jmenovaného rodu jsou druhově početnější, druhý rod je zastoupen v našich sběrech pouze jediným druhem. Pouze dva z popsaných druhů, a to *Polidevcia attenuata* a *P. sharmani* byly bezpečně zjištěny i v jiných karbonských sedimentačních oblastech.

Po stránce biostrationomické je nutno zdůraznit, že v některých mořských patrech má zjištěná fauna ráz thanatocenosy, vzniklé přeplavením a redepositioní jednotlivých misek odumřelých živočichů. V jiných případech se setkáváme s uzavřenými schránkami, které nasvědčují, jak

se domníváme tomu, že tito jedinci byli redeponováni do hlubších partií sedimentační pánve, přičemž byli zaživa pohřbeni v mocném sedimentu.

V práci použité biometrické metody se ukázaly ve většině případů vhodné ke zpracování nuculanidních mlžů a forem jím blízkých.

Považujeme ze svou milou povinnost poděkovat dr. M. Pradáčové, prom. geol. F. Řehořovi, prof. Vodičkovi, J. Gengelovi a inž. V. Brixovi za laskavé zapůjčení, po případě předání materiálu. Rovněž jsme zavázáni British Museum (Nat. Hist.) v Londýně za laskavé zapůjčení srovnávacího materiálu, Akademii nauk Ukrainské SSR za zapůjčení některé literatury a za připomínky P. L. Šulgové, M. Schwarzbaucha a J. Lintzovi.

## ČÁST VŠEOBECNÁ

### Pracovní metody.

Metodika paleontologické práce, které se doposud běžně užívá při určování fosilních společenstev má jisté, většinou známé nedostatky. Jedním z nich je skutečnost, že sebe důkladnější, vyčerpávající slovní popisy zkamenělin zůstávají vcelku více nebo méně subjektivní. Subjektivita těchto popisů je ještě zvyšována odkazem na vyobrazení některých studovaných jedinců-představitelů popisovaného druhu. Tyto tzv. *holotypy*, *lektotypy*, *syntypy* atd. nereprezentují totiž celý variační okruh toho či onoho taxonu. Ve většině případů jsou vyobrazováni spíše jedinci nejlépe zachovaní a nikoliv jedinci nejtypičtější, tj. takoví, kteří postihují charakter variačního seskupení. Z toho vyplývá, že např. vyobrazení samotného holotypu nelze považovat z taxionomického hlediska za dostačující.

Dosavadní metodika práce někdy zaviňuje i neopodstatněné stanovení nových druhů či poddruhů. Studie, které zpracovávaly některá fosilní společenstva jako celky s přihlédnutím k jejich variabilitě, prokázaly totiž, že mnohé nové druhy byly stanoveny tak, že za jejich holotypy byly vzati jedinci tvořící krajní meze jediného variačního seskupení. Dokonce se ukázalo, že v některých případech patří holotypy různých druhů jediné růstové řadě. Tak např. A. Pastiels (1953) dokázal pomocí biometrických studií, že některé druhy rodu *Carbonicola* z belgického karbonu byly stanoveny naprostě uměle. Proto v poslední době někteří pracovníci (G. G. Simson, 1940; H. B. Burrma, 1948, 1949; N. D. Newell, 1949 aj.) oprávněně doporučují, aby dosavadní více méně ryze deskriptivní praxe paleontologického studia byla opuštěna a zároveň, aby vymezování taxonu na základě několika málo typických jedinců bylo nahrazeno studiem celých vzorků populací, které by určovaly vlastnosti fosilního společenstva kterékoliv formy. V této souvislosti, s odkazem na výše uvedené autory, poznamenáváme, že význam holotypů a lektotypů není vždy správně taxionomicky chápán. Podle našeho názoru spočívá hlavní těžiště významu těchto pojmu na poli nomenklatorickém. Je to tedy zajištění stálosti a jednoznačnosti taxionomického názvu vztahujícího se k dané formě. Taxionomický objem této formy není však tímto systematickým pojmem ohrazen. Nomenklatorická pravidla, která jsou pro systematickou paleontologii mezinárodně platná a všeobecně závazná nás na další nutí,

abychom pro formální uznání platnosti taxionomických názvů, které nově navrhujeme, holotypy nadále stanovovali. Je nám však jasno, že pro reálné a pokud možno objektivní stanovení morfologického rozsahu kteréhokoliv druhu bude nutno deskripci stanovit spíše na vlastnostech celého společenstva. Připojujeme se proto k stanovisku G. G. Simpsona (1940), který za základ paleontologické systematické práce doporučuje na místě holotypů stanovení tzv. *hypodigmů*. Podle N. D. Nevella (1949) je totiž *hypodigm* vzorek populace, kterým jsou určeny její vlastnosti. Složení *hypodigmu* se mění tím, že jsou k němu přidáváni noví jedinci a jedinci nevhodní jsou z *hypodigmu* vylučováni. Kritickými studiemi, založenými na nově přidaných jedincích, se rozšiřují znalosti o druhu tak, že se zvětšuje velikost *hypodigmu*. *Hypodigm* je tedy statistickým vzorkem. Vzrůstá-li tento vzorek při dodávání nových sběrů různých autorů v různých dobách, pak odhad vlastností celé populace, je-li založen jednotně na kvantitativním statistickém vyjádření vlastností *hypodigmu*, se postupně přibližuje skutečnému stavu v přírodě.

Je samozřejmé, že tento nový způsob práce, který umožňuje kvantitativní vyjádření vlastností studovaného společenstva jako celku na základě vlastností studovaných vzorků, vyžaduje nové pracovní metody. Proto používáme statisticko-biometrických metod, které statisticky vyšetřují vlastnosti vzorku populace na základě měření jednoznačně stanovitelných veličin (morfologických znaků). Význam statisticko-biometrických metod spočívá především v tom, že objektivní výsledky, získané jejich užitím, vhodně doplňují popisy druhů. Doporučujeme proto, aby v paleontologických pracích byl v systematické části zařazen vždy za slovní popisy jednotlivých druhů oddíl „*Statisticko-biometrická charakteristika*“, ve které by byly tvarové vlastnosti studovaného druhu objektivně vyjádřeny. Domníváme se, že takto vyjádřené vlastnosti vzorků jsou dobrým kritériem pro srovnávací práce. Statisticko-biometrické metody umožňují dále jednoznačně vyjádřit určitý morfologický znak vzorku populace kolektivně, tj. s ohledem na všechny jedince. Pro takové vyjádření má statistika k dispozici výborné prostředky jako aritmetický průměr, směrodatné odchyly apod., které nejen že umožňují velmi přesně určit skutečného „typického jedince“ (průměrného ve smyslu statistickém), ale dovolují stanovit i hranice, ve kterých se může studovaný morfologický znak u celého společenstva měnit.

Statisticko-biometrická analýsa nám může být významně nápomocna při zjišťování, zda materiál, se kterým pracujeme, obsahuje jeden či více druhů, popřípadě poddruhů. Je však zcela pochopitelné, že problém rozlišení druhů a poddruhů nelze rozhodnout pouze na základě statisticko-biometrické analýsy, neboť znaky, podle kterých druhy nebo poddruhy od sebe odlišujeme, bývají často těžko kvantitativně vyjádřitelné.

Užití statisticko-biometrických metod při rozlišení druhů je založeno na známé skutečnosti, nejnověji znova zdůrazněné B. H. Burmu (1948), že poměry dvou, případně více morfologických znaků, zůstávají u jedinců jednoho druhu v průběhu růstu velmi přiblížně konstantní (např. poměr výšky a délky misky u mlžů apod.), jsou tedy navzájem ve více nebo méně lineárním vztahu — korelují spolu. Tato skutečnost, vyjádřená v podstatě jí Cuvirovým korelačním pravidlem, nám pak umožňuje vyšetřit

pro každý druh růstové zákonitosti, které zástupci každého druhu velmi přibližně zachovávají.

Uvedli jsme, že výhody užití statisticko-biometrických metod v paleontologii proti dosavadnímu postupu spočívají především v tom, že umožňují objektivní vyjádření vlastností celého vzorku a že mohou být platnými pomocníky při systematických studiích. Všeobecně (avšak pouze všeobecně) užití těchto metod může v budoucnosti prokázat značné služby i stratigrafii. Je známo, že společenstvo jednoho horizontu bývá společenstvem stejnorođím, soustřeďujícím se kolem definovaného průměru. Naproti tomu průměrné hodnoty morfologických znaků společenstev ze stratigraficky různých horizontů se od sebe liší, což je způsobeno časovým odstupem a vším, co s sebou takový odstup nese. Zdá se tedy, že v budoucnosti bude možno vést detailní biostratigrafická studia i touto cestou.

Rozsáhlé použití statisticko-biometrických metod v paleontologii umožní v budoucnosti sledovat v souvrstvích s horizonty, bohatými na faunu, krok za krokem i faciální vývoj pánví a tím, ve smyslu B u r m o v ě (1948) i zpřesnění objektivního geologického výzkumu. Je však pochopitelné, že problémy stanovení časových a geografických variet bude moci paleontologie užitím statisticko-biometrických metod řešit jedině tehdy, budou-li k disposici velmi rozsáhlé sběry a dojdou-li hypodigmy širokého uplatnění.

Aby bylo umožněno srovnání fosilních společenstev, je třeba, aby morfologické znaky, které podrobujeme statisticko-biometrickým studiím, byly jednoznačně definovány.

### Výběr parametrů.

Při výběru znaků, kterými chceme dané fosilní společenstvo biometricky studovat, musíme přihlížet k tomu, aby tyto znaky byly snadno stanovitelné a měřitelné. Při zpracovávání mlžích forem studujeme především obrysou křivku misek, neboť tato bývá nejlépe zachována a je ji možno poměrně snadno rekonstruovat tam, kde je mírně poškozena. Obrysou křivku charakterizujeme jejími základními parametry, tj. délku a výšku misky. Tyto veličiny měříme od nejvyššího bodu vrcholu, protože tento je ve všech případech jednoznačně stanovený a takto dodržujeme zásadu měřit základní parametry ve směru růstu. K měření parametrů nepoužíváme přitom vrcholu dorsálního úhlu (respektive subumbonálního bodu), protože tento není ve většině případů jednoznačně stanovitelný.

Délku misky je možno ve většině případů stanoviti takto: (obr. 1, 2). Na sedminásobných zvětšeninách obrysové křivky, pořízených fotoprojekcí, stanovíme nejvyšší bod vrcholu (*V*), zadní krajní bod (*Z*), přední krajní bod (*P*). Součet délek *VP* (parametr *a*) a *VZ* (parametr *b*) označujeme jako délku misky.

Výšku misky (obr. 1) stanovujeme pak tak, že nejprve vedeme k volnému okraji tečnu (*t*) rovnoběžnou s *PZ*. Dotykový bod tečny (*t*) s volným okrajem je spodní krajní bod (*T*). Na tečnu (*t*) spustíme kolmici z nejvyššího bodu vrcholu. Délka této kolmice je pak výškou misky (*v*).

Je vhodné kvantitativně vyjádřit volný okraj misek, jehož systematický a biologický význam je dán již tím, že představuje ve skutečnosti geometrické místo bodů synchronně vylučovaných pláštěm. Volný okraj misek studoval především L. Lison (1939, 1940, 1941, 1949) a A. Pastiels (1953). Zpočátku jsme i my při studiu volného okraje používali částečně pozměněné metody, kterou navrhl A. Pastiels (1953). Kvan-

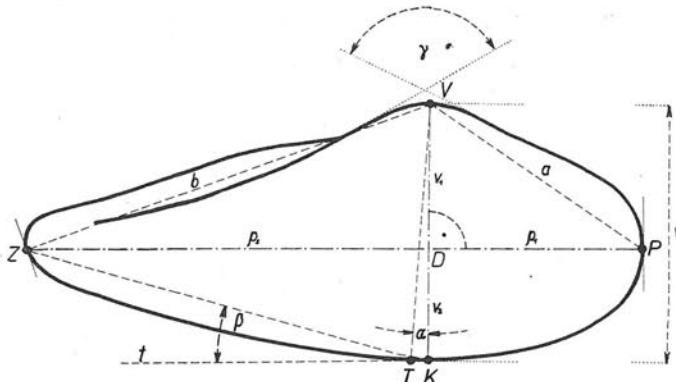


Fig. 1 Determination of the basic parameters of the outline of nuculanid shells.  
 P — anterior extreme point (přední krajní bod); Z — posterior extreme point (zadní krajní bod); V — highest point of the beak (nejvyšší bod vrcholu); T — inferior extreme point (spodní krajní bod); K — contraumbonal point (kontraumbonální bod);  $a + b$  — valve length (délka misky);  $v$  — valve height (výška misky);  $p_1$ ,  $p_2$  — parameters characterizing the position of the beak (parametry charakterizující pozici vrcholu);  $v_1$ ,  $v_2$  — parameters characterizing the sloping of the posterior part of the outline (parametry charakterizující zvednutí zadní části obrysové křivky);  $t$  — tangent to the free margin, parallel to PZ (tečna k volnému okraji rovnoběžná s PZ);  $\alpha$ ,  $\beta$  — angles characterizing the lower margin (úhly charakterizující spodní okraj);  $\gamma$  — apical angle (vrcholový úhel).

titativní vyjádření volného okraje jsme prováděli totiž součtem vnitřních úhlů ( $\Sigma\tau$ ), které mezi sebou svíraly sečny k volnému okraji, vedené koncovými body průvodičů, které měly počátek v nejvyšším bodu vrcholu a svíraly s hlavní osou (Dopita-Růžička, 1953) úhly, jež byly celými násobky  $20^\circ$ . I když parametr  $\Sigma\tau$ , jehož tento autor používá, je význačnou veličinou, rozhodli jsme se u jedinců, námi studovaných, použít jednodušší charakteristiku, která by především kvantitativně vyjádřila zvednutí zadní části obrysové křivky. Za tím účelem jsme studovali úhel  $\beta$  sevřený úsečkou  $KZ$  a tečnou  $t$ . Dále jsme zjistili, že pro vyjádření charakteru volného okraje je význačná posice spodního krajního bodu ( $T$ ) vzhledem ke kontraumbonálnímu bodu ( $K$ ). Vzájemnou posici těchto dvou bodů vyjadřujeme úhlem  $\alpha$ , sevřeným úsečkou  $VT$  a výškou. Tento úhel je buďto kladný, je-li měřen od výšky směrem k zadnímu okraji, nebo záporný, je-li měřen od výšky směrem k přednímu okraji, tj. podle toho, zda spodní krajní bod leží za nebo před kontraumbonálním bodem.

Polohu vrcholu jsme charakterisovali vzájemným poměrem parametrů  $p_1$  a  $p_2$ . Zakřivení volného okraje jsme se pokusili charakterisovat pomocí poměru parametru  $v_1$  k parametru  $v_2$ .

Dále jsme studovali velikost vrcholového úhlu  $\gamma$ . Vrcholový úhel je měřítkem špičatosti vrcholu. Konečně jsme studovali vzájemný vztah mezi délkou, výškou a šírkou misky.

### Početní metody.

Při biometrických studiích mlžích společenstev je možno obvykle použít charakteristiky a metody, běžné v současné statistické analyse. Především je to aritmetický průměr, jako nejjednodušší a nejčastěji užívaná charakteristika:

$$A = \frac{\sum x}{n}$$

kde  $x \dots$  naměřená hodnota studovaného morfologického znaku,  
 $n \dots$  počet jedinců.

Již tato jednoduchá charakteristika může podat informaci o homogenním vzorku. Je nutno však upozornit na to, že aritmetického průměru hodnot, které se mění s růstem jedince, není pochopitelně možné použít jako charakteristiky studovaného společenstva, nepracujeme-li se stejnými stadiemi růstu. Jelikož paleontolog nejčastěji pracuje s různými růstovými stadiemi, užíváme aritmetického průměru k charakteristice studovaného vzorku homogenní populace jen u těch hodnot, které zůstávají v průběhu růstu jedince přibližně konstantní. U těch parametrů, jejichž hodnota se s růstem jedince mění, může aritmetický průměr podat informaci např. o vývoji daného společenstva v různých horizontech nebo v různých mísách pánve.

Když jsme vypočetli aritmetický průměr studovaného znaku, použijeme výsledku, který jsme obdrželi, k výpočtu pro paleontologii zvlášť důležitého druhého momentu kolem aritmetického průměru, tzv. směrodatné odchylky. Nejprve zjistíme rozdíly naměřených hodnot studovaného morfologického znaku od aritmetického průměru:

$$\xi = x - A$$

Pak směrodatná odchylka

$$\sigma_x = \sqrt{\frac{\sum (\xi)^2}{n}}$$

Směrodatná odchylka je vlastně mírou variability studovaného znaku v daném vzorku a proto je její použití při paleontologických studiích zvláště důležité. Čím je  $\sigma_x$  větší, tím jsou hodnoty měřeného znaku volněji rozptýleny kolem aritmetického průměru.

Nemůžeme z praktických důvodů zpracovávat všechny jedince, kteří by do studované populace patřili. To je dáno již povahou zachování fosilií a neúplnosti našich sběrů. Přesto však chceme, aby nám závěry, učiněné z biometrických studií menšího počtu jedinců (statisticky řečeno — náhodného výběru), umožnily objektivně charakterisovat celou populaci (celý tzv. základní soubor). Ve statické matematice pro to existují objektivní výrazy. Vypočteme-li aritmetický průměr a směrodatnou odchylku našeho vzorku, pak s jejich pomocí můžeme určit hranice variability ve studovaném společenstvu.

Platí, že mezi hodnoty

- $A \pm 1\sigma_x$  zapadne 68,00 % jedinců základního souboru  
 $A \pm 2\sigma_x$  zapadne 95,50 % jedinců základního souboru  
 $A \pm 3\sigma_x$  zapadne 99,70 % jedinců základního souboru  
 $A \pm 4\sigma_x$  zapadne 99,99 % jedinců základního souboru

Za hranice variability v základním souboru zpravidla přijímáme hodnoty  $A \pm 3\sigma_x$  (pro hranice variability užíváme obvykle symbolu  $h$ ).

Dále můžeme vypočítat tzv. odhad směrodatné odchylky výběrových průměrů:

$$\sigma_A = \frac{\sigma_{xn}}{\sqrt{n}}$$

když jsme před tím zjistili nejlepší odhad směrodatné odchylky základního souboru

$$\sigma_{xn} = \sqrt{\frac{\sum(\xi)^2}{n-1}}$$

Rozmezí, do něhož pak zapadne průměr populace, je  $A \pm 3\sigma_A$  s pravděpodobností 99,70 % (pro rozmezí průměru populace používáme obvykle symbolu  $R$ ).

Statistická analýza může být paleontologovi nápomocná při zjištění, zda jeho sběr je homogenní či heterogenní.

K tomu je možno doporučit tento postup: Po provedeném měření vybraných morfologických znaků sestavíme diagramy četnosti každého znaku zvlášť a zjišťujeme, zda rozdělení četnosti má jeden či více vrcholů. Druhý případ nám napoví, že podle toho znaku, u kterého má diagram rozdělení četnosti více maxim, je studovaný sběr nestejnorodý. Studium rozdělení četnosti doplníme posouzením grafického zobrazení vztahu dvou parametrů (např.  $d$  a  $v$ ,  $p_1$  a  $p_2$ ) v systému pravoúhlých souřadnic  $x, y$  tak, že každému jedinci odpovídá v grafu bod. Rozmístění bodů v takto získaném korelačním poli nám opět napoví, zda sběr je stejnorodý či různorodý. Zjistíme-li nestejnorodost, rozdělíme nás sběr na příslušné výběry a přikročíme k matematické analýze, která ukáže, zda rozdíly mezi sběry jsou nebo nejsou statisticky významné. Podle toho pak můžeme usoudit, zda máme co činit s variacioním okruhem jednoho taxonu či s variačními okruhy několika taxonů.

Nejjednodušší je provést srovnání dvou výběrů na základě jednoho morfologického znaku (např. úhlu  $\beta$ , v našem případě). Nejprve vypočítáme aritmetické průměry hodnot studovaného znaku pro každý průměr zvlášť ( $A_1$  a  $A_2$ ), a jejich směrodatné odchylky ( $\sigma_{x1}$  a  $\sigma_{x2}$ ). Dále vypočítáme směrodatnou odchylku výběrových průměrů

$$\sigma_d = \sqrt{\frac{\sigma_{x_1}^2}{n_1} + \frac{\sigma_{x_2}^2}{n_2}}$$

kde  $n_1 \dots$  počet jedinců v prvním výběru,

$n_2 \dots$  počet jedinců v druhém výběru,

a rozdíl výběrových aritmetických průměrů  $d = A_1 - A_2$  (nebo  $d = A_2 - A_1$ . Je-li  $A_2 > A_1$ ). Nyní zjišťujeme významnost rozdílů mezi našimi výběrovými průměry. Je-li  $\frac{d}{\sigma_d} < 2$ , je rozdíl mezi průměry statisticky nevýznamný; jestliže  $\frac{d}{\sigma_d} > 2$ , může být rozdíl mezi průměry statisticky významný, při-

čemž pravděpodobnost, že je statisticky významný, stoupá s rozsahem obou výběrů. Je-li  $\frac{d}{\sigma_d} > 3$ , můžeme rozdíl mezi výběrovými průměry považovat za statisticky významný.

Pracujeme-li s malými sběry, užíváme raději ke zjištění statistické významnosti rozdílu mezi výběrovými průměry tzv. *t*-testu: nejprve zjistíme nejlepší odhad směrodatné odchylky výběrových průměrů:

$$\sigma_{(x, v)} = \sqrt{\frac{\sum \xi_1^2 + \sum \xi_2^2}{n_1 + n_2 - 2}}$$

kde výraz  $n_1 + n_2 - 2$  nahrazuje v tomto případě počet jedinců a je vlastně tzv. stupněm volnosti. Od celého počtu pozorování zde odečítáme 2 proto, že u každého výběru je již stanoven aritmetický průměr. Dále vypočítáme množství  $t$

$$t = \frac{d}{\sigma_{(x, v)}} \cdot \sqrt{\frac{n_1 \cdot n_2}{n_1 + n_2}}$$

Velikost takto  $t$  získaného srovnáváme s tabulkou hodnot  $t$  (R. A. Fisher a F. Yates, 1948), do níž vstupujeme se stupněm volnosti  $n_1 + n_2 - 2$  a testujeme na jedno-, pěti- nebo desetiprocentní stupeň významnosti (nejčastěji na pětiprocentní stupeň). O statické významnosti rozdílu výběrovými průměry uvažujeme, je-li vypočtené  $t$  stejně či větší než  $t$ , které jsme vyhledali v tabulce.

Při paleontologických studiích můžeme vhodně použít metodu srovnání dvou výběrů na základě poměru dvou znaků. Předpokládejme, že máme dva výběry 1 a 2, jejichž srovnání chceme provést na základě vztahu dvou znaků  $x$  a  $y$  (např. délky a výšky nebo  $p_1$  a  $p_2$ ) a že vztah mezi těmito znaky je lineární. Tento požadavek bývá zejména u mlžích společenstev splněn. Vypočteme nejprve koeficient korelace mezi  $x$  a  $y$  pro každý z obou vzorků

$$K_{xy} = \frac{\Sigma (\xi \cdot \eta)}{n \cdot \sigma_x \cdot \sigma_y}$$

$$\text{kde } \xi = x - A_x \\ \eta = y - A_y$$

$\sigma_x, \sigma_y \dots$  směrodatné odchylky.

Koeficient korelace je mírou těsnosti vztahu mezi  $x$  a  $y$ . Na základě vypočteného koeficientu korelace můžeme již posuzovat, zda jedinci našeho výběru zachovávají v průběhu růstu stejnou nebo přibližně stejnou zákonitost. Všeobecně může mít koeficient korelace v paleontologii hodnotu od 0 do 1. Je-li  $k < 0,3$ , svědčí to o nízkém stupni těsnosti vztahu mezi proměnnými  $x$  a  $y$ . Jestliže je  $0,3 < k < 0,5$ , je stupeň těsnosti malý. Hodnota  $k > 0,9$  svědčí o velmi těsném vztahu mezi proměnnými.

Dále vypočteme směrodatnou odchylku obou koeficientů korelace

$$\sigma_{db} = \sqrt{\frac{n_1(\sigma_{y1}^2)(1-K_1^2) + n_2(\sigma_{y2}^2)(1-K_2^2)}{n_1 + n_2 + 4} \cdot \left( \frac{1}{n_1 \cdot \sigma_{x1}^2} + \frac{1}{n_2 \cdot \sigma_{x2}^2} \right)}.$$

Nyní zjistíme koeficient regrese  $y$  vzhledem ku  $x$  pro každý výběr

$$b_{yx} = K \cdot \frac{\sigma_y}{\sigma_x} = \frac{\Sigma (\xi \cdot \eta)}{\Sigma (\eta)^2}$$

a rozdíl koeficientů regrese obou vzorků

$$db = b_{yx_1} - b_{xy_2}$$

nebo  $d\bar{b} = \bar{b}_{yx_2} - \bar{b}_{xy_1}$ ,

podle toho, kterým způsobem získáme kladné číslo. Konečnou fází tohoto výpočtu pro zjištění statistické významnosti rozdílu mezi koeficienty regrese je zjištění hodnoty poměru  $db/\sigma db$ . Analogicky o postupu zjištění statistické významnosti rozdílu mezi výběrovými průměry při srovnání vzorků na základě jednoho znaku uvažujeme i v tomto případě o statistické významnosti, je-li  $\frac{db}{\sigma db} > 3,0$ .

Pro zjištění statistické významnosti rozdílu koeficientů regrese můžeme použít i t-testu. Nejprve zjistíme rozptyl koeficientu regrese pro každý vzorek

$$s_b = \sqrt{\frac{s}{\Sigma(\xi)^2}}$$

kde  $s = \sqrt{\frac{I}{n-2} \cdot \Sigma \eta^2 - b_{xy}^2 \cdot \Sigma(\xi)^2}$

Tento výraz odpovídá průměrné čtvercové odchylce hodnot proměnné y pro určitá x od přímky regrese. Dále zjistíme směrodatnou odchylku rozdílu koeficientů regrese.

$s_{b_1-b_2} = \sqrt{s_{b_1}^2 + s_{b_2}^2}$   
a hodnotu  $t = \frac{d}{s_{b_1-b_2}}$ . Do tabulky hodnot t pak vstupujeme s  $n_1 + n_2$  stupni volnosti.

Hodnot některých statistických veličin, které jsme vypočetli při statistické analyse, můžeme použít i pro charakteristiku fosilních společenstev. Vedle koeficientu korelace je to především koeficient regrese. Koeficient regrese y vzhledem ku x je vlastně směrnicí regresní přímky y vzhledem ku x. Je-li  $K < 1$ , jsou u vzorku takové přímky dvě, čím více se hodnota K blíží 1, tím více se obě přímky k sobě přibližují (svírají menší úhel), až při  $K=1$  splynou v jedinou regresní přímku. Ukazuje se, že studované fosilní společenstvo může být regresními přímkami vhodně charakterizováno. Rovnice regresních přímek nám ukáže, jaká je změna jednoho znaku při dané změně znaku druhého (např. jak se mění výška misky s délkou apod.). To přináší velké možnosti paleontologii, vzhledem k tomu, že poměry mnoha dvojic znaků zůstávají, jak jsme již podotkli, v průběhu růstu v rámci jednoho druhu velmi přibližně konstantní. Je tedy regresní přímka v našem případě vyjádřením lineární růstové zákonitosti fosilního společenstva. U fosilních i žijících společenstev jsou totiž lineární jen některé růstové zákonitosti. Velmi hojný je růst podle spirály, ať již podle logaritmické či Archimedovy. V těchto případech je postup analysy odlišný od analysy v případě lineární závislosti.

Sklon regresní přímky daný koeficientem regrese nám napoví o růstových změnách jednotlivých parametrů fosilní schránky. Jestliže má regresní přímka v grafu sklon  $45^\circ$  k osám x a y, jsou poměrné změny x a y v průběhu růstu stejné. Jestliže regresní přímka svírá s osou x menší úhel než  $45^\circ$ , je poměrná změna větší u x než u y a naopak.

Ukázali jsme, jak je možno analysovat studované společenstvo na základě jednoho znaku a na základě vztahu dvou znaků. Zdá se však, že nejvhodnějším způsobem můžeme srovnání dvou vzorků provést metodami multivarietní analýsy. Tato metoda je použitelná všude tam, kde máme více znaků, které jsou ve vzájemném vztahu. Výpočet není ani u této metody složitý, zato však je dosti pracný, takže vyžaduje použití elektrického počítacího stroje. Z tohoto důvodu ho v této práci neužíváme.

## **Revision of the Nuculanidae from the Ostrava-Karviná District. (Pelecypoda)**

### **Introduction.**

In the present study dealing with the Carboniferous pelecypods of the family *Nuculanidae* from the Ostrava-Karviná District biometrical methods, besides the usual classical methods of paleontological work, were used in order to obtain more precise and objective methods of determining single taxons. In the biometrical analysis we proceeded essentially in the same way as in some previous works (B. Růžička & F. Prantl, 1958, 1959).

As to the details we refer to the preceding Czech text, where these methods are thoroughly described.

### **Acknowledgement**

The authors wish to thank the Trustees of British Museum (Nat. Hist.) in London for the loan of the comparative material, the Academy of Sciences of the Ukrainian SSR for the loan of literature, and P. L. Shulgina, M. Schwarzbach and J. Lintz for valuable comments.

### **The shell morphology and used terminology.**

During the study of fossil assemblages in question we reached the conclusion that the existing terminology used for single morphological parts of the studied shells is not quite satisfactory. Therefore we are forced to give an explanation and definition of the new terminology used in the present work. The single terms are alphabetically arranged. (See also the diagrammatic drawings on text-figures 2—10).

#### **ACCESSORY MUSCLES:**

In some specimens of our collection minute impressions of accessory muscles are present, situated usually in a furrow left by the umbonal ridge. We designate them umbonal muscle scars. Moreover, in *Phestia bellicostata* muscle scars situated in the anterior part of the cardinal margin were ascertained. The function of these muscles is not yet clear. Some authors suppose that they are pedal muscles but this opinion is not sufficiently proved. Similarly it is not known as to what extent the number and shape of accessory muscles could serve for a more detailed distinction within a taxon.

The material which is available does not permit us to solve this problem, yet it enabled us to ascertain that the number of the so called umbonal muscles is often variable even among specimens of the same species. Stratigraphically older populations of the same species have sometimes a greater number of umbonal muscles of about the same size, while stratigraphically younger forms of the same species show a reduction in number of the umbonal muscles, which results in the disappearing of the inferior muscles and in the tendency of the superior muscles to join into one larger muscle. For the time being we do not dare to decide whether this reduction of umbonal muscles of the studied specimens during their development in geological time has a general validity. We believe that a greater number of better preserved specimens would be necessary for a satisfactory solution of this problem.

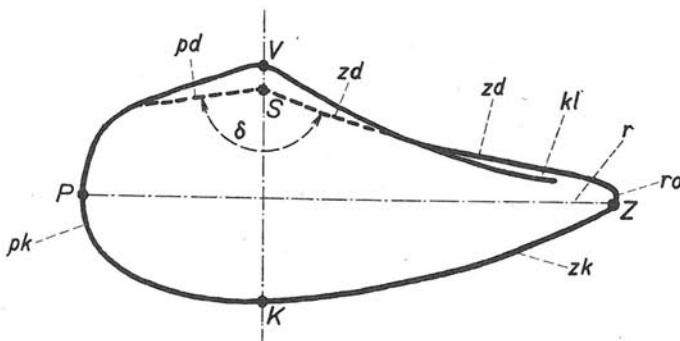


Fig. 2 Some morphological parts of the nuculanid shells. V — highest point of the beak (nejvyšší bod vrcholu); K — contraumbonal point (kontraumbonální bod); S — subumbonal point (subumbonální bod); P — anterior extreme point (přední krajní bod); Z — posterior extreme point (zadní krajní bod); pk — anterior line (přední křivka); zk — posterior line (zadní křivka); pd — anterior part of the dorsal margin (přední část dorsálního okraje); zd — posterior part of the dorsal margin (zadní část dorsálního okraje); ro — rostral arch (rostrální oblouk); r — rostrum; kl — keel (kýl);  $\delta$  — dorsal angle (dorsální úhel).

The umbonal muscles scars are usually small, subcircular or elongated towards the inferior valve margin or sometimes in the anteroposterior direction. According to the mode of fossilization they are either distinctly elevated or flat, faintly distinct or indistinct. In the first case the valve matter was dissolved so that there arose an internal mold; in the second case sculptural molds are involved. The distinctness of the umbonal muscles scars depends in this case on whether, in the course of fossilization, the lower or higher part of the shell matter was impressed.

In our collection the umbonal muscles scars are most conspicuous in *Polidevicia attenuata* and *Phestia bellicostata*. In the last mentioned species an additional accessory muscle scar was ascertained, visible in the dorsal view of internal molds, in which the valve material was dissolved. The scar is small, elongated in the direction of the dorsal line, subovoidal, elevated, and situated in the anterior part of the hinge line in the proximity of its end. Along its margin, which is nearer to the hinge margin, a narrow furrow runs on each valve towards the anterior adductor scar, the furrow corresponding to a rib which probably supported the accessory muscle as well as the anterior adductor. The state of preservation of the remaining forms does not enable us to decide whether the accessory muscles of this type are exclusively a feature belonging to the above mentioned species, or whether they occur in other species of the same genus as well, or whether they were present in other related genera too.

#### ANGLE OF THE POSITION OF THE INFERIOR EXTREME POINT ( $\alpha$ ):

The angle formed by the straight line connecting the highest point of the beak with the inferior extreme point, and by the valve height.

#### ANGLE OF THE SLOPING OF THE POSTERIOR PART OF THE VALVE ( $\beta$ ):

The angle formed by the tangent (t) and the line connecting the contraumbonal point with the posterior extreme point.

#### ANTERIOR EXTREME POINT:

The point of the anterior part of the valve outline which is farthest from the posterior extreme point.

#### APICAL ANGLE ( $\gamma$ ):

The angle formed by the direction of the posterior part of the outline of the beak (drawn on the presumption that the plane of junction of the valves lies in the plan of the drawing) and the direction of the anterior part of the outline of the beak. By the "direction" of the outline of the beak we mean the straight line which substitutes best the curved outline of the beak in the posterior or anterior part:

#### CONTRAUMBONAL POINT (K):

The point opposite the beak which is the intersection point of the outline with the plane passing through the highest point of the beak at right angles to the parameter  $PZ$ .

#### DORSAL ANGLE ( $\delta$ ):

The angle at which the anterior and posterior portion of the dorsal line meet:

#### ESCUTCHEON:

The more or less depressed area defined by the keel and the dorsal line.

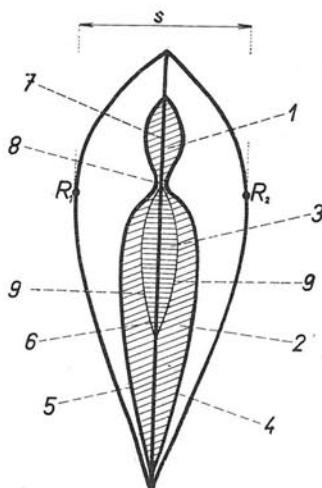


Fig. 3 Diagrammatic representation of the dorsal view. 1 — lunule (lunula); 2 — escutcheon (štitek); 3 — inner part of the escutcheon (vnitřní část štítku); 4 — keel of the right valve (kýl pravé misky); 5 — keel of the left valve (kýl levé misky); 6 — posterior part of the dorsal margin (zadní část dorsálního okraje); 7 — anterior part of the dorsal margin (přední část dorsálního okraje); 8 — beak (vrchol); 9 — rib separating the inner and outer part of the escutcheon (žebírko oddělující vnitřní a vnější část štítku);  $R_1$ ,  $R_2$  — points of maximum convexity of the right and left valve (body největšího klenutí pravé a levé misky);  $s$  — width of both valves (šířka obou misek).

#### HEIGHT OF THE VALVE ( $v$ ):

The length of the perpendicular dropped from the highest point of the beak to the tangent ( $t$ ) which touches the valve outline in the inferior extreme point.

#### HIGHEST POINT OF THE BEAK:

The highest point of the outline of the beak which is drawn on the presumption that the plane of junction of the valves lies in the plane of the drawing.

#### INFERIOR EXTREME POINT ( $T$ ):

The tangent point of the tangent ( $t$ ) to the inferior part of the valve outline, the tangent being parallel to  $PZ$ .

Internal rib: see umbonal ridge.

#### LENGTH OF THE VALVE ( $d$ ):

The total length of parameter  $a$  and parameter  $b$ .

#### LINE OF THE MAXIMUM CONVEXITY:

The line following the outline of the valve presuming that the plane of junction of both valves and the parameter  $PZ$  are perpendicular to the plane of the drawing.

#### OUTLINE OF THE VALVE:

In the description of the valves a number of terms is used which are not at all precise. So for instance, the "anterior margin" is a term which in our opinion should not be used for the description of the outline, as the anterior margin is formed partly by the free (ventral) margin, partly by the anterior part of the dorsal margin. The same holds true for the posterior margin. The inferior margin, in our opinion, cannot be defined in many pelecypods at all, as it is impossible to determine on the outline where the margin ceases to be "inferior" and begins to be "anterior", or "posterior". Therefore, in the present work the existing terminology was abandoned and the terms "anterior line" and "posterior line" are suggested for the description of the outline of lamellibranch shells.

By the term "anterior line" the anterior portion of the outline marked out by the contraumbonal point and the apex of the angle  $\delta$  is designated. By the term "posterior line" the posterior portion of the outline of the valve defined by the contraumbonal point and by the apex of the dorsal angle is designated.

In case of forms with a straight hinge line (forms with a dorsal angle of 180 degrees) it is possible to consider the foot of the perpendicular line dropped from the highest point of the beak to the dorsal margin as the beginning of the anterior and posterior line. This point which lies on the dorsal margin is designated "subumbonal point".

In both lines the upper and the lower part is distinguished. The upper part of the outline is defined by the extreme point (anterior or posterior) and the apex of the dorsal angle (or the subumbonal point). The lower part of the outline is defined by the extreme point (anterior or posterior) and the contraumbonal point.

The terms "anterior", "posterior" and "inferior" margin of the valve are used in the present work only as general terms in cases where there is no need for an exact determination (e. g. "the umbonal ridge is elliptical, elongated towards the lower margin of the valve" etc.).

#### PARAMETER $a$ :

The distance between the highest point of the beak and the anterior extreme point.

#### PARAMETER $b$ :

The distance between the highest point of the beak and the posterior extreme point.

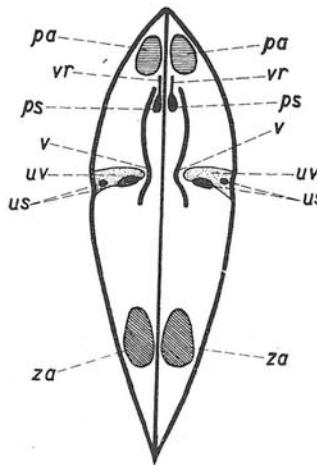


Fig. 4 Diagrammatic representation of the impression of the inner surface of the valve in the apical view of *Phestia bellicostata* (Schwarzbach, 1939). (Type no 74). pa — anterior adductor scars (otisky předních adduktorů); za — posterior adductor scars (otisky zadních adduktorů); v — beaks (vrcholy); uv — impressions of the umbonal ridges (otisky umbonálních valů); us — umbonal muscles scars (otisky umbonálních svalů); ps — accessory muscles scars (přídatné dorsální svaly); vr — impression of the inner dorsal furrow (otisk vnitřní dorsální rýhy).

#### PARAMETER $p_1$ :

The portion of the parameter  $\overline{PZ}$  defined by the intersection point of the height and  $\overline{PZ}$ , and by the anterior extreme point.

#### PARAMETER $p_2$ :

The portion of the parameter  $\overline{PZ}$  defined by the posterior extreme point and the intersection point of the height and  $\overline{PZ}$ .

#### PARAMETER $v_1$ :

The portion of the valve height defined by the highest point of the beak and the intersection point of the height and  $\overline{PZ}$ .

#### PARAMETER $v_2$ :

The portion of the valve height defined by the intersection point of the height and  $\overline{PZ}$ , and by the tangent ( $t$ ).

#### PLANE OF THE VALVE HEIGHT:

The plane perpendicular to the plane of junction of the valves passing through the highest point of the beak and involving the valve height.

#### POINT OF THE MAXIMUM CONVEXITY ( $N$ ):

The point of the line of maximum convexity which is farthest from the plane of junction of both valves.

#### POSTERIOR EXTREME POINT ( $Z$ ):

The point of the posterior part of the valve outline which is farthest from the highest point of the beak.

ROSTRAL ARCH:

The arch connecting the upper and lower part of the posterior line.

ROSTRUM:

The rostrate or cuneiform elongation of the posterior part of the valve.

SUBUMBONAL POINT (*U*):

The point, which is nearest to the beak, and is the intersection point of the valve outline with the plane passing through the highest point of the beak at right angles to the parameter  $PZ$ . In nuculanid pelecypods it usually lies in the apex of the angle formed by the anterior and posterior hinge branch.

UMBONAL MUSCLES: see accessory muscles.

UMBONAL RIDGE:

By the term "umbonal ridge" a swelling of the valve matter on the inner side of the valve is designated. The umbonal ridge extends from the highest portion of the beak and disappears towards the free margin. (Sometimes it bisects the apical angle, sometimes its beginning is placed somewhat forwards or backwards from the oldest portion of the beak.) In our specimens it is usually short, not too broad, most often simple, only rarely bifurcated. Its impression is more or less distinct and appears as a relatively short, usually narrow furrow which disappears towards the ventral margin. Owing to the fact that our specimens are preserved in different stages of fossilization, the impression of the umbonal ridge on molds is variously distinct. On the whole it can be stated that the higher the layer of the valve matter has been fossilized the less the impression of the umbonal ridge is preserved and vice versa.

The course of the umbonal ridge in our specimens is relatively various. In some cases the umbonal ridge runs more or less perpendicular to the antero-posterior parameter, in other it is moderately curved towards the anterior extreme point of the valve or slightly towards the posterior end. In some cases the impression of the umbonal ridge, which is narrow and deep at the beginning, becomes in its course broader and shallower towards the free margin. In this case the umbonal ridge has the character of an internal rib.

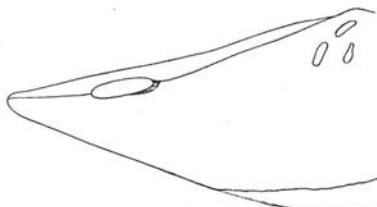


Fig. 5 *Polidevicia attenuata* (Fleming, 1828). Type no. 71 from the mine Šverma at Mar. Hory, Nanetta marine band. Posterior adductor scar and accessory umbonal muscles scars on a sculptural mold of the right valve.

The first mention of the umbonal ridge was made by W. Hind (1896—1900). This author, however, does not pay special attention to it, nor does he describe it or try to explain its function. He designates it less exactly as "subumbonal ridge" G. H. Girty (1915), when describing the representatives of *Leda bellicostata* mentions an internal ridge running from the beak to the ventral margin, this ridge being according to the mentioned author more pronounced in the umbonal portion than near the free margin. As can be seen from Girty's figure it is moderately oblique towards the antero-posterior parameter so that it reaches the ventral margin at about the middle of the valve length.

J. Dorlodot and G. Delépine (1930, p. 87) suppose that the small internal ridge (*petite lamelle ou cuilleron* = umbonal ridge in our conception) in the members of *Nuculana* Link, 1807, supports the ligament.

E. Demanet (1943) mentions in the description of *Nuculochlamys attenuata* an internal rib (côte interne) but does not pay further attention to it.

B. I. Chernyshhev (1943, 1951) designates the umbonal ridge in the members of the genera *Polidevcia* and *Phestia* as "radial rib" (*radial'noje rebro*). He observes that it is situated on the internal surface of the valves and extends from the cavity near the beak, being short and distinct in *Polidevcia*, and curved in *Phestia*, broadening towards the posterior margin and disappearing in the proximity of the pallial line. The function of the umbonal ridge, according to the above mentioned author, is not known to him. He notes, however, that it undoubtedly did not serve only to support the umbonal muscles.

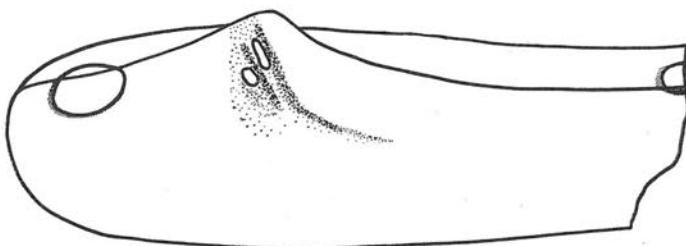


Fig. 6 *Polidevcia gengeli* nov. spec., type no 1 from the mine Pionýr at Orlová. Barbora marine band. Both adductors scars, accessory umbonal muscles scars and impression of the umbonal ridge on an incomplete mold of the left valve.

It is plain from the above stated that no special attention has been payed so far to the umbonal ridge and, with the exception of the evidently wrong opinion of Dorlodot and Delépine (1930), no attempt has been made to explain its function. On the basis of a limited number of specimens, which we have at our disposal, we do not think it possible to solve the question as to what extent the source and shape of the umbonal ridge is a constant feature which could be used for a more detailed systematic division within a genus or species and, therefore, we leave this question until further open. However, we consider our material sufficient to prove our view about the function of the umbonal ridge. We presume that in the elongated forms it served to strengthen the part of the valve which was most subjected to the external loading. When considering the valve a supporting surface which is affected by an evenly distributed loading we can see that the maximum moment against the anterior and posterior extreme points affects in the umbonal portion of the valve. If we further know that the valve convexity varies indirectly with the thickness of the valve matter we reach the conclusion that the umbonal ridge served as a mechanical stiffening of the vaulting of the valve. The size and distinctness of the umbonal ridge was ascertained to be rather variable owing to the stratigraphic age of the studied forms. In spite of this a certain regularity can be observed. In stratigraphically earlier specimens the umbonal ridge is usually short, less apparent, while it is mostly elongated and conspicuous in stratigraphically younger forms. As to the thickness of the valve, the opposite is the case. Stratigraphically older specimens have thick valves while stratigraphically younger forms have thinner shells. We suppose that in the course of development of the genus *Phestia* and *Polidevcia* during geological time a gradual thinning of the shell took place, during which the mechanical firmness of the valves, diminished through the decrease of the valve matter, was compensated by the increase of the arch of vaulting. When reaching the critical stage, after which a further increase of vaulting would not be capable to substitute statically the decrease of the valve matter due to the thinning of the valve, the development proper of the umbonal ridge began in order to increase the mechanical firmness of the valve. The development of the umbonal ridge is undoubtedly connected with the character of environment in which the development of a certain

genus took place. B. I. Chernyshev (1951) supposes that the specimens of the genus *Phestia* (that is, forms with a distinct umbonal ridge extending as far as the middle of the valve height) lived on relatively solid, fine-grained bottom in the littoral zone, in which the mechanical effects of the waves are still perceptible. The representatives of the genus *Polidevcia* (that is, forms with shorter and less expressed umbonal ridge), are supposed to have lived on the shelf beyond the boundary of the mechanical effects of the waves. We believe that this opinion can be accepted as correct. Thus far we leave the question as to what extent the development of the umbonal ridge is connected with the development of the accessory muscles, which are fixed on it in the umbonal portion, open, as we do not consider it possible to solve it on the basis of the material which is at our disposal.

#### WIDTH OF THE VALVE (s):

The length of the perpendicular dropped from the point of maximum convexity to the plane of junction of the valves.

### Nuculanidae Stoliczka, 1871.

Type species: *Nuculana* Link, 1807

Distribution: Ordovician to recent

Diagnosis: Being generally known and cited by numerous authors, we do not consider necessary to quote the origin diagnosis again. We refer to the work of F. Stoliczka (1871, p. 318) and I. A. Korobkov (1954, p. 74).

Synonym: *Ledidae auctorum*

As is known, H. & A. Adams (1853—1858) subdivided the family *Nuculanidae* on the basis of the position of the internal ligament into the subfamilies *Nuculaniae*, comprising the forms with internal ligament, and *Maletinae* with external ligament. The presence of the mother-of-pearl layer is indicated by the authors as an additional feature of the subfamily *Nuculaniae*.

According to the position of the ligament it would be possible to place the genera *Polidevcia* and *Phestia* into the subfamily *Nuculaniae*, however, the presence of the umbonal ridge in both genera is in our opinion such a prominent feature that it justifies the establishing of a new subfamily for the two genera and others related. The name *Polidevcinae* nov. subfam. is suggested for this subfamily.

### Polidevcinae nov. subfam.

Type genus: *Polidevcia* Chernyshev, 1951

Diagnosis. Nuculanid pelecypods with the shells more or less produced posteriorly into a rostrum. Hinge composed of two branches of taxodont teeth meeting under the beak. Ligament internal. Umbonal ridge distinct.

Distribution and Occurrence. Carboniferous to Permian. (World-spread).

Remarks. B. I. Chernyshev (1951) placed his new genera *Polidevcia* and *Phestia* in the family *Ledidae* (= recte *Nuculanidae*). His view is newly shared by P. L. Shulgina (1956) and M. K. Elias (1957). By the establishment of an independent subfamily *Polidevcinae* we wish to express the fact that both genera placed here differ in several common features from the remaining nuculanid forms. Those differences are, in

our opinion, the expression of a special evolutionary line inside the whole family. In the Permian of Europe a form, labelled as *Leda speluncaria* Geinitz, which is abundant in British and German Zechstein and in the Kazanian Formation of Eastern Europe, belongs to this subfamily. In our opinion, this Geinitz's species is not congeneric with *Polidevcia* or *Phestia* and, therefore, it would be necessary to establish a new generic taxon for it.

### **Polidevcia Chernyshev, 1951 (nov. emend.)**

*Polidevcia Chernyshev*, 1943 (*nomen nudum*)

*Polidevcia Chernyshev*, 1951

*Polidevcia Shulgina*, 1956

*Polidevcia Elias*, 1957

*Genoholotype*: According to the original designation — *Polidevcia karagandensis* Chernyshev, 1951. Lower Carboniferous, Karaganda USSR.

#### *Synonyms*:

*Nucula Sowerby*, 1824 (*partim*)

*Nucula auctorum* (*partim*)

*Leda d'Orbigny*, 1850 (*partim*)

*Leda auctorum* (*partim*)

*Nuculochlamys Paul*, 1041 (*nomen nudum*)

*Nuculochlamys Demanet*, 1943 (*nomen nudum*)

*Culunana Lintz*, 1958

*Non*: *Nucula Lamarck*, 1799

*Nuculana Link*, 1807

*Leda Schumacher*, 1817

*Original diagnosis*. (A free translation of B. I. Chernyshev's original diagnosis, in which some of the author's terms are left, although we cannot agree with them entirely): "Shell relatively large, equivalve, strongly inequilateral, the posterior side being twice or even more times longer than the anterior. Beak opisthoglyrate. A narrow rib below the beak separates along the margin of the valve a lanceolate area, on which the ribs ornamenting the valve continue. A blunt keel behind the beak passing to the posterior end defines a broad area along the valve margin. Inside this area, a rib runs from the beak to the valve margin. The rib separates anteriorly a slightly concave area, which is elevated beginning from the point of connection of the rib with the valve margin. The rib, the elevated portion of the valve and the keel define a triangular concave area. In some cases, a slight swelling in front of the keel can be observed rather suggesting the second keel of *Leda*.

The hinge consists of two branches of taxodont teeth, which meet at an angle under the beak. Number of teeth is in both branches approximately the same. Teeth of the anterior branch are placed along the entire area, which is separated by the rib, while in the posterior branch the teeth continue only as far as the elevated portion of the valve. Chondrophore absent. Adductor scars faint. Pallial line without sinus. The internal rib short, sharply marked. Umbonal muscle scar large, situated on the rib near the beak. Below it, two shallower scars are visible. A short rib is present at the posterior end of the valve.

The ornamentation consists of acute, concentric, fine ribs, which are abruptly bent at the above mentioned rib and continue further in the

form of fine lines on the posterior area. On the keel they are often smoothed off."

*Remarks and Relations.* B. I. Chernyshev (1951) separated from late Paleozoic nuculanid forms two groups of pelecypods, which differ from the typical representatives of *Nuculana* Link (= *Leda Schumacher*) mainly in the presence of the umbonal ridge ("the internal rib" of Chernyshev). For the first group Chernyshev (1951) established the genus *Polidevcia*, for the second the genus *Phestia*. The two genera differ from each other first of all in the general shape of the shell, the structure of the escutcheon, the character of the umbonal ridge and in some additional secondary features. The differences between the two genera and others related were discussed by B. I. Chernyshev in his previous article of the year 1943, to which we refer. We note that in this work B. I. Chernyshev already used the generic names *Palidevcia nov. gen.* and *Phestia nov. gen.*, although he did not establish them systematically. The representatives of the genus *Polidevcia* have been placed by the previous authors in different genera, such as *Nuculana* Link, *Leda Schumacher*, *Yoldia Möller*, though they actually differ from the original diagnosis of these genera especially in the presence of the umbonal ridge. H. Paul (1941, pp. 38-40) placed some of them to his manuscript genus *Nuculochlamys*. Paul, however, even later did not present any diagnosis of this genus, nor did he determine its genotype and, therefore, it is necessary to consider it invalid. F. Demanet (1943, pp. 88-89) used in his work the generic name *Nuculochlamys* Paul MS., but neither did this author give any diagnosis of the genus or its genotype.

On the basis of our own observations of the representatives of *Polidevcia* we arrived to certain reservations concerning the original Chernyshev's diagnosis.

B. I. Chernyshev states in his diagnosis that chondrophore is absent in *Polidevcia*. We have not succeeded in ascertaining the basis of Chernyshev's conclusion. In the description of the genotype he remarks (pp. 26-27) that the internal structure of the valve is not known to him. The same remark can be found in the description of some other members of the genus *Polidevcia* in Chernyshev's work (1951). Even in the forms in which he describes the hinge apparatus Chernyshev does not explicitly state that chondrophore is lacking. On the other hand, neither in the species in which he describes the escutcheon does this author indicate whether he has observed the external ligament or not.

M. K. Elias (1957, p. 750), supposes, in connection with this question, that there is some misprint or error in observation in Chernyshev's work. He remarks that N. D. Newell too is very skeptical towards the question of the absence of chondrophore in late Paleozoic nuculanid forms.

P. L. Shulgina informed us in a written communication of 1959 that our supposition about the presence of chondrophore in *Polidevcia* is probably right, although she could not ascertain it on her material owing to the poor state of preservation.

The presence of the internal ligament is also discussed in a separate article to which we refer (B. Růžička & F. Prantl, 1960).

When studying the descriptions of different species of *Polidevcia* one could suppose that the question of presence or absence of chondrophore in this species is easily solvable.

Already W. Hind (1896—1900) states in the description of *Nuculana attenuata* that chondrophore is present in this species. Similarly other authors, both previous and recent (e.g. Elias, 1957), refer chondrophore in the descriptions of the forms of *Polidevcia* (*Leda*, *Nuculana*, *Yoldia*), but they do not describe it precisely nor do they figure it. This drawback is probably due to the difficulties with which individual authors met in the course of the study of the above mentioned genus and which are the same as met by us. In most cases isolated valves, on which it would be possible to observe the connection of both hinge branches, are not available. The impression of the hinge on the molds, which are the essential part of our collection, is either quite indistinct or not distinct enough to enable to ascertain whether chondrophore is present or not. Only in a single case (*P. attenuata*, our type no. 91) the posterior hinge branch narrows to underneath the beak while the anterior hinge branch continues with the same width as far as below the umbonal portion, which could indicate the presence of chondrophore. Valves with the shell matter preserved are known quite rarely. We have not succeeded in isolating the single valves in these forms and thus enable to the observation of the hinge, but it is possible to study on them in detail the structure of the escutcheon. The latter is, as becomes evident from the diagnosis, divided into two parts on each valve by a thin rib passing from beneath the beak to the valve margin: the external part being limited by the keel, the rib mentioned above and the raised portion of the dorsal line, and the internal part being defined by the rib and the depressed portion of the dorsal line. In the apical view the internal parts suggest a ligamental area of lanceolate shape. This impression is to a considerable extent increased by the inner area of the escutcheon being depressed. This area shows in one of our specimens (*P. attenuata*, type no. 137) even indications of transversal striping and minute shallow pits along the external borders which suggest small muscle scars. It is possible that a similar observation made Chernyshev believe that the external ligament is present in *Polidevcia*, which he expressed in his diagnosis by the statement: "chondrophore absent".

B. I. Chernyshev cites as one of the characteristic features of *Polidevcia* that the number of teeth in both hinge branches is approximately the same. A more detailed scrutiny of his descriptions and figures, however, leads us to the opinion that this statement is not sufficiently proved. B. I. Chernyshev in some cases gives the number of teeth in both hinge branches, but it does not seem possible to determine a valid generic feature on the basis of such a small number of specimens with distinct hinge. Especially when isolated valves with distinct hinge apparatus are in fact unknown and the impression of the teeth on the molds, which form the majority of Chernyshev's collection as well as ours, are not distinct enough as to enable to determine exactly their

number. It is rather possible to follow the lengths ratio of both hinge branches. In our material the posterior hinge branch appears longer than in the anterior branch.

Chernyshev's expression: "posterior part twice or even more times longer than the anterior" is not in our opinion enough exactly defined and can be explained in various ways. (See p....) We suggest to replace this part of the diagnosis with the expression of the parameter a/parameter b ratio, as this expression is considered more exact. The corrected part of the diagnosis would then read as follows: "parameter b twice or even more times longer than parameter a".

Unlike Chernyshev we have not been able to ascertain in our specimens the course of the pallial line. Consequently, we cannot take a standpoint on his statement that pallial line in *Polidevicia* is without sinus. We comment that Chernyshev did not express the course of the pallial line either by a drawing, nor did he mark it on the photographs. These are poorly reproduced so that it is impossible to trace the pallial line on them.

Chernyshev's diagnosis can be complemented by an additional statement that the shells of single species need not be large even in the adult stage. They can be small but they are always more or less elongated and claviform.

The part of the diagnosis concerning the beaks can be complemented as well. According to what we ascertained in our material, the beaks extend moderately over the hinge line, and are more or less opisthogryrate, either contiguous or slightly distant.

B. I. Chernyshev states in his diagnosis that a short rib is present at the posterior end of the valve in *Polidevicia*. He does not mention, however, whether it is found on the interior or exterior surface of the valve. It can be only supposed that it is present on the interior surface of the valve, as the author cites it in connection with the adductor scars, pallial line etc. Our studies, however, prove that it is more a rounded fold of the interior surface of the valve than an interior rib in the proper sense of the term.

Finally we state that in a number of our forms a more or less distinct radial striating on the lamellous concentric ribs has been observed, especially on the surface of the anterior portion of the valve near to the free margin. The diagnosis indicates that "ornamentation consists of sharp concentric ribs", but these are in fact flat lamellae arranged so that their margins are imbricated from below upwards. This is visible only at great enlargement, while with the naked eye the ribs appear to be sharp. In our opinion, the striation of the lamellae is due to the fact that the subsurface layer of the valve matter, which has prismatic structure, has been fossilized (the prisms are more or less perpendicular to the direction of the lamellae).

The genus *Culunana* Lintz, 1958 is considered a later subjective synonym of *Polidevicia* Chernyshev, 1951. The former differs from *Polidevicia* Chernyshev in reality only in the internal ligament, which has been reliably ascertained in it as well as it has been found in the British and Silesian representatives of the genus. Owing to what was

mentioned above we reached the opinion that Chernyshhev's diagnosis of the genus *Polidevcia* is wrong in this point and that even on the well preserved Russian material the internal ligament is preserved. The related genus *Phestia* Chernyshhev differs from *Polidevcia* especially in these features: Escutcheon and lunule are shallow to indistinct. In case of the escutcheon being distinct no special lanceolate area separated by the ribs is visible in it, which is typical of *Polidevcia*. The distinctness of the escutcheon and lunule depends on several factors: First of all it was found to depend on the thickness of the valves. In some cases the escutcheon and lunule are well distinct on the molds while they are less clear on the surface of the valves proper. The clearness of these features depends consequently on the state of preservation as well. B. I. Chernyshhev (1943) considered both genera ecologically differentiated in spite of their close phyletic relationship and states that they substitute each other in different biotopes. However, our experiences from the Ostrava-Karviná Coal District do not prove this statement. Here in some stratigraphical levels both genera occur together. Of course, we cannot exclude with certainty the possibility of our assemblages representing redeposited thanatocenoses.

The mutual distinguishing of *Polidevcia* and *Phestia* meets in practice with considerable difficulties. The above mentioned distinguishing characters are well visible only in the apical view of isolated shells, which are, however, very rarely found. On the single valves, which are most commonly found, the structure of the escutcheon and lunule cannot be observed, the assignment of these forms to one genus or the other depending consequently mainly on general shape of the valve. This difference is, in our opinion, only quantitative. Therefore, for the time being, we preserve the generic validity of *Phestia* Chernyshhev only with certain doubts. We are hindered here by the impossibility of deciding whether these two morphological types are in this country, as well as in other countries, members of the original biocenosis, and in this case independant taxons, or postmortally associated forms of the same type altered according to the different environmental conditions either genetically or phenotypically.

*Occurrence.* *Polidevcia* Chernyshhev is in the Ostrava-Karviná basin represented by five species: *P. attenuata* (Fleming, 1828), *P. sharmani* (Etheridge jun., 1878), *P. čepeki nov. spec.*, *P. gengeli nov. spec.* and *P. vašičeki nov. spec.* They were found in the Ostrava beds (Namurian A, less probably the lowest part of the Namurian B) of the Upper Silesian fore-deep.

*Distribution.* Carboniferous of N. America, Asia and Europe.

#### *POLIDEVCIA ATTENUATA* (FLEMING, 1828).

- 1793 — *Multiarticulate cockle* Ur e, Nat. Hist. of Rutherglen, p. 310, pl. XV., fig. 5.  
1828 — *Nucula attenuata* Fleming, Hist. Brit. Animals, p. 403.  
1836 — *Nucula claviformis?* Phillips, Geol. Yorkshire, p. 210, pl. V., fig. 17.  
1843 — *Nucula attenuata* Morris, Catal. Brit. Foss., p. 94.  
1844 — *Nucula attenuata* M'Co y, Carb. Limestone Fossils Ireland, p. 68.  
1844 — *Nucula birostrata* M'Co y, ibid, p. 68, pl. XI., fig. 23.

- 1844 — *Nucula clavata*. M'Coy, ibid, p. 69, pl. XI, fig. 25.  
 1844 — *Nucula leiorhynchus* M'Coy, ibid, p. 69, pl. XI, fig. 27.  
 1849 — *Nucula claviformis* Brown, Illustr. Foss. Conch., p. 185, pl. 76, fig. 38.  
 1850 — *Leda claviformis* d'Orbigny, Prodrome paléont., p. 129.  
 1850 — *Leda birostrata* d'Orbigny, ibid, p. 129.  
 1850 — *Leda clavata* d'Orbigny, ibid, p. 129.  
 1850 — *Leda leiorhynchus* d'Orbigny, ibid, p. 129.  
 1855 — *Nucula?* attenuata M'Coy, Brit. Palaeoz. Foss., p. 511.  
 1862 — *Leda attenuata* Baily, Mem. Geol. Surv. Ireland, p. 9, fig. 2a—c.  
 1863 — *Leda attenuata* Roemer, Z. deutsch. geol. Ges., 15, p. 568, pl. XV, fig. 9a—d.  
 1876 — *Leda attenuata* Roemer, Leathea geognostica, pl. 44, fig. 11a—b.  
 1878 — *Ctenodonta attenuata* Bigsby, Thesaur. Devonico-Carb. p. 303.  
 cf. 1885 — *Nuculana leiorhynchus* Koninck, Faune calc. carb. Belg., Lamellibr. p. 137, pl. 26, fig. 44—46.  
 1888 — *Nuculana attenuata* Etheridge, sen. Brit. Fossils, p. 288.  
 1896—1900 — *Nuculana attenuata* Hind, Brit. Carb. Lamellibr., 1, p. 195, pl. XV., fig. 1—16.  
 1912 — *Nuculana attenuata* Klebeberg, Marine Fauna Ostrauer Schichten p. 487, pl. XX (II), fig. 43, 45, 46, 47 non pl. XX (II), fig. 44.  
 1914 — *Nuculana (Leda) attenuata* Dunlop, Trans. geol. Soc. Glasgow, 15, pl. 20, fig. 17—19.  
 1915 — *Nuculana attenuata* Smetana, Rozpravy Čes. Ak., roč. XXV, tř. II, č. 1, p. 23—24.  
 1923 — *Nuculana attenuata* C. Schmidt, Jb. preuss. geol. Land.-Anst. 44, p. 365.  
 1928 — *Nuculana attenuata* Šusta Stratigr. Ostrau-Karwiner steinkohlenrevier, pl. XII, fig. 32.  
 non 1929 — *Nuculana attenuata* Demanet, Mém. Mus. r. Hist. natur. Belg., 40, p. 9; pl. I, fig. 1.  
 1929 — *Nuculana attenuata* Daguin, p. 33; pl. VII, fig. 12a—e.  
 1929 — cf. *Nuculana attenuata* Voogd, Geol. Bureau Heerlen, Jaarverslag over 1928; pl. V, fig. 10.  
 ?1930 — *Nuculana attenuata* Dorlodot & Delépine, Mém. Inst. geol. Univ. Louvain, 6, 1, p. 87; tab. VI, fig. 13—15.  
 1932 — *Nuculana attenuata* Corsin, Trav. et Mém. Univ. Lille, Albums, 5, pl. 37, fig. 14, a, b.  
 1932 — *Nuculana attenuata* Pfab, Mitt. naturwiss. Ver. Troppau, 24/25, p. 77.  
 ?e. p. 1933 — *Leda attenuata* H. Schmidt, Kellerwaldquarzit, p. 22, tab. III (XX), fig. 17, non. fig. 16.  
 1935 — *Nuculana attenuata* Böhm, Dév. sup. et Carb. inf. Montagne Noire, p. 146; pl. VIII, fig. 4, a, b.  
 1937 — *Nuculana attenuata* Weigner, Bull. serv. géol. Pologne, 9, 2, p. 29.  
 1939 — *Leda attenuata* Schwarzbach, Die Muscheln im Oberkarb. Oberschl. I. Taxodonta, p. 12, non pl. I, fig. 9—10.  
 1941 — *Nuculana attenuata* Demanet, Faune et stratigr. de l'est. Nam. de la Belg., Mém. Mus. Royal, No 97, p. 238, pl. 14, fig. 13, non fig. 12.  
 1941 — *Nuculochlamys attenuata* Paul, Foss. Catal. I. Animalia, 91, Lamellibr. infracarb., p. 38.  
 1943 — *Nuculochlamys attenuata* Demanet, Mém. Mus. r. Hist. nat. Belg., 101, p. 88, pl. III, fig. 8, 9, 10, 12, non fig. 11.  
 1949 — *Leda (Nuculana) attenuata* Hromada, Rozpravy II. České Akademie, roč. LVIII, č. 6, p. 7, pl. IV, fig. 11.  
 1949 — *Leda attenuata* Schwarzbach, Die Fauna d. Bug-Karb. u. ihre Strat. u. Paleogeogr. Bed., p. 43, textfig. 27.  
 1949 — *Leda attenuata reticulata* Schwarzbach, ibid, p. 44, non textfig. 28, non pl. 4, fig. 1.  
 1956 — *Polidevicia attenuata* Shulgina, Fauna и флора каменоугольных отложений гал.-волынской впадины. Пласт. моллюски, p. 115, pl. 1, fig. 15, non fig. 16.  
 ?1956 — *Polidevicia gigantea* Shulgina, ibid, p. 116, pl. 1, fig. 18.  
 ?1956 — *Polidevicia ex. gr. attenuata* Shulgina, ibid, p. 118, pl. 1, fig. 17.

- Non 1824 — *Nucula claviformis* Sowerby, Mineral. Conchology vol. V. p. 119, pl. 476, fig. 2.  
 Non 1932 — *Leda cf. attenuata* Fedotov, Carb. Pelecyp. Donetz Basin, p. 26; pl. 1, fig. 22—26.  
 Non 1932 — *Nuculana attenuata* Rakusz, Oberkarb. Foss. Dobrina u. Nagyvisnyó, p. 92, pl. V., fig. 29.

*Holotype*: *Nucula attenuata*, Fleming, 1828, Hist. Brit. Animals, p. 403, according to Ur'e's figure as *Multiarticulate cockle* (Ur'e, 1793, Nat. Hist. of Rutherglen, p. 310, pl. XV, fig. 5).

*Locus typicus*: Glasgow.<sup>1)</sup>

*Stratum typicum*: In Fleming (1828): Independent Coal Formation.

*Material*. A number of left and right non-isolated valves and their fragments and several free shells. Eighteen best preserved forms have been used for biometrical studies. Material comes partly from our own collections, partly from the collections of the Geological Department of the Syndicate of the Ostrava-Karviná Coal Mines. It is deposited in the collections of the Mining University in Ostrava. Besides, we have at our disposal the comparative material lent by the British Museum (Nat. Hist.). This material comes from the following strata and localities: Dunfermline, Scotland; Lanark, Scotland; Coal Measures, Five, Scotland, and Coal Measures, Howick, Northumberland.

*Mode of preservation*. The majority of our material are internal molds and sculptural molds. Impressions and free shells with the shell matter preserved are also known.

*Original Fleming's diagnosis*. "Transversally elongated, ventricose, one end short rounded, the other produced with a broad concave area, elevated in the middle along the point; the whole covered with regular fine concentric ribs, or striae." We note that the complementing of the original Fleming's diagnosis is given under the remarks on the species, to which we refer.

*Description*. Outline. Anterior line long, lobate, in its upper part nearly straight, passing at about two thirds of the distance between the beak and the anterior extreme point into a broad arch, which coalesces in its lower part with the lower part of the posterior line. The inferior extreme point of the outline lies close beyond the contraumbonal point, exceptionally in front of it. The subumbonal point lies a little before the umbonal plane; dorsal angle obtuse, of about 160 degrees. Upper part of the posterior line is more or less concave, rostral arch narrow, minute, lower part of the posterior line either moderately bent downwards or straight, or in the proximity of the rostral arch slightly bent upwards. Rostrum is usually produced into the form of a duck or goose beak or a spur, according to the variability of the course of the posterior line.

1) W. Hind (1896—1900) figures as the type species on the plate XV. fig. 1 the form which Phillips considered as a typical representative of *Nucula claviformis*? This form from Gilbertson's collection have been reported from Carboniferous Limestone, Bolland. Hind does not believe that this specimen comes from limestones. Of the localities which could yield this form, he prefers Harelaw or Otterburn rather than Bolland. Fleming (1828), does not refer to any locality. In the present work Glasgow is referred to as the typical locality on the basis of Hind's statement (1896—1900, p. 197) about the frequent occurrence of this species in its surroundings.

Vaulting. Valves vaulted or strongly vaulted, the line of maximum convexity passing from the beak approximately at right angles to the anteroposterior parameter. The point of maximum convexity lies in the middle third of the valve height in most cases nearer to the midpoint, Keel is conspicuous, in the proximity of the beak acute, in the rostral part more rounded, being more or less bent throughout its course. It disappears in the vaulting of the valve before the posterior end or remains apparent as far as the rostral arch.

Beaks. Vaulted, rounded, distinctly incurved, contiguous, raised over the hinge line, in the oldest portion pointed, moderately opisthoglyrate, situated on the boundary between the anterior and the middle third of the anteroposterior parameter, or sometimes a little before it.

Escutcheon. Long, distinctly depressed, raised along the dorsal line in the posterior part, separated by the keel from the remainder of the valve, divided into two parts by an acute thin rib, which passes on each valve from the oldest part of the beak and joints the elevated dorsal margin in the middle third of the distance between the umbo and the posterior extreme point. In the apical view the inner part of the escutcheon appears narrowly lanceolate. Its surface bears fine longitudinal striae which are parallel to the dorsal margin. These striae break at an obtuse angle on the acute rib towards the external part of the escutcheon. In our type no. 137, minute, shallow, regularly spaced, anteroposteriorly slightly elongated pits are visible along the thin ribs, suggesting to a certain degree the muscles insertions of the external ligament. On the inner area, low inconspicuous ribs connect transversally the above mentioned pits, which suggests the striping of ligamental groove.

Lunule. Inconspicuous, shallow.

Hinge. In our collection isolated shells preserved in such a way as to enable to study in details the hinge character are missing. Most often there are only more or less distinct impressions of teeth of different levels. In cases where it was possible to observe the structure of the hinge plates it was evident that the posterior, moderately concave hinge plate was longer than the anterior one which was slightly convex. The junction of both hinge branches was not clear enough as to enable to state whether chondrophore was absent or not. Only in the type no. 91 the posterior hinge branch is narrowing in a typical way to beneath the umbo, while the anterior hinge branch continues with the same width as far as the umbonal part, which could indicate the presence of chondrophore. It was impossible to study the shape and number of teeth, consequently, we are unable to take up an attitude towards Hind's remark (1896-1900) that both branches bear a row of vertical V-shaped teeth having the apex of the V directed towards the umbo.

Muscle scars. Posterior muscle scar on the internal molds is large, oval, in the direction of the keel strongly elongated, situated partly on the keel, partly on the valve body. The side nearer to the umbo is distinctly raised. Anterior muscle scar is nearly circular, relatively large, situated near the anterior margin. The portion nearer to the valve margin is raised. The muscle scars observed on the fragments of the shells quite agree with the above given description.

Pallial line. It was impossible to observe the entire course of the pallial line in any of our specimens.

Umbonal ridge. In our collection the impression of the umbonal ridge on molds in which the shell material has been removed can be observed. The impression of the ridge is short, running somewhat backwards either straight or moderately curved. In the upper part it is broad and deeper, being produced downwards and becoming shallower. Generally it does not exceed the anterior third of the valve height. As far as it was possible to observe the umbonal ridge directly on the fragments of the shell, its course agrees with the above given description.

Impressions of the accessory muscles. They can be observed best on molds in which the shell material has been removed. They are minute, somewhat raised, subovoidal, mostly vertically, even somewhat horizontally elongated, being either three, situated in a triangle in which the lower impression is the largest, or two, the upper impression being larger than the lower one. They lie in the impression of the umbonal ridge or on its borders.

The shell proper. As far as it could have been observed it is mostly thick, about 1 mm.

Costation. The valves proper bear regular, narrow, close, flat concentric ribs imbricating from below upwards. Close before the keel the ribs disappear, so that the surface of the keel is smooth. On the sculptural molds the concentric costation is similar. Besides, a fine, threadlike vertical costation is visible on the single ribs, which is distinct especially on the ribs situated nearer to the free margin. The vertical ribs do not seem to be continuous. They are not visible on the surface of the valves proper. Only after a thorough etching of the shell matter do their traces sometimes become visible. Therefore, we presume that the vertical costation on the sculptural molds appears in those cases where some lower layer of the valve material has been fossilized.

Biometrical characterization. Equation of the regression line of  $v$  as plotted against  $d$ :

$$v = 0.35 d + 0.45$$

Equation of the regression line of  $p_1$  as plotted against  $p_2$ :

$$d = 2.81 v - 1.0$$

$$\frac{d}{v} \doteq 2.6$$

$$\frac{v}{p_1 + p_2} \doteq 0.41$$

Equation of the regression line of  $p_1$  as plotted against  $p_2$ :

$$p_1 = 0.45 p_2 + 0.02$$

Equation of the regression line of  $p_2$  as plotted against  $p_1$ :

$$p_2 = 1.48 p_1 + 3.2$$

$$\frac{p_2}{p_1} \doteq 2.2$$

$$\frac{p_1}{p_1 + p_2} = 0.31 \text{ (boundary } 0.24\text{---}0.136)$$

Equation of the regression line of  $v_1$  as plotted against  $v_2$ :

$$v_1 = 0.73 v_2 + 0.66$$

Equation of the regression line of  $v_2$  as plotted against  $v_1$ :

$$v_2 = 0.59 v_1 + 1.3$$

$$\frac{v_2}{v_1} \doteq 1.05$$

$$\begin{aligned} A\alpha &= 50^\circ 22'; & h\alpha &= -120^\circ 30' \text{ to } 23^\circ; & Ra &= 30^\circ 58' \text{ to } 60^\circ 48' \\ A\beta &= 170^\circ 30'; & h\beta &= 13^\circ \text{ to } 22^\circ; & R\beta &= 160^\circ 45' \text{ to } 180^\circ 55' \\ A\gamma &= 128^\circ 04'; & h\gamma &= 109^\circ 45' \text{ to } 146^\circ 09'; & R\gamma &= 123^\circ 33' \text{ to } 132^\circ 33' \end{aligned}$$

*Remarks and Relations.* The above mentioned species has been established by Fleming (1828) on the basis of Ure's (1793) figure. The author gives the diagnosis of the species but does not figure it. As can be seen, the above cited diagnosis is rather general and in our opinion it is applicable to a number of species. Therefore, it has been complemented and made more precise by some authors, especially by Hind (1896-1900), whose description is referred to by subsequent authors more often than the original Fleming's diagnosis. Therefore, we consider it necessary to quote the original Hind's diagnosis. "Shell moderately gibbose, produced and attenuated posteriorly almost to a point. The anterior end is of moderate size, and has a regularly rounded margin. The inferior or ventral border is gently convex for the anterior four fifths; it then may become straight. The posterior border is very narrow, and is acutely rounded. The dorsal border is rounded and short in front, produced and straight behind, the latter portion being at a lower level than the anterior."

The umbones are small and inconspicuous, incurved and non-contiguous. They are situated at about the junction of the anterior and middle thirds of the hinge-line. In front of the umbones is a small elongate elliptical lunette, and posterior to them is an elongated, comparatively broad escutcheon, which is marked off by an acutely edged fold arising from the apex of the umbo; and, curving at first outwards and backwards, soon passes inwards and below the level of the hinge edge, terminating at the extreme posterior point of the shell. The escutcheon is divided into two parts by obscure lines, which arise from the edge of the ridge, and pass obliquely inwards and backwards to meet in the middle line. The portion in front of these lines is diamond-shaped and concave; posterior to them the upper edge of the valve rises in the middle line, so that this part is roof-shaped, but slightly hollow at the sides. The valves are gently and evenly convex; the great test convexity is at a point midway on the vertical line which passes from the umbo to the ventral border.

Interior. The hinge-plate is thickened, and consists of two portions, anterior and posterior, separated by a pit for the internal cartilage, situ-

ated immediately beneath the umbones. The anterior portion is curved, convex upwards, and is set with a number of vertical V-shaped teeth having the apex of the V directed towards the umbo. The anterior teeth are larger in front, and diminish in size as they approach the centre. The posterior portion also consists of numerous similarly shaped teeth, but arranged with their apices pointed forwards. They are larger in the middle than at either end, and do not occupy the whole of the posterior part of the hinge-plate, the hinder half being edentulous. This part is gradually thinned and twisted upwards to form a very thin and delicate edge to the produced portion of the valve.

The scar of the anterior adductor muscle is shallow and not very conspicuous; it is situated at the anterior-superior angle of the shell, and is marginal, and extends some little way backwards along the hinge-plate. It is marked off from the umbo by a slight ridge which runs forwards and downwards. The posterior adductor muscle-scar is narrow and transversally elongate, and situated just below the hingeline near the posterior end. A ridge extends downwards from the interior of the umbo, shown as a wellmarked hollow in casts. On the anterior portion of this are two pit-like hollows, probably from the insertion of the pedal muscles. The pallial line is not sinuated.

Exterior. The surface is for the most part ornamented with fine, regular, concentric lines of growth, which terminate behind abruptly at the acute edge which forms the boundary of the escutcheon. At the posterior end the lines are bent upwards and twisted forwards over this ridge, and are less well marked, giving rise to a wavy appearance. Here and there on the surface of the valve the regularity of the marking is interfered with by deeper lines, especially near the ventral margin. The valves are closed all round.

Dimensions (Pl. XI, fig. 3). An average-sized specimen from Thornton, in our Collection, measures

Antero-posteriorly . . . . .	28 mm.
Dorso-ventrally (at umbo) . . . . .	12 mm.
From side to side . . . . .	6.5 mm.

Subsequent authors, who based their studies on H i n d's diagnosis, did not complement it essentially. Our observations agree in principal features with H i n d's description. The differences lie first of all in that we could not reliably ascertain the chondrophore, the entire course of the pallial line, the shape and number of teeth and their placing on the hinge plates. However, in several features our specimens differ from H i n d's forms. The dorsal margin is in our specimens curved, not straight, beaks are sometimes contiguous, the ribs dividing the escutcheon are distinct, the posterior muscle scar is not narrow, but large and oval, and the sculpture does not consist of growth lines, but of flat, narrow lamellous ribs. (We believe that H i n d's formulation is rather inexact and that the sculpture of both ours and H i n d's forms is the same.) The Namurian representatives of *P. attenuata* F l e m i n g (1828) which form the majority of our collection, differ further from H i n d's forms in their rostral part not having the shape of a duck beak and not bearing a more

or less distinct narrow furrow which emphasizes the above mentioned character of the rostral portion. (Hind figures this furrow running on the rostral part in the direction of the keel, but he does not describe it.) On the contrary, in our Namurian species the rostral part is evenly vaulted, ending by a narrow upwards sloping point. A similar difference in the form of the rostral part was ascertained also by P. L. Shulg (1956). This author explains it by the fact that Hind's forms are Visean in age while the Russian forms are Namurian. The structure of the rostral part described by W. Hind was ascertained only in our Visean forms.

We do not consider it necessary to separate from *P. attenuata* the forms which have the end of the rostral part pointed because the rostrum of the shape of a duck beak is not equally developed even in Hind's form and, besides, it is possible that Hind's illustrations are not free from drawing errors.

M. Schawrzbach (1949) subdivided the above mentioned species into two subspecies, the first designated *Leda attenuata attenuata*, the second *Leda attenuata reticulata*. The typical subspecies, as becomes evident from Schawrzbach's diagnosis as well as from his remarks, corresponds on the whole with Hind's and Fleming's conception of *Nuculana attenuata*. Specimens assigned by Schawrzbach to the subspecies *Leda attenuata reticulata* are characterized, according to this author, by their sculpture consisting besides concentric costation from: "einer noch feineren regelmäßigen, radialen Rippung, die besonders in den Zwischenräumen der Längsrippen hervortritt und mit bloßem Auge kaum erkennbar ist." This reticulate sculpture is according to Schawrzbach visible "... nur im vorderen Teil der Klappe (etwa bis in Höhe des Wirbels)". Under the remarks of this species Schawrzbach states further that "... die netzförmige Skulptur... nicht als Seltenheit gelegentlich bei kleineren Exemplaren von *Leda attenuata* angedeutet findet...".

We believe that Schawrzbach's subdivision of *Leda attenuata* into two subspecies on the basis of presence or absence of reticulate sculpture is not well-founded and justified. (The specimen that was selected by M. Schawrzbach [1949] for holotype of the subspecies *Leda attenuata reticulata* [text-fig. 28, pl. IV, fig. 1] falls in our opinion beyond the variation circle of *P. attenuata*.) As becomes evident from the above cited quotations the reticulate sculpture is not an exclusive character of a group within the species *P. attenuata*. We have even found that a similar sculpture is more or less visible in some other forms of *Polidevcia* and also in *Phestia*. As already has been mentioned above we consider the radial costation of the lamellar ribs a fossilized subsurface layer of the shell mater, which shows such structure.

We point out that the form figured by M. Schawrzbach (1939, pl. I, fig. 9) designated *Leda attenuata* does not seem to belong to the described species, as it differs from it, besides other features, in its more elongated form. Also R. v. Klebeberg (1912, pl. XX [2] fig. 44) figures a similar form. We consider both these forms belonging to the species designated *Polidevcia čepeki nov. spec.*

Other forms figured by Klebeberg (1912, pl. XX [2], fig. 46 and 47) suggest through their general shape the holotype of *Polidevicia gigantea* Schulga, 1956. On the basis of the existing description we do not dare to decide as to what extent this species is related with *Polidevicia attenuata* (Flem.) and, therefore, we leave this question open. However, it is possible that a study of the original material could even prove that both species could be considered the same.

Several authors assign to *P. attenuata* also such specimens of which the basal parameter or even the shape of the outline indicate only a distant relationship with the mentioned species. In our opinion it is not possible to consider a representative of *P. attenuata* the specimen figured by Demant (1941) on pl. XIV, fig. 12, and the specimen figured by the same author (1943) on pl. III, fig. 11. The latter suggests our specimens of *Phestia bellicostata* (Schwarzbach, 1939). In our collection *Polidevicia čepeki nov. spec.* stands nearest to *P. attenuata*. *Polidevicia attenuata* differs from *P. čepeki nov. spec.* in the less slender outline, the distinctly bent keel, the escutcheon raised only along the posterior part of the dorsal margin, the inner part of the escutcheon and the less produced and more sloping posterior part of the valve.

From *P. vašičeki nov. spec.* in the less slender and more vaulted shell, the rostrate and less narrowing posterior part, more depressed and broader area, less distinct lunule, and continuous course of the ribs which are not wavy in the posterior part of the valve in front of the keel. The posterior part of the valve is more upwards sloping in *Polidevicia attenuata*.

*P. attenuata* differs from *P. gangeli nov. spec.* in the larger, less slender shell, the more acute keel, the distinctly depressed escutcheon, the less expressive lunule, in the absence of a depression passing from the umbo to the posterior part of the free margin and in the more upwards sloping posterior part of the valves.

The above described species differs from *P. sharmani* first of all in the position of the beak, the position of the inferior extreme point (the value of the angle  $\alpha$ ), in the more vaulted valves and in the position of the maximum convexity point. Lunule is in *P. attenuata*, unlike in *P. sharmani*, broad and indistinct, escutcheon deeply depressed, keel acute and in most cases raised above the dorsal margin.

*Distribution.* The above described species occurs in the Lower Carboniferous of British Islands, in the Central, Western and Eastern Europe, and in the Namurian of Belgium, Upper Silesia and Volyn-Galicia.

*Occurrence.* Our collection contains specimens from the Visean and Namurian A (less probably from the lower part of Namurian B) from both marine bands of the Nanetta seam from the mines Stalin at Hrušov, Šverma at Mar. Hory, and Bezruč at Sl. Ostrava, from the outcrops of the mine Urx at Petřkovice, from the Františka marine band, from the mines Stalin II and Bezruč, and from the bores Staříč NP 133 and 123, from the third Enna marine band, from the mines Zárubek at Sl. Ostrava and Cingr at Michálkovice and from several undesigned marine bands of the Enna seam from the mines Václav at Orlová, Alexander at Kunčičky, Jeremenko at Vítkovice, and from the bore Staříč NP 133, from the third

Barbora marine band from the mine Václav, from an undesignated marine band of the Barbora seam from the mine Fučík II at Petřvald and from the Gabriela marine band from the mine Pionýr at Petřvald. The Visean specimen comes from the Culm strata near Opatovice which are ranged by K. Hromadka (1949) to the Zone III  $\alpha$ — $\beta$ .

### Polidevcia čepeki nov. spec.

cf. 1912 — *Nuculana attenuata* Klebeleberg, Die marine Fauna der Ostrauer Schichten; Jähr. d. K. K. geol. Reichsanst., Vo. 62, No. 3, Pl. XX, fig. 44, non fig. 43, 45, 46, 47.

1939 — *Leda attenuata* Schwarzbach, Die Muscheln im Oberkarbon Oberschlesiens, Jahrberichte d. geol. Vereinig. Oberschles., pl. I, fig. 9, non fig. 10.

Non 1827 — *Nucula attenuata* Fleming, Hist. Brit. Animals, p. 403.

*Holotype:* Right valve, type no. 170, figured on pl. II, fig. 7.

*Derivatio nominis:* In honour of Ing. Dr. L. Čepek, who greatly contributed to the investigation of the Carboniferous and Permian of Czechoslovakia.

*Locus typicus:* Petřkovice, mine Urx.

*Stratum typicum:* Bohdan marine band, Petřkovice zone, Namurian A.

*Material.* Several right and left valves and their fragments. Material coming partly from our own collections, partly from the collections of the Mining School in Ostrava. The biometrical analysis could not be made because of the small number of specimens.

*Mode of preservation.* Sculptural molds and forms in which the valve material has been preserved.

*Diagnosis.* A species of the genus *Polidevcia* characterized by a long, narrow vaulted shell. Keel is acute, reaching as far as the posterior extreme point. Anterior line short, lingulate, posterior line produced in the form of a goose beak, rostral arch minute. Beaks broad, rounded, strongly incurved, moderately raised above the hinge line, straight to slightly opisthoglyrate, situated in the anterior third or anterior quarter of the antero-posterior parameter. Escutcheon narrow, elongated depressed moderately raised throughout the length of the dorsal margin; it is finely striated, divided into two parts by a thin rib, which joins the dorsal margin at about the midpoint of the distance between the umbo and the posterior extreme point. Lunule minute, distinct. Muscle scars not very pronounced, the anterior scar being smaller, subcircular, posterior somewhat larger, elongated in the direction of the rostrum. Umbonal ridge short, not too high, approximately bisecting the apical angle. Accessory muscle scars minute, faint, their number is not known to us. It was not possible to ascertain the entire course of the pallial line. Surface costation of the valves close, regular, concentric; single ribs narrow, flat, imbricating so that the border of the younger rib covers the lower border of the older rib. Besides, on sculptural molds fine, close, thread-like radial ribs, which are more distinct in the anterior part of the valve near the free margin, are apparent. Granulation of the free margin appears on the internal molds. The hinge character could not be ascertained.

### Description.

*Outline.* Anterior line lingulate, rather short, vaulted, its dorsal and ventral part being formed by a broad arch, while the anterior part is

formed by a narrow arch. Dorsal angle nearly 180 degrees. Posterior line long, produced in the form of a goose beak, its upper part being more or less straight, passing fluently in the proximity of the posterior extreme point into a minute arch of small radius. Below the rostral part the lower part of the posterior line is moderately bent upwards to straight and passes fluently by a moderate arch into the lower part of the anterior line.

*Vaulting.* Valves evenly vaulted, the maximum convexity line passes from the umbo to the inferior extreme point, approximately in the plane of the valve height. The maximum convexity point lies in the upper half of the valve height, nearer to the midpoint. Keel very acute, in the dorsal view passing from the beak to the posterior extreme point in a broad arch, which becomes straight in the posterior portion. In the lateral view the keel appears almost straight.

*Beaks.* Broad, rounded, only in the oldest portion moderately pointed, strongly incurved, slightly raised above the hinge line, straight to moderately prosogyrate, situated in the anterior third or the anterior quarter of the anteroposterior parameter.

*Escutcheon.* Narrow, elongated, distinctly depressed, moderately raised along the dorsal margin, marked off by an acute keel from the rest of the valve. The internal structure and character of striation as in *Polidiscia attenuata*. The inner part of the escutcheon is, however, narrower, slightly depressed, and the little rib dividing the escutcheon into two parts joins the dorsal margin at about the middle of the distance between the umbo and posterior extreme point.

*Lunule.* Minute, shallow, unpronounced.

*Hinge.* In none of our specimens is the hinge apparatus preserved well enough to enable a detailed study of its character.

*Muscle scars.* Shallow, not too prominent. Anterior muscle scar subcircular, situated near to the dorsal margin, its portion nearer to the umbo is elevated. Posterior muscle scar somewhat larger, in the direction of the rostrum strongly elongated, situated between the keel and the dorsal margin on the boundary of the middle and posterior third of the distance between the umbo and the posterior extreme point.

*Pallial line.* Faintly distinct, its entire course is not known.

*Umbonal ridge.* The impression of the umbonal ridge has been studied only on the internal molds. It is short, rather shallow, approximately bisecting the apical angle and disappearing in the vaulting of the valve at about the third or half of the valve height.

*Accessory muscle scars.* Impressions were observed on the internal molds. They are minute, not too prominent, produced towards the free margin, situated on the impression of the umbonal ridge. Owing to the poor preservation, their total number is not known.

*Shell proper.* In one of our specimens almost the entire shell was preserved; in another specimen we removed a fragment of the shell matter from the dorsal margin. In both cases the shell matter is considerably thick.

*Costation.* The surface of the valves proper bears regular, narrow, close, flat ribs arranged as in *P. attenuata*. Keel is for the most part smooth, bearing only in the proximity of the posterior margin relatively

irregular, wavy, not too prominent striae. At a great enlargement, close, fine, threadlike radial costation, which is distinct especially near the free margin, can be observed in the anterior part of sculptural molds. Individual costae are continuous and diverge out from the beak. Furthermore, in the type no. 170 a fine crenulation of the anterior valve border is visible.

*Biometrical characterization.* Owing to the small number of specimens only two basic parameters of two best preserved specimens are given.

Parameter Type No.	<sup>1)</sup> <i>a</i>	<i>b</i>	<i>d</i>	<i>v</i> <sub>1</sub>	<i>v</i> <sub>2</sub>	<i>v</i>	<i>p</i> <sub>1</sub>	<i>p</i> <sub>2</sub>	<i>a</i> <sup>o</sup>	<i>A</i> <sup>o</sup>	<i>y</i> <sup>o</sup>
170	6,3	16,6	22,9	3,6	3,45	7,05	5,1	16,1	1	11,5	147
69	4,9	12,25	17,15	2,45	2,45	4,9	4,2	12,0	12	11,5	138,5

<sup>1)</sup> All length values in tables I—+ LII are 7X enlarged. In tables VII, XIV, XXI, XXVIII.

*Remarks and Relations.* The specimen figured by M. Schwarzbach (1939) on pl. I, fig. 9 can be in our opinion considered the member of the above described species. The specimen figured by R. v. Klebel sberg (1912) on pl. XX, fig. 44 suggests also to certain extent *Polidevicia čepeki nov. spec.* Relations and differences of the new species have been discussed under the Remarks on *P. attenuata* (Fleming) (see p. ....).

*Distribution and Occurrence.* The above described species was reliably ascertained only in the Namurian of the Upper Silesian basin.

In our collection specimens from the Bohdan marine band of the Petřkovice zone of the Ostrava beds from the mines Urx and Lidice at Petřkovice are found. One uncertain specimen is known from Enna II marine band and from the mine Alexandr at Kunčičky. Schwarzbach's specimen (1939) designated *Leda attenuata*, which according to the figure is very close to our species, comes from the marine band V from the Polish part of the basin.

*Polidevicia čepeki nov. spec.* differs from *P. attenuata* in the more slender, posteriorly more produced valves, the sharp keel, which is nearly straight in the lateral view, the escutcheon, which is raised throughout the length of the dorsal margin, and the narrower, less depressed inner part of the escutcheon, the larger apical angle and the posterior part of the outline being less upwards sloping.

The above described species differs from *P. vašičeki nov. spec.* besides other features in the less elongated shell and the general shape of the rostral part, which in *Polidevicia čepeki* has the form of a goose beak; furthermore it differs in the broader, more rounded keel and less expressed lunule and in the ribs being continuous, not wavy in the posterior part in front of the keel.

The species differs from *P. gengeli nov. spec.* in the more produced shell, more acute keel, broader and contiguous beaks, in the more depressed escutcheon, less apparent lunule and the narrower rostrum.

It differs from *P. sharmani* mainly in the structure of the escutcheon and keel, in the beak being more anterior, in the position of the inferior extreme point (in the angle  $\alpha$ ), and in the course and shape of the maximum convexity line.

### **Polidevcia engeli nov. spec.**

cf. 1956 — *Polidevcia attenuata* Shulgá, Fauna и флора каменоугольных отложений гал.-волынской впадины, Пласт. моллюски, p. 115, pl. 1, fig. 16, non fig. 15.

No n. 1827 — *Nucula attenuata* Fleming, Hist. Brit. Animals, p. 403.

*Holotype*: Right valve, type no. 98, figured on pl. II, fig. 12.

*Derivatio nominis*. In honour of J. Gengela, who contributed to the investigation of the coal bearing sediments of the Upper Silesian fore-deep.

*Locus typicus*: Doubrava near Karviná, mine Doubrava.

*Stratum typicum*: Roemer's marine band, Poruba zone, Namurian A (less probably the lowest part of the Namurian B).

*Material*. Several left valves, one right valve and two complete specimens. Material comes partly from our own collections, partly from the collections of the Syndicate of the Ostrava-Karviná Coal Mines. It is deposited in the collections of the Mining University in Ostrava.

*Mode of preservation*. Sculptural molds and specimens with the shell material preserved.

*Diagnosis*. A species of the genus *Polidevcia* characterized by a small, slender, moderately vaulted shell with rounded keel and rounded rostrum. Anterior line short, lobate, posterior line longer, wedge-shaped, rostral arch narrow, minute. Beaks narrowly rounded, inflated, slightly incurved, raised above the dorsal line, straight or opisthograde, situated approximately on the boundary between the second and third fifth of the antero-dorsal parameter. Escutcheon long, narrow, moderately depressed, strongly raised along the dorsal margin, its inner part is not too clear. Lunule pronounced. Muscle scars shallow, subcircular. Accessory muscles scars two to three, small, vertically elongated, non elevated, situated in a vertical row in the proximity of the anterior border of the umbonal ridge. Umbonal ridge short, rather distinct, straight or moderately bent anteriorly, not exceeding the upper third of the valve height. The course of the entire pallial line is not known. The surface costation close, concentric, arranged as in *P. attenuata*. It was not possible to study the hinge in our specimens.

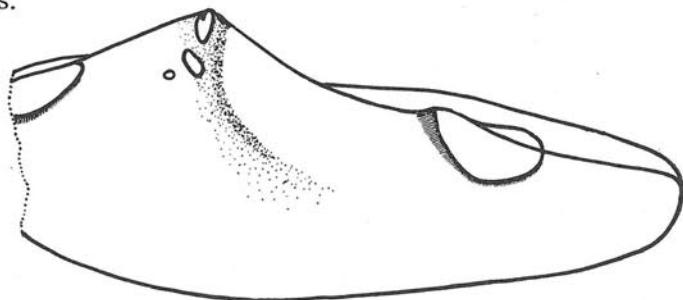


Fig. 7 *Polidevcia engeli* nov. spec., type no 89 from the mine Žofie, Koks marine band. Both adductors scars, accessory umbonal muscle scars and impression of the umbonal ridge on an incomplete mold of the left valve.

*Description.*

Outline. Anterior line lobate, short, straight in its beginning; at about two thirds of the distance between the beak and the anterior extreme point it breaks at a very obtuse angle and passes into a high arch, which coalesces fluently with the posterior line. Dorsal angle very obtuse. Posterior line long, elongated in the form of a narrow wedge with rounded point. In its upper part it is straight, at about one third or in the middle of the distance between the beak and the posterior extreme point it breaks at a very obtuse angle and runs directly to the posterior extreme point. Rostral arch narrow, small. Lower part of the posterior line more or less straight, passing fluently into the moderate arch of the lower part of the anterior line.

Vaulting. Shell slightly vaulted, the line of maximum convexity passing from the umbo to the free margin approximately following the direction of the height. The point of maximum convexity lies between the third of the valve height and its middle. Keel rounded, inconspicuous, straight or moderately curved, in the portion near to the rostrum being somewhat broader, more rounded, less pronounced, in the umbonal portion more clear. A depression runs from the umbo obliquely back towards the free margin, widens downwards and emphasizes morphologically the lower part of the keel.

Beaks. Narrowly rounded, vaulted, only slightly incurved in the oldest portion, non contiguous, raised above the hinge line, straight or only faintly opisthogryrate, situated approximately on the boundary of the second and third fifth of the anterodorsal parameter. They are sometimes very near to each other, sometimes rather distant.

Escutcheon. Long, narrow, moderately depressed, strongly raised along the dorsal margin. Its inner part is not too clear and does not exceed the middle of the distance between the umbo and the posterior extreme point. Striation of the escutcheon indistinct.

Lunule. Conspicuous, rather broad.

Hinge. In none of our specimens the hinge apparatus was well enough preserved to enable the study of its character. However, both branches seem to be of the same length.

Muscle scars. Shallow, subcircular, the posterior one situated below the keel at about two thirds of the distance between the beak and the posterior extreme point, the anterior one in the proximity of the dorsal angle.

Pallial line. Obscure, its entire course unknown.

Umbonal ridge. The impression of the umbonal ridge was studied on the internal molds. It is clear, short, widening downwards, straight or anteriorly curved, approximately bisecting the umbonal angle and disappearing in the vaulting of the valve at about the upper third of the height.

Accessory muscle scars. Two or three impressions of accessory muscles situated in the furrow left by the umbonal ridge are visible on the molds. They are small, oval, vertically elongated, faintly elevated, arranged in a vertical row nearer to the anterior border of the furrow.

Shell proper. In one of our specimens the shell matter is preserved almost entirely. In this case it is evident that the shell matter was rather thick.

Costation. The shell proper bears flat, close, regular concentric ribs arranged so that the upper border of the younger rib partly covers the lower border of the older rib. Costation is well distinct mainly in the anterior portion of the valve, while it seems to lose its distinctness posteriorly. The poor preservation, however, does not allow us to follow the course of concentric ribs with certainty.

*Biometrical characterization.*

Equation of the regression line of  $v$  as plotted against  $d$ :

$$v = 0.26 d + 0.63$$

Equation of the regression line of  $d$  as plotted against  $v$ :

$$d = 3.63 v - 1.8$$

$$\frac{d}{v} \approx 3.0; \frac{v}{d} \approx 0.36$$

Equation of the regression line of  $p_1$  as plotted against  $p_2$ :

$$p_1 = 0.32 p_2 + 0.36$$

Equation of the regression line of  $p_2$  as plotted against  $p_1$ :

$$p_2 = 1.93 p_1 + 1.56$$

$$\frac{p_2}{p_1} \approx 2.6 \text{ (boundary } 2.0\text{---}3.4\text{)}$$

$$\frac{p_1}{p_1 + p_2} \approx 0.27 \text{ (boundary } 0.22\text{---}0.3\text{)}$$

Equation of the regression line of  $v_1$  as plotted against  $v_2$ :

$$v_1 = 1.05 v_2 + 0.11$$

Equation of the regression line of  $v_2$  as plotted against  $v_1$ :

$$v_2 = 0.86 v_1 + 0.04$$

$$\frac{v_2}{v_1} = 0.88 \text{ (boundary } 0.75\text{---}1.0\text{)}$$

$$\begin{array}{lll} A\alpha = & 80^\circ 18'; & h\alpha = - 40^\circ 33' \text{ to } 20^\circ 38'; \\ A\beta = & 130^\circ 00'; & h\beta = 10^\circ 52' \text{ to } 15^\circ 08'; \\ A\gamma = & 133^\circ 00'; & h\gamma = 116^\circ 04' \text{ to } 148^\circ 19'; \end{array} \quad \begin{array}{ll} R\alpha = - 0^\circ 02' \text{ to } -3^\circ 30' \\ R\beta = 12^\circ 01' \text{ to } 13^\circ 59' \\ R\gamma = 124^\circ 53' \text{ to } 141^\circ 08' \end{array}$$

*Remarks and Relations.* The above described species suggests to a certain degree the specimen figured by P. L. Schulga (1959) on pl. I, fig. 16, designated *Polidevcia attenuata* (Flem.). This form differs from *P. gengeli* in the more central position of the beak and in the more acute keel.

*Distribution and Occurrence.* The specimens of our collection come from the Nanetta II marine band from the outcrops near the mine Urx

at Petřkovice, from the Enna II marine band from the mine P. Cingr at Michálkovice, from Barbora marine bands from the mine Václav at Orlová, from Roemer's marine bands from the mine Doubrava at Doubrava and from Gaebler's marine band from the mine Žofie at Orlová.

Šulgá's specimen comes from the Visean of Lvov District.

### **Polidevcia vašíček nov. sp.**

cf. 1956 — *Polidevcia* sp. Šulgá, Fauna и флора каменоугольных отложений гал.-волынской впадины, Пластинчатожаберные моллюски, р. 119, pl. 2, fig. 21.

*Holotype:* Right valve, type no. 142b, figured on pl. IV., fig. 2.

*Derivatio nominis:* In honour of the prominent paleontologist Dr. M. Vašíček who contributed to the investigation of the coal bearing sediments of the Upper Silesian fore-deep.

*Locus typicus:* Staříč, bore NP 178, depth 668,70 m.

*Stratum typicum:* Stur's marine band, Petřkovice zone, Namurian A.

*Material.* Several left and right valves, partly postmortally deformed, and their fragments. Material comes from the bore samples of the Coal Survey in Ostrava, where it is deposited with the exception of the holotype. Six specimens have been used for the biometrical analysis.

*Mode of preservation.* Sculptural molds, impression, in one case a fragment of the shell matter.

*Diagnosis.* A species of the genus *Polidevcia* characterized by a relatively large, very slender shell, moderately vaulted and strongly produced posteriorly. Keel is indistinct, rounded, rostrum pointed. Anterior line short, lingulate, posterior line in the shape of a long, narrow point with rounded end. Beaks small, vaulted, narrowly rounded, opisthoglyrate, moderately raised above the dorsal margin, situated near the boundary of the anterior and middle third of the anteroposterior parameter. Escutcheon very narrow, long, slightly depressed, raised along the dorsal line, lunule distinct. It was not possible to study the hinge, muscle scars, pallial line and umbonal ridge in our specimens. The surface costation close, concentric, single ribs being narrow, arranged so that the upper border of the younger rib partly covers the lower border of the older rib. In the posterior part of the valve the concentric ribs are distinctly bent upwards, producing a narrower or broader wavy band, becoming then straight and running parallel to the posterior portion of the free margin. The ribs disappear before the keel so that only a faint, slightly distinct striation is visible on the keel.

#### *Description.*

*Outline.* Anterior line short, lingulate straight in the upper part, in the lower part forming a semicircular arch, which coalesces with the broad arch passing fluently into the lower part of the posterior line. Dorsal angle obtuse, about 170 degrees. Posterior line has the shape of a long narrow thorn with a rounded point. Its upper part is at first moderately bent, in the rostral part straight; it passes by a small pointed rostral arch into the lower part, which is straight in front of the rostral arch, breaking at an obtuse angle near the boundary of the third and

fourth quarter of the anterodorsal parameter and passing into the moderately vaulted arch, by which it joins the anterior line.

Vaulting. Valves evenly moderately vaulted, the line of the maximum convexity passing from the beak to the inferior extreme point, that lies approximately in the plane of the valve height. The point of maximum convexity lies approximately in the superior third of the valve height. Keel rounded, inconspicuous, more prominent only in the umbonal portion, disappearing in the vaulting of the valve around the middle of the distance between the beak and the posterior extreme point. (This is true only of adult specimens. In young forms it is distinct as far as the posterior extreme point.)

Beaks. Small, vaulted, narrowly rounded, opisthogyrate, moderately raised above the dorsal line, situated approximately on the boundary of the anterior and posterior third of the anterodorsal parameter.

Scutcheon. Very narrow, slightly depressed, raised along the dorsal line. It was not possible to study it in details in our specimens.

Lunule. Pronounced.

It was not possible to study the hinge, muscle scars, pallial line and umbonal ridge.

Shell proper. The shell matter is preserved only on the type no. 155. It is thin, bearing close concentric ribs arranged as in *P. attenuata*. Only in the posterior part of the valve the course of the ribs is distinctly different. In *P. vašičeki nov. spec.* the concentric ribs are abruptly bent upwards in the posterior part of the valve, producing a more or less narrow wavy band, becoming then again straight and running parallel to the posterior part of the free margin. The axis of the waving of the concentric ribs passes from the free margin approximately through the middle third of the anteroposterior parameter obliquely upwards to the umbo. In front of the keel the ribs disappear so that only a faint, little distinct striation is visible on the keel. In the close proximity of the free margin the ribs are sometimes somewhat dilated.

#### *Biometrical characterization.*

Equation of the regression line of  $v$  as plotted against  $d$ :

$$v = 0.27 d + 0.39$$

Equation of the regression line of  $d$  as plotted against  $v$ :

$$d = 3.52 v - 0.98$$

$$\frac{d}{v} = 3.1; \frac{v}{d} = 0.33$$

Equation of the regression line of  $p_1$  as plotted against  $p_2$ :

$$p_1 = 0.36 p_2 + 0.41$$

Equation of the regression line of  $p_2$  as plotted against  $p_1$ :

$$p_2 = 2.7 p_1 - 0.97$$

$$\frac{p_2}{p_1} = 2.3 \text{ (boundary 1.7--2.6)}$$

$$\frac{p_1}{p_1 + p_2} = 0.30 \text{ (boundary } 0.27-0.32\text{)}$$

Equation of the regression line of  $v_1$  as plotted against  $v_2$ :

$$v_1 = 0.7 v_2 - 0.17$$

Equation of the regression line of  $v_2$  as plotted against  $v_1$ :

$$v_2 = 1.29 v_1 - 0.08$$

$$\frac{v_2}{v_1} = 1.22 \text{ (boundary } 0.78-1.54\text{)}$$

$$\begin{aligned} A\alpha &= 5^\circ; \quad h\alpha = 10^\circ 34' \text{ to } 20^\circ 34'; \quad R\alpha = - 1^\circ 58' \text{ to } 11^\circ 58' \\ A\beta &= 16^\circ 45'; \quad h\beta = 10^\circ 10' \text{ to } 21^\circ 20'; \quad R\beta = 13^\circ 14' \text{ to } 18^\circ 14' \\ A\gamma &= 140^\circ 50'; \quad h\gamma = 122^\circ 32' \text{ to } 159^\circ 08'; \quad R\gamma = 132^\circ 13' \text{ to } 149^\circ 26' \end{aligned}$$

*Remarks and Relations.* *Polidevcia vašičeki* is most similar to the form figured by P. L. Shulgá (1956) on pl. II, fig. 31, designated *Polidevcia sp.* We cannot decide with certainty whether it is the same species, as Shulgá does not describe its surface sculpture. The relations to other related forms are discussed under the remarks on *P. attenuata* (Flem.) (see p. . . .). *P. vašičeki* differs from all species of our collection mainly in the slender, strongly elongated shape of the outline, the pointed rostrum and the characteristic wavy appearance of the ribs in the posterior part of the valve.

*Distribution and Occurrence.* *Polidevcia vašičeki nov. spec.* has been hitherto ascertained only in the Namurian of the Ostrava part of the Upper Silesian basin, where it is limited to the lowermost horizons of the Petřkovice zone of Ostrava beds (Namurian A).

This species is in our collection represented by some specimens coming from the Stur's marine band from the bores Starýč NP 93, NP 100, NP 123, NP 178, NP 181, NP 184 and from the Bohdan marine band from the mine Lidice at Petřkovice.

The specimen figured by P. L. Shulgá (1956) on pl. II, fig. 21, designated *Polidevcia sp.*, which strongly resembles to our new species, comes from the Lower Namurian of the Galizia-Volyn Basin.

#### POLIDEVCIA SHARMANI (R. ETHERIDGE JUN., 1878)

- 1878 — *Nuculana Sharmani* R. Etheridge jun., The Quart. Journ. Geol. Soc., London, vol. XXXIV, pl. II, fig. 18, p. 15.
- 1885 — *Nuculana Sharmani* R. Etheridge jun., Brit. Fossils, pt. 1, Palaeoz., p. 288.
- 1896—1900 — *Nuculana Sharmani* Hind, Brit. Carb. Lamellibr., 1. pl. XV, fig. 17—22, p. 199.
- 1905 — *Nuculana Sharmani* Hind, Quart. J. geol. Soc. London, 61, pl. XXXV, fig. 19, p. 536.
- 1912 — *Nuculana Sharmani* Klebeberg, Die marine Fauna der Ostrauer Schichten, Jahrb. K. K. Geol. Reichsanstalt LXII, p. 588.
- 1932 — *Nuculana Sharmani* Pfab, Die Begleitfauna der Goniatiten des Ostsudetischen Unterkarbon, Mitt. naturwiss. Ver. Troppau, Nr. 24/25, 38, p. 77.
- 1937 — *Nuculana sharmani* Paul, Abh. preuss. geol. Land.-Anst., N. F. H. 179, pl. I, fig. 11, p. 74.

- 1938 — *Nuculana sharmani* Renier, Stockmans, Demanet et Van Straelen, Flore et Faune houillères Belg., pl. 113, fig. 16—20, p. 134.
- 1941 — *Nuculochlamys sharmani* Paul, Fossilium Catalogus, I., Animalia, pars 91: Lamellibranchiata infracarbonica, p. 39.
- 1949 — *Leda sharmani* Schwarzbach, Die Fauna des Bug-Karbons und ihre stratigraphische und palaeogeographische Bedeutung, Sond.-Abd. aus Palaeontogr., Beitr. Naturgesch. Vorz., Vol. XCVII, Abt. A., p. 45. Non textfig. 29.
- 1956 — *Polidevicia sharmani* Šulgá, Fauna и флора каменоугольных отложений гал.-волынской впадины, Пластиначатожаберные моллюски, р. 117, pl. 1, fig. 19.
- Non 1941 — *Nuculana sharmani* Demanet, Faune et stratigrafie de l'étage Namurien de la Belgique, Mém. Mus. Royal Hist. Nat. Belg., No 97, pl. XIV, fig. 14 et 15, p. 239.
- Non 1943 — *Nuculochlamys sharmani* Demanet, Les horizons marins du Westfalien de la Belgique et leurs faunes, Mém. Mus. Royal Hist. Nat. Belg., No 101, pl. 3, fig. 6—7, p. 88. Non fig. 4—5.

*Holotype:* *Nuculana sharmani* Etheridge jun., 1878. On Lower Carboniferous Invertebrata — The Quarterly Journal of the Geol. Society of London, vol. XXXIV., pl. II, fig. 18.

*Locus typicus:* Woodhall, Water of Leith, near Edinburgh, Scotland.

*Stratum typicum:* Calciferous Sandstone series, Tournaisien.

*Material.* A number of left and right non-isolated valves and fragments. Fifteen right and eleven left valves were used for biometrical studies. Material is partly from our own collections, partly from the collections of the Mining University in Ostrava, of the Ostrava Museum and of the Geological Section of the Syndicate of the Ostrava-Karviná Coal Mines. It is deposited partly in the collections of the Mining University, partly in the collections of the Ostrava Museum.

*Mode of preservation.* Our material are internal molds and sculptural molds. Forms with the shell matter preserved are unknown.

*Original Etheridge's diagnosis.* "Transversally elongated, slightly clavate, moderately convex. Anterior end rounded; posterior end produced gradually compressed laterally to the bluntly rounded point. Ventral margin convex, sloping upwards posteriorly. Umbones nearly but not quite central, a little anterior; lunule probably small and ill-defined; escutcheon or posterior lunette narrow and not duple marked, or bounded by ridges from the beak. Surface of the valves ornamented with imbricating striae; on the posterior end these striae widen out, become coarser and broad and assume the aspect of small waves or fluctuations." The emendation of Etheridge's diagnosis is given under the remarks of the species.

#### *Description.*

*Outline.* Anterior line long, lingulate, in the upper part more or less straight, passing at about two thirds of the parameter between the beak and the anterior extreme point into a vaulted arch, the lower part of which coalesces with the lower part of the posterior line. Dorsal angle very obtuse. The upper part of the posterior line straight to slightly curved, rostral arch small, sometimes rather acute, sometimes more obtuse. The upper part of the posterior line nearly straight or slightly bent downwards. Rostrum broadly cuneiform with rounded point.

Vaulting. Valves moderately vaulted, in the posterior part less than in the anterior. Keel rounded, more or less bent downwards. In the part nearer to the beak it is more pronounced, nearly disappearing in the convexity of the valve in the rostral part. Line of maximum convexity lies usually in front of the umbonal plane. Point of maximum convexity lies on this line, most often in the anterior third of the valve height.

Beaks. Small, vaulted, considerably broad, incurved, moderately raised above the hinge line, more or less opisthogyrate, sometimes nearly orthogyrate, their placing being rather variable. However, beaks are never situated essentially near to the valve anterior margin but are always more or less distant from the middle of the anterodorsal parameter.

Escutcheon. Relatively long, narrow, moderately depressed, raised along the dorsal line, bounded off from the rest of the valve by the rounded keel, more distinctly in the umbonal portion than in the rostral part. The inner part of the escutcheon is in the specimens of our collection poorly preserved. It is relatively short, moderately depressed, broadly lanceolate, and the small rib bordering it joins the dorsal margin on the boundary of the anterior and middle third of the distance between the beak and the posterior extreme point. Striation of the escutcheon is not distinct in our specimens.

Lunule. Small, moderately depressed, in our forms not clear, its sculpture being indistinct.

Hinge. Isolated valves preserved so that it would be possible to study the character of the hinge are missing in our collection. Most frequently only more or less distinct teeth fossilized in different levels are preserved. The obscurity of the hinge apparatus is increased by the impressions of the teeth of both valves meeting often on a single hinge plate. It is consequently evident that the shape, number and placing of teeth on the hinge plates could not be observed. The hinge plates, as far as it was possible to observe them in the impressions, are not too broad, relatively short, the anterior being broader than the posterior. Their length's ratio is usually 1:1. The state of preservation of our material does not allow us to decide with certainty, whether chondrophore was present or not.

Muscle scars. The impressions of both adductors are preserved in none of our specimens. Generally it can be stated that in our specimens the muscle scars are preserved only exceptionally. They are faint, not too clearly defined, small, flat, elevated on the molds. The anterior adductor scar is small, ovoidal, situated in the anterior part of the valve more or less distant from the anterior margin. The posterior adductor scar is usually situated on the keel, approximately in the anterior third of the distance between the beak and posterior extreme point, being divided into two unequal parts by the line of maximum convexity of the keel. The shape of the posterior adductor scar is very variable. [The variability of the posterior adductor scar is due to the form of the posterior part of the valve; in forms with the posterior part extremely produced and narrow it has the shape of a narrow ovoid or ellipse, the axis of which only slightly deviates from the anteroposterior parameter; in forms with the posterior part only slightly produced and rather blunt, the

posterior adductor scar is more or less circular.) The posterior adductor scar is twice as large as the anterior one.

Pallial line. It was not possible to ascertain the entire course of the pallial line.

Umbonal ridge. We point out that in forms which were at our disposal the impression of the umbonal ridge on the internal molds is usually more or less smoothed off so that, consequently, its shape and course are rather misrepresented. When it is observable, it appears as a shallow narrow, posteriorly moderately bent furrow, which starts from the umbonal part and nearly bisects the umbonal angle.

Accessory muscle scars. Owing to the unfavourable state of preservation it is not possible either to localize them or to determine their number. In several cases only one small subcircular impression of the umbonal muscle was observed, situated near the umbo. Sometimes even the indications of two small muscle scars were observed in the umbonal portion.

Shell proper. None of the specimens of our collection has the shell matter entirely preserved. Only on a few specimens thin rests of the shell matter are present. Although they do not inform us about the thickness of the shell we suppose that it was not too thick.

Costation. The costation is indistinct in the specimens in which fragments of the shell matter are preserved. The concentric ribs are only faintly marked. Sculptural molds bear regular, close, flat concentric ribs arranged so that the upper border of the younger rib partly covers the lower border of the older rib. Ribs are most distinct in the anterior part of the valves, losing in distinctness posteriorly and disappearing before the keel or on it.

#### *Biometrical characterization.*

Equation of the regression line of  $v$  as plotted against  $d$ :

$$v = 0.33 d + 0.58$$

Equation of the regression line of  $d$  as plotted against  $v$ :

$$d = 2.48 v + 0.09$$

$$\frac{d}{v} = 2.5; \frac{v}{d} = 0.44$$

Equation of the regression line of  $p_1$  as plotted against  $p_2$ :

$$p_1 = 0.86 p_2 - 1.10$$

Equation of the regression line of  $p_2$  as plotted against  $p_1$ :

$$p_2 = 0.82 p_1 + 2.27$$

$$\frac{p_2}{p_1} \doteq 1.6 \text{ (boundary } 2.0-1.08\text{)}$$

$$\frac{p_1}{p_1+p_2} \doteq 0.4 \text{ (boundary } 0.48-0.31\text{)}$$

Equation of the regression line of  $v_1$  as plotted against  $v_2$ :

$$v_1 = 1.19 v_2 - 0.01$$

Equation of the regression line of  $v_2$  as plotted against  $v_1$ :

$$v_2 = 0.65 v_1 + 0.35$$

$$\frac{v_2}{v_1} \doteq 0.85 \text{ (boundary } 1.1 - 0.75\text{)}$$

$$A\alpha = -5^{\circ} 18'; h\alpha = -31^{\circ} 24' \text{ to } 20^{\circ} 47'; R\alpha = -0^{\circ} 06' \text{ to } -10^{\circ} 32'$$
$$A\beta = 18^{\circ} 21'; h\beta = 14^{\circ} 20' \text{ to } 22^{\circ} 22'; R\beta = 17^{\circ} 32' \text{ to } 19^{\circ} 09'$$
$$A\gamma = 127^{\circ} 37'; h\gamma = 104^{\circ} 35' \text{ to } 150^{\circ} 39'; R\gamma = 123^{\circ} 02' \text{ to } 132^{\circ} 12'$$

*Remarks and Relations.* Among the specimens of our collection two types can be distinguished on the basis of the general structure of the valve. The specimens of the first type agree on the whole with the holotype of the species figured by R. Etheridge jun. (1878) on pl. II, fig. 18. The specimens of the second type have subcentral to central beaks, the anterior line sometimes long, lingulate, the lower extreme point situated anteriorly and the line of maximum convexity passing obliquely to the front. In all remaining features the representatives of both types are similar, even passing over from one type to the other so that it was not possible to separate them on the basis of biometrical studies. Consequently, we have worked them as one sample.

When comparing Etheridge's original diagnosis with our description we do not see any fundamental difference. The only objection against Etheridge's diagnosis would refer to the "imbricating" of the surface ribs. In fact the younger rib covers the lower border of the older rib. The "imbricating" character would appear if the shell would be observed from the free margin towards the beak, consequently, against the direction of growth.

W. Hind (1896-1900) emended the original Etheridge's diagnosis by several new statements. He notes that the dorsal border of the valves consists of two parts, which meet at an obtuse angle below the beak; he describes the shape and position of adductor scars, the umbonal ridge and pallial line which he refers to as faintly marked, without sinus. Our observations agree with Hind's statements except for the pallial line, which we could not reveal in its entire course.

We believe that it is possible to agree with the opinion of P. L. Shulgina (1956) that the forms described by F. Demanet (1941) as *Nuculana sharmani* (p. 239, pl. XIV, fig. 14, 15) do not belong to this species. However, we do not accept the further opinion of the author that these forms belong to the genus *Anthraconeilo* Girty, as we do not consider possible to make a reliable generic determination on the basis of a mere figure, which does not even show the hinge.

Also the forms described by F. Demanet (1943, pl. III, fig. 4-5) as *Nuculochlamys sharmani* cannot be, in our opinion, regarded as conspecific with *Polidevcia sharmani* because they fall outside the circle of this species by the general shape of the outline.

The differences between Etheridge's species and related forms have been sufficiently discussed by this author (1878) and therefore we refer to him. *Polidevcia sharmani* differs so distinctly from the remain-

ing representatives of the genus described in the present work that we do not think it necessary to point out single differences.

*Distribution.* The species *Polidevcia sharmani* is referred from the Lower Carboniferous of Scotland and from the Lower Carboniferous of the Volyn-Galizia District of the European part of USSR, from the Visean and Namurian of the Upper Silesian Basin, and from the Namurian of Belgium. Its occurrence in the Westfalian of Belgium is uncertain.

*Occurrence.* The species is typical of the Petřkovice zone of the Ostrava beds. Our collection contains specimens from the Bohdan marine band of the mine Lidice at Petřkovice, from the Leonard marine band of the mine Urx at Petřkovice, from the Poustevník marine band of the mine Stachanov at Hrušov, from the second Bruno marine band, of the bore Koblov—NP 87, from the Viléma marine band of the mine Urx at Petřkovice, from the Pavel marine band of the mine Vítězný únor at Přívoz and a great quantity of forms from both Nanetta marine bands from the mines Šverma at Mar. Hory, Jiří at Přívoz, Stachanov at Hrušov, Stalin II at Hrušov, Petr Bezruč at Sl. Ostrava, Vítězný únor at Přívoz, and from the outcrops of Carboniferous strata near the mine Urx at Petřkovice and from the bore Koblov NP 87.

### ***Polidevcia* sp.**

From the collections of the Coal Survey in Ostrava a sculptural cast of a specimen was gained from the Františka marine band from the bore Ostrava-Kunčičky NP 133. This specimen, although not very well preserved (beaks and escutcheon are not distinct) is very characteristic in its general shape and does not suggest any known representative of the genus *Polidevcia*. Therefore we describe it with open nomenclature.

Shell slender, vaulted, strongly produced posteriorly, rostral part very narrow, moderately curved upwards, rostral arch comparatively broad. Anterior line lingulate, two thirds of the upper part of the posterior line are straight, then it slopes upwards at an obtuse angle and passes in a broad arch to the posterior extreme point. The lower part of the posterior line is only slightly curved downwards. The shape of the posterior part of the shell is very typical of this form. Two inconspicuous keels, between which a shallow, not very broad depression runs, are present. The first keel begins probably on the beak (owing to the poor preservation we are not able to follow the beginning of the keel), the second extends from the dorsal line to below the posterior extreme point. Both are rounded and oblique towards the back. The rostral end produced upwards from the second keel is also characteristic of this form. Sculpture, as far as it can be observed, consists of flat concentric ribs, which pass over the first keel and disappear before reaching the second, which is consequently smooth. Only in the close proximity of the free margin do the ribs pass over the second keel. The ribs are arranged in a similar way as in other members of the genus *Polidevcia* which are described in this work. Muscle scars, pallial line and hinge indistinct. This form has been ranged to the genus *Polidevcia* only on the basis of its general shape.

### **Phestia Chernyshev, 1951 (nov. emend.)**

*Phestia Chernyshev*, 1943 (nomen nudum)

*Phestia Chernyshev*, 1951

*Phestia Shulgá*, 1956

*Phestia Elias*, 1957

*Genoholotype*: According to the original designation *Phestia inflatiformis* Chernyshev, 1937. Upper Carboniferous, C<sub>3</sub>? Donietz Basin.

*Synonyms*: *Nucula auctorum* (partim)

*Leda auctorum* (partim)

*Yoldia auctorum* (partim)

*No n*: *Nucula Lamarck*, 1799  
*Leda Schuhmacher*, 1817

**D i a g n o s i s.** Shell equivalve, small, elongated, posteriorly produced into a rostrum. Beaks opisthogyrate, somewhat raised above the hinge margin. A keel runs from the beak to the upper part of the posterior margin. The keel defines together with the valve margin a rather flat area similar to the escutcheon. On the inner surface of the valve a distinct rib curved to the posterior border runs from the cavity near the beak. This rib broadens and disappears in the proximity of the pallial line or somewhat sooner. On the anterior slope of the rib or before it a comparatively large ellipsoidal impression of the umbonal muscle is situated in the umbonal portion. The anterior adductor scar is small, more or less rounded, distinct, the posterior adductor scar being elongated, as large and pronounced as the anterior scar. Pallial line without sinus. Hinge consists of two branches of taxodont teeth which meet at an angle under the beak. Number of teeth in both branches does not differ very much, their ratio being approximately 1:1.5. Hinge branches are separated by an oblique ligamental groove. The teeth of the posterior branch extend over the border of the groove, the anterior teeth only touch it without changing in size. Sculpture consists of numerous acute concentric ribs.

**Remarks and Relations.** The genera *Phestia* and *Polidevcia* are closely related. The differences between them were discussed by B. I. Chernyshev already in his article of 1943, to which we refer. In the present work the mutual relationship between the two genera is discussed in the description of the first genus (see p. 34). We note that several forms of the genus *Phestia* from the Ostrava-Karviná District, which correspond by the general habitus to the original diagnosis, show certain small differences. The umbonal ridge is in some cases relatively short and keel inconspicuous. Of course, we are fully aware of the fact that it is not possible to draw precocious conclusions concerning the complementing of the generic diagnosis, on the basis of a single species. Therefore, we leave the systematic significance of the length of the umbonal ridge in *Phestia* open as yet. The genus *Phestia* is in our material represented by a single species *Phestia bellicostata* (Schwarzbach 1949).

**Distribution.** Carboniferous of Europe, North America and Asia.

**Occurrence.** Ostrava beds of the Ostrava-Karviná District.

## **Phestia bellicostata (Schwarzbach, 1939)**

1939 — *Leda sharmani* (Etheridge) var. *bellicostata* Schwarzbach, Die Muscheln im Oberkarbon Oberschlesiens, Jahrb. Geol. Vereinig. Obersch., pl. I, fig. 11—13, p. 12.

1939 — *Leda stilla* (Mac Coy) Schwarzbach ibid. pl. I, fig. 14, p. 13.

*Holotype:* Specimen designated *Leda sharmani bellicostata* Schwarzbach (1939), (pl. I, fig. 11).

*Locus typicus:* Bytom, Poland.

*Stratum typicum:* Undesignated marine band, 110 m under the Prokop seam.

*Material.* A number of right and left separated valves, and their fragments and several shells with both valves preserved in the natural biological position. The documentary material comes mostly from our own collections, partly from the collections of the Geological Department of the Ostrava-Karviná Coal District. It is deposited in the collections of the Mining University in Ostrava. Twenty specimens were used for the biometrical analysis.

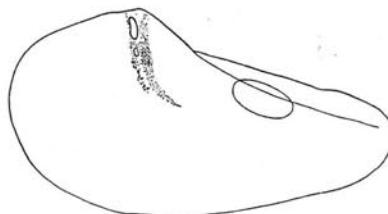


Fig. 8 *Phestia bellicostata* (Schwarzbach, 1939), type no. 9, mine Bezruč at St. Ostrava, Nanetta marine band. Posterior adductor scar, impression of the umbonal ridge and accessory umbonal muscles scars on a sculptural mold of the left valve.

*Mode of preservation.* Sculptural molds and shells with the shell matter preserved. In some cases, after having photographed the forms we dissolved the shell matter in order to study the inner parts of the shells. In such cases, internal molds are left as documentary material.

*Diagnosis.* A species of the genus *Phestia* characterized by a clavate shell, small to medium sized, moderately produced posteriorly, with rounded inconspicuous keel and rounded rostrum. Anterior line short, lingulate, posterior line broadly cuneiform. Beaks small, vaulted, moderately raised above the hinge line, moderately prosogyrate, contiguous. Escutcheon in the proper sense of the term as well as lunule wanting. Hinge of taxodont teeth, the posterior hinge branch a little longer than the anterior. Adductor muscle scars clear, partly elevated, well defined, large. Pallial line partly clear, its entire course unknown. Umbonal ridge not too long, distinct, nearly bisecting the umbonal angle. Umbonal muscle scars are two, situated on the umbonal ridge. In the dorsal view a small, elongated, subovoidal muscle scar is visible in the anterior part of the internal molds. Along its border nearer to the hinge margin an acutely defined furrow runs on each valve.

The shell matter is comparatively thick, costation consists of concentric ribs which disappear before the keel and appear as close, fine striation behind the keel, converging towards the beak.

*Description.*

**Outline.** Anterior line not very long, lingulate, semicircular curved. Dorsal angle obtuse. Posterior line broadly cuneiform. Its upper part straight or slightly curved. It passes fluently into a small rostral arch above the posterior extreme point. The lower part of the posterior line is moderately curved downwards and coalesces in a broad arch with the anterior line. Inferior extreme point is either identical with the contrabumonal point or lies somewhat behind it.

**Vaulting.** Valves considerably vaulted, line of maximum convexity lies in the plane of the valve height. Maximum convexity point lies approximately in the upper third or the middle of the valve height. Keel inconspicuous, broadly rounded, more distinct in the umbonal part only. In some cases it may be even more acute.

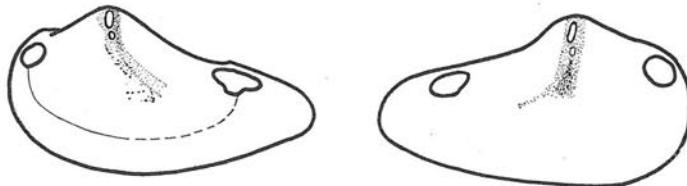


Fig. 9 *Phestia bellicostata* (Schwarzbach, 1939), type no. 74, mine Pionýr at Petřvald, Koks marine band. Adductor scars, accessory umbonal muscles scars, impression of the umbonal ridge and incomplete pallial line on a pyritized mold of the left valve.

Fig. 10 *Phestia bellicostata* (Schwarzbach, 1939), type no. 104, mine Pionýr at Petřvald, Koks marine band. Adductors scars, accessory umbonal muscles scars and impression of the umbonal ridge on a pyritized mold of the right valve.

**Beaks.** Forms with the shell matter preserved have the beaks very small, vaulted, raised above the hinge line, in the oldest portion incurved, moderately opisthogyrate, contiguous. Beaks in the internal molds are usually not incurred over the hinge line; they are rather elevated, non contiguous and appear more orthogyrate than opisthogyrate.

**Escutcheon.** A shallow, inconspicuous depression, raised along the dorsal margin, which cannot be taken for an escutcheon in the proper sense of the term.

**Lunule.** The beaks are emphasized anteriorly by a minute depression, which cannot be considered a lunule.

**Hinge.** Specimens with distinct hinge are missing in our collection. Only indistinct teeth impressions of different levels can be observed in our specimens. In forms with the shell matter preserved the junction of both hinge branches can be studied after the solution of the shell. The impression of the anterior hinge plate is usually narrow and shorter than the impression of the posterior hinge plate, which is broader.

**Muscle scars.** Muscle scars can be best studied on molds in which the shell matter was removed. They are conspicuous, well defined and partly elevated. Anterior adductor scar is subcircular, heart-shaped, considerably large, situated in the anterior part of the valve, close to the margin. The portion of the anterior adductor which is nearer to the umbo is in molds more elevated than the portion nearer to the margin. The posterior adductor scar is large, distinct, larger than the anterior, reniform and elongated in the direction of the keel. It is situated near to the posterior border of the valve, partly on the keel, partly on the moderately concave area between the keel and the dorsal margin. Its portion which is nearer to the beak is more elevated, the rest being only slightly raised.

**Pallial line.** Conspicuous in the anterior part of the valve, getting gradually less distinct. Its junction with the posterior adductor scar indistinct.

**Umbonal ridge.** The impression of the umbonal ridge is in our specimens represented by a broad, curved furrow, which extends from the umbonal portion, approximately bisects the apical angle and disappears in the upper third or the middle of the valve height. This impression is best preserved on molds in which the shell matter was dissolved.

**Accessory muscle scars.** Two distinct impressions of umbonal muscles are visible on pyritized molds gained after the solution of the valve matter. They are situated in the umbonal portion on the impression of the umbonal ridge. The first scar is longer, narrow, elongated in the direction of the valve height, situated outside the middle of the apical angle, nearer to the anterior margin. It is well defined and elevated. The second muscle scar is situated much lower, most often in the axis of the apical angle or nearer to the posterior margin. It is circular to subcircular, elevated, very small. In the anterior part of the shell a small muscle scar is visible in the dorsal view. The scar is subovoidal, elongated in the direction of the dorsal line, situated near the end of the hinge line. A relatively deep, narrow, well defined furrow runs on each valve along the border of the scar towards the anterior adductor. The furrow corresponds very likely to a small supporting rib in the positive.

**Shell proper.** The shell matter is relatively thick.

**Costation.** The costation of the shell of small specimens is indistinct by the naked eye. The concentric ribs are flat, regular, close and arranged so that the upper border of the younger rib covers the lower border of the older rib. The costation is equally distinct on the entire surface of the shell. In front of the keel the ribs sometimes disappear so that the keel is smooth. Behind the keel the ribs become apparent again in the form of close, fine striae converging towards the beak.

#### *Biometrical characterization.*

Equation of the regression line of  $v$  as plotted against  $d$ :

$$v = 0.46 d + 0.13$$

Equation of the regression line of  $d$  as plotted against  $v$ :

$$d = 2.04 v + 0.17$$

$$\frac{d}{v} \doteq 1.91; \frac{v}{d} \doteq 0.56$$

Equation of the regression line of  $p_1$  as plotted against  $p_2$ :

$$p_1 = 0.32 p_2 + 0.73$$

Equation of the regression line of  $p_2$  as plotted against  $p_1$ :

$$p_2 = 1.99 p_1 - 0.27$$

$$\frac{p_2}{p_1} \doteq 1.8 \text{ (boundary } 2.1-1.5\text{)}$$

$$\frac{p_1}{p_1 + p_2} \doteq 0.35 \text{ (boundary } 0.38-0.32\text{)}$$

Equation of the regression line of  $v_1$  as plotted against  $v_2$ :

$$v_1 = 0.82 v_2 + 0.43$$

Equation of the regression line of  $v_2$  as plotted against  $v_1$ :

$$v_2 = 0.68 v_1 - 0.40$$

$$\frac{v_2}{v_1} \doteq 0.91 \text{ (boundary } 1.16-0.69\text{)}$$

$$A\alpha = 2^0 01'; h\alpha = - 6^0 59' \text{ to } 10^0 58'; R\alpha = - 0^0 01' \text{ to } 4^0 04'$$

$$A\beta = 22^0 39'; h\beta = 18^0 10' \text{ to } 27^0 07'; R\beta = 21^0 38' \text{ to } 23^0 40'$$

$$A\gamma = 108^0 29'; h\gamma = 92^0 47' \text{ to } 124^0 10'; R\gamma = 104^0 47' \text{ to } 112^0 10'$$

*Remarks and Relations.* M. Schawrzbach (1939) established a new subspecies, which he designated *Leda sharmani* (Etheridge) var. *bellicostata* and characterized as follows: "Ziemlich kurz, (L: Höhe kaum 2:1). Wirbel ziemlich weit vorn. Schale dick, mit kräftigen, konzentrischen Rippen; Steinkern fast ohne Streifung. Maße: L. durchschnittlich 5-11 mm." This diagnosis is evidently incomplete, neglecting many characteristic features and can be therefore applied to a number of forms. Neither the original Schawrzbach's illustrations (pl. I, fig. 11-13) are sufficiently clear to compensate the imperfection of the diagnosis. In the remarks Schawrzbach defines the differences between his new subspecies and some related species but neither these remarks do sufficiently clear up the right conception of his subspecies. He states: "*Leda attenuata* ist im Gesamthabitus ganz gleich, aber viel länger, *Leda stilla* dagegen kürzer. *Leda sharmani* (Etheridge) (Etheridge 1878, S. 95, Taf. 2/18; Hind 1896-1900, S. 199, Taf. 15/17-22) hat dieselbe Form, aber die Schale ist glatt (nach Hind ist die Streifung „hardly visible to the naked eye“).

Vielleicht ist unsere Form identisch mit *Leda bellistriata* Stevens (Girty 1915, S. 122, Taf. 14/1-9) der nordamerikanischen Wewoka-Formation."

Here should be noted that the specimens figured by M. Schawrzbach (1939) lack the characteristic structure of the escutcheon, the keel and the rostral part of *Polidevcia attenuata*. *Phestia (Leda) stilla* as figured by M. Schawrzbach (1939, pl. I, fig. 14) does not correspond to the specific definition and belongs in our opinion to the shorter type of Schawrzbach's "subspecies" *bellicostata*. The above cited Schawrzbach's remark is therefore ungrounded. Furthermore we

pointed out that in our specimens of *Polidevcia* and *Phestia* the surface costation is always indistinct to the naked eye. The last Schwarzbauch's observation seems also to be groundless, as this author does not state that his subspecies has a conspicuous umbonal ridge which is so typical of the American form *Phestia (Leda) bellistriata* Stevens.

Nevertheless, we presume that a number of forms of our collection is conspecific with Schwarzbauch's specimens. Unlike Schwarzbauch, however, we do not consider them related to *Polidevcia sharmani* but place them into the genus *Phestia* as an independent species—*Phestia bellicostata* (Schwarzbauch).

This species was thoroughly studied, biometrically analysed and its diagnosis complemented. Two groups of slightly different forms were ascertained within the limits of the species. Forms of the Petřkovice zone are larger with more acute keel and greater angle  $\gamma$ , forms of the Poruba zone are characterized by a smaller shell, which is evenly vaulted in the posterior part, by a rounded keel distinct only in the apical portion of the valve and by smaller angle  $\gamma$ . These differences, however, are not significant and did not appear so even in the biometrical analyses.

Our specimens of *Phestia bellicostata* suggest to a certain degree the forms which B. I. Chernyshev (1951, p. 10, pl. I, fig. 1-4) designated *Phestia petri* but differ from the latter in a slender shell, less conspicuous umbonal ridge and smaller, more acute beak.

*Distribution.* *Phestia bellicostata* is known from the Ostrava beds of the Upper Silesian Carboniferous—Namurian A (less probably the lower part of the Namurian B), both from the Czech and Polish part of the basin.

*Occurrence.* Our specimens come from the Petřkovice zone of the Ostrava beds, from the Viléma marine band from the mine Urx at Petřkovice, from the Pavel marine band from the mine Stalin II at Hrušov, from the marine bands Nanetta I and Nanetta II from the mine Šverma at Mar. Hory, from the mines Stachanov at Hrušov, Stalin II at Hrušov, Bezruč at Sl. Ostrava, Jiří at Přívoz and from the outcrops near the mine Urx at Petřkovice. The specimens from the Poruba zone come from the Koks marine band from the mine Pionýr at Petřvald and from the Roemer's marine band from the mine Doubrava at Doubrava. In the Polish part of the basin this species is reported by M. Schwarzbauch (1939) from the marine horizons V, VI and VIII of the Ostrava beds.

#### RESULTS OF THE STATISTICAL BIOMETRICAL ANALYSIS OF THE SAMPLES<sup>1</sup>

The whole assemblage of nuculanid pelecypods from the Namurian of the Upper Silesian fore-deep was divided into six samples. As becomes

<sup>1)</sup> All length values in tables I-XLII are  $7X$  enlarged. In tables VII, XIV, XXI, XXVIII, and XLII the  $t_p$  values are computed values of  $t$ , and  $t_t$  values are taken from statistical tables. Values of  $t_p$  proving the statistical significance of the differences of individual samples are in frames.

evident from the preceding part of the present work, these samples correspond to the following species: *Polidevcia attenuata* (Fleming, 1828), *Polidevcia vašičeki nov. spec.*, *Polidevcia gengeli nov. spec.*, *Polidevcia sharmani* (Etheridge, 1878) and *Phestia bellicostata* (Schwarzbach, 1939). The collection of the last species was divided into two samples: sample no. I comprising the specimens from the marine bands Nanetta I and II of the Petřkovice zone of the Ostrava beds, and sample no. II composed of the specimens from Koks and Roemer's marine bands of the Poruba zone of the Ostrava beds. On the basis of these two samples of the collection of one species we studied by means of statistical biometrical methods as to what extent the species under study changed during geological time. The specimens of *Polidevcia čepeki nov. spec.* were not included in the comparative studies because of the small number of well preserved specimen.

#### **Result of the comparison of the samples on the basis of the relation between $v$ and $d$**

Statistical basis for the comparison is involved in the tables I and VI, and the results of the comparison in the table VII. From the diagram on figure 11 it is evident that the relation between  $v$  and  $d$  is rectilinear. The table VII presenting the  $t$ -values shows that *Polidevcia gengeli* and *P. vašičeki* differ distinctly from our specimens of *P. attenuata* in the more elongated outline. From this table it is also evident that both samples of *Phestia bellicostata* differ remarkably from all representatives of the genus *Polidevcia*.

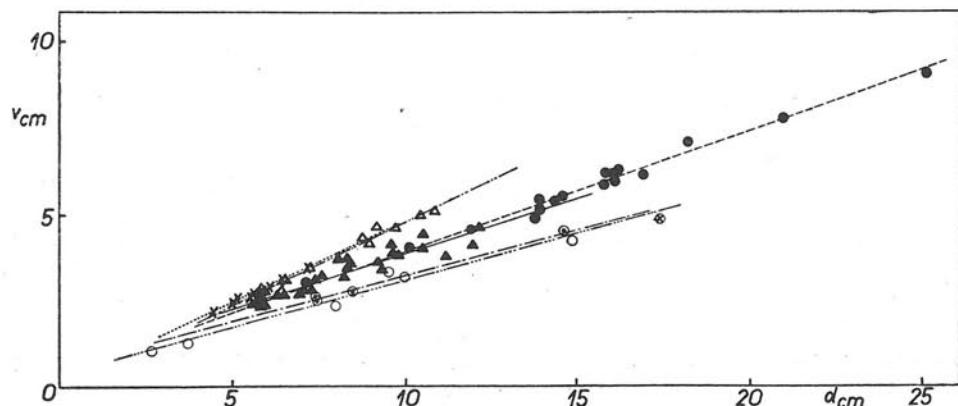


Fig. 11 Diagram of the relation between  $v$  and  $d$  in the studied nuculanid forms (all values  $\times 7$  enlarged) with the regression lines of  $v$  as plotted against  $d$ .  
 ● *Polidevcia attenuata*, ○ *Polidevcia gengeli*, □ *Polidevcia vašičeki*, ○ *Polidevcia čepeki*, ▲ *Polidevcia sharmani*, △ *Phestia bellicostata* — sample I,  
 + *Phestia bellicostata* — sample II. Regression lines: — *Polidevcia attenuata*, - - - *Polidevcia gengeli*, - · - - *Polidevcia vašičeki*,  
 - - - *Polidevcia sharmani*, - - - - *Phestia bellicostata* — sample I,  
 ..... *Phestia bellicostata* — sample II.

On the whole there can be observed that the relation between  $v$  and  $d$  in all studied samples does not vary greatly. This is evident especially from the values of the correlation coefficients of individual samples which vary from 0.90 to 0.99. Consequently, the relation between  $v$  and  $d$  is very close within the assemblage of one species and can be considered an important specific feature. This relation is especially close in the associations which are synchronous and synpatric (e.g. *Phestia bellicostata*—sample II). In these cases the difference between the "typical" specimen (the mean specimen in the statistical sense) and the specimens from the periphery of the variation field is in most cases very small. However, a synchronous assemblage can exceptionally greatly vary in some feature. The closeness of the relation between  $v$  and  $d$  is also evident from the diagram on figure 11. Therefore, in the graphical expression of this relation only one regression line was drawn, the second regression line being nearly coincident with the first.

#### **Result of the comparison of the samples on the basis of the relation between $p_1$ and $p_2$**

The computations of the principal characteristics are involved on the tables VIII-XIII. The resultant  $t$ -values are presented on table XIV. The relation is expressed by a graph on figure 12. The analysis proved that the samples of individual species do not usually differ remarkably in the position of the beak. The sample of *Polidevicia sharmani*, which differs remarkably from the remaining samples in the subcentral position of the beak, is an exception. This division of the whole collection is also evident from the diagram on figure 12, in which the regression lines of *Polidevicia sharmani* distinctly deviate from the regression lines of the remaining samples. From the diagram it will be seen that some specimens of *P. attenuata* have subcentral beaks. It is interesting that these specimens come from the Nanetta marine band, that is, from the same horizon in which also the specimens of *Phestia bellicostata* with subcentral to central beaks are frequent.

On the whole the variability between  $p_1$  and  $p_2$  is greater than that between  $v$  and  $d$  (the correlation coefficient in most cases attaining the value of about 0.80). In one synchronous assemblage this relation is again very close ( $K > 0.99$  in *Polidevicia vašičekii* from the Stur's marine band).

#### **Result of the comparison of the samples on the basis of the relation between $v_1$ and $v_2$**

The results of the study of the relation between  $v_1$  and  $v_2$  are given on tables XV-XX and the results of the comparison of individual samples on table XXI. The relation between  $v_1$  and  $v_2$  is shown on figure 13. The comparison showed that in the relation between  $v_1$  and  $v_2$  only *Polidevicia sharmani* and *Phestia bellicostata* (sample from the Koks marine bands differ from each other. A distinct tendency to  $v_1 > v_2$  appears in the first sample, in the second the opposite is the case. No further deviations

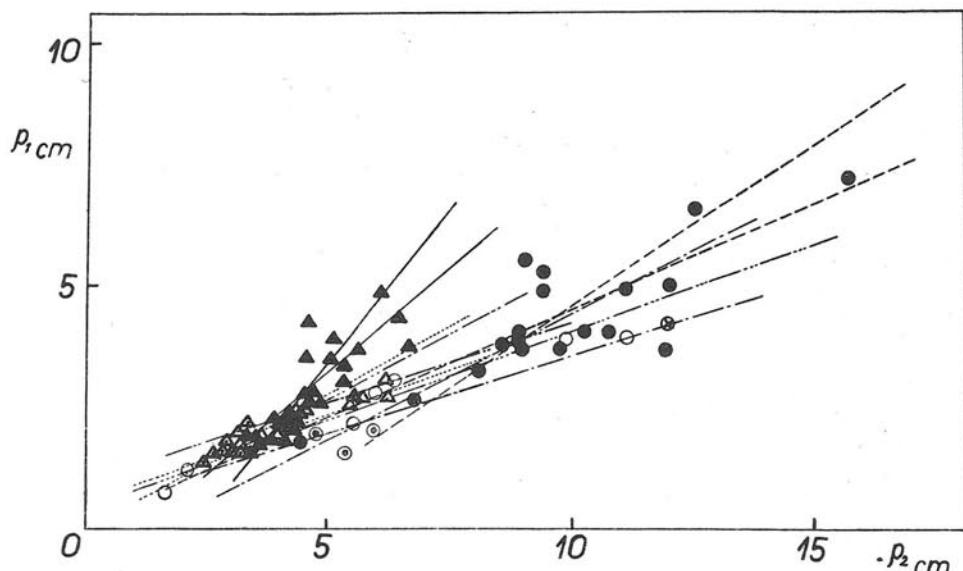


Fig. 12 Diagram of the relation between  $p_1$  and  $p_2$  in 76 studied specimens of the nuculanid pelecypods (all values 7 X enlarged) with the regression lines of  $p_1$  as plotted against  $p_2$ , and of  $p_2$  as plotted against  $p_1$ .  
 ● *Polidevcia attenuata*, ○ *Polidevcia gengeli*, ○ *Polidevcia vašičekii*, ○ *Polidevcia čepeki* ▲ *Polidevcia sharmani*, △ *Phestia bellicostata* — sample I,  
 △ *Phestia bellicostata* — sample II. Regression lines designated as in fig. 11.

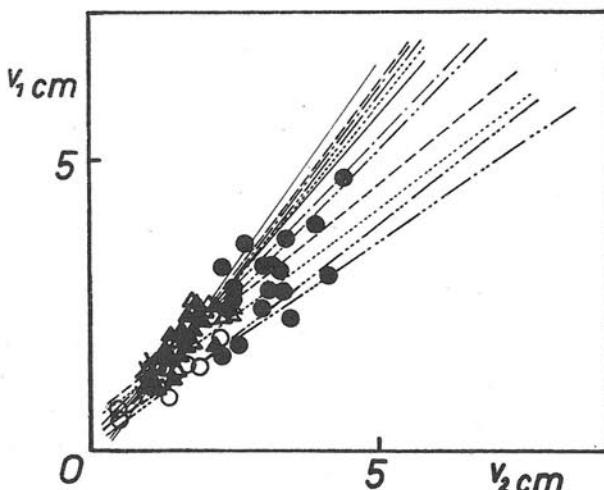


Fig. 13 Graphical representation of the relation between  $v_1$  and  $v_2$  in 76 studied specimens of nuculanid pelecypods (all values 7 X enlarged). In the diagram the regression lines of  $v_1$  as plotted against  $v_2$ , and of  $v_2$  as plotted against  $v_1$  are marked. (All margins as in fig. 11).

in the frequency distribution of the  $v_1/v_2$  ratio occur in our assemblage. On the whole, the relation between  $v_1$  and  $v_2$  is greatly variable, varying to a considerable degree about the value 1, and is consequently not a good distinguishing feature. Like in the case of  $p_1$  and  $p_2$ , the assemblage of *Polidevcia attenuata*, which is a heterochronous and allopatric association, is also strongly variable in the  $v_1:v_2$  relation. However, a certain deviation can be observed in the specimens from the Enna marine bands. In this forms  $v_1 > v_2$ . The tendency of  $v_1 > v_2$  has been observed also in other specimens of *P. attenuata* from Enna marine bands from our collection which were not included in the biometrical studies and in many specimens from Enna marine bands from other collections which we have had the possibility to study.

### Result of the statistical biometrical study of the angle $\alpha$

The results of the study of the angle  $\alpha$  are given on tables XXII-XXVII, the results of the comparison of individual samples according to the angle  $\alpha$  on table XXVIII. Figure 14 represent a histogram of the frequency of the values of the angle  $\alpha$ .

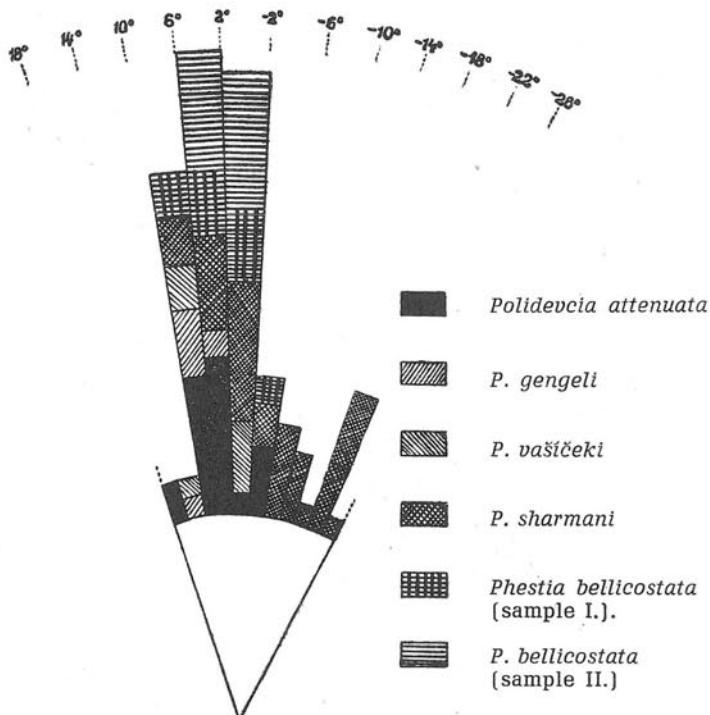


Fig. 14 Histogram of the frequencies distribution of the values of the angle  $\alpha$  in 76 studied nuculanid pelecypods. (A column of 5 mm in the histogram corresponds to one specimen).

The investigation proved that the whole assemblage can be divided on the basis of the angle  $\alpha$  into two parts: one formed by the specimens of *Polidevcia sharmani* with the angle  $\alpha$  prevailingly negative, the other formed by the specimens of the remaining species with a positive angle  $\alpha$  prevailing. A similar situation is shown in the diagram of the figure 14, which has one apex within the interval from -2 to 2 degrees, the other within the interval from -18 to -20 degrees. From this diagram and table XXIV it is evident that the assemblage of *Polidevcia sharmani* is greatly variable according to the angle  $\alpha$  and has two apices of frequency distribution.

Furthermore, a certain difference can be observed in *Polidevcia gengeli*, which shows a tendency to a comparatively large positive angle  $\alpha$ .

When comparing the results of the studies of the angle  $\alpha$  and those of the relation between  $p_1$  and  $p_2$ , we see that the increase of  $p_1/p_2$  ratio is accompanied by the increase of the negative angle  $\alpha$  and, on the contrary, the decrease of the mentioned ratio is accompanied by the increase of the positive angle  $\alpha$ . This is especially evident in *P. sharmani* and *P. gengeli* which both have extreme values in the  $p_1/p_2$  ratio and angle  $\alpha$  as well.

### **Result of the statistical biometrical study of the angle $\beta$**

The results of the study of the angle  $\beta$  are given on tables XXIX to XXXIV, the results of the comparison of individual samples on the basis of the angle  $\beta$  on table XXXV. Figure 15 shows the histogram of the frequencies of the values of the angle  $\beta$ .

The values  $t$  on plate XXV show that the size of angle  $\beta$  is a good distinguishing feature among the majority of species of nuculanid pelecypods of our collection. The differences are especially distinct between the samples of the single species of *Phestia* and those of *Polidevcia*. The frequency distribution on figure 15 has evidently two apices: one corresponding to the members of *Phestia* (22-24 degrees), other belonging to the members of *Polidevcia* (18-20 degrees). However, the comparatively small variability of the angle  $\beta$  enables even specific distinguishing.

From the table XXIX it is evident that specimens of *P. attenuata* from Enna marine bands have the lowest values of the angle  $\beta$  of all specimens of this species. This is due to the form of the posterior part of the shell which is typical of the mentioned species from the Enna horizon. This appears, as mentioned above, in the  $v_1/v_2$  ratio as well.

### **Result of the statistical biometrical study of the angle $\gamma$**

The results of the angle  $\gamma$  are given on tables XXXVI-XLI, the results of the comparison of individual samples on the basis of the angle  $\gamma$  on table XLII. Figure 16 shows the histogram of frequencies of the values of the angle  $\gamma$ .

The values of the angle  $\gamma$  show, unlike the remaining angular features, a comparatively great variability. Also within the samples of single

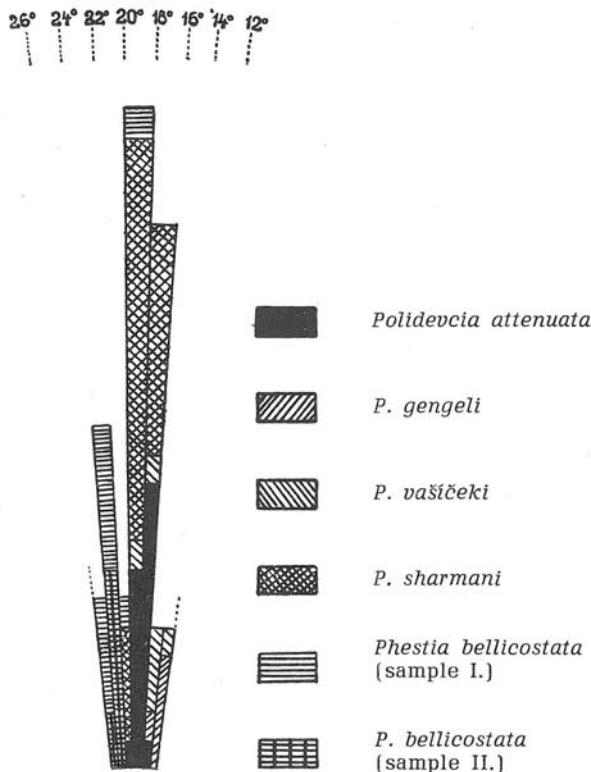


Fig. 15 Histogram of the frequencies distribution of the values of the angle  $\beta$  in 76 studied nuculanid forms. (A column of 5 mm in the histogram corresponds to one specimen).

species the variability boundaries are considerably large. This is undoubtedly due, to a certain extent, to the different mode of fossilization. The apical angle  $\gamma$  depends the most of all morphological features on the mode of fossilization. The size of the apical angle can vary even in one specimen according to whether it is preserved as a sculptural mold, internal mold or with the shell proper preserved. In the sculptural molds the size of the apical angle may vary according to which level of the shell matter has been fossilized.

Nevertheless, with a great number of differently preserved specimens this error of the arithmetic mean decreases to a minimum. The computed boundaries of the variability of the angle  $\alpha$  in individual samples, however, are to be taken with precaution, as they are fully affected by the errors due to the unequal fossilization.

However, from the table XLII it is evident that the values of the angle  $\gamma$  are significantly different in the samples of single species of our collection. This can be seen also from the diagram on figure 16, which has three apices. This diagram and the table XLII as well show that the whole collection can be divided according to the value of the

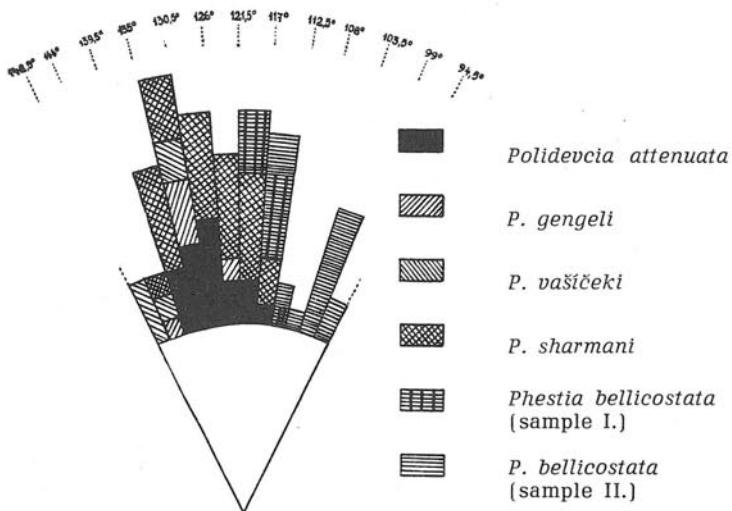


Fig. 16 Histogram of the frequencies distribution of the values of the angle  $\gamma$  in 76 studied specimens of nuculanid forms. (A column of 5 mm in the histogram corresponds to one specimen).

apical angle into three parts: the first maximum limit of the variation field is formed by the specimens of *Polidevcia vašičekii*, in which the values of the angle  $\gamma$  vary around 140 degrees and attain up to 148 degrees. The second maximum limit is formed by *Phestia bellicostata*, in which the size of the angle  $\gamma$  is about 150 degrees in forms from the Poruba zone and about 115 degrees in forms from Petřkovice zone. (This difference is partly due to the different mode of fossilization. Specimens from the Poruba zone have the shell matter preserved, while those from the Petřkovice zone are sculptural molds.) The third part of the variation field is formed by specimens of *Polidevcia attenuata*, *P. sharmani* and *P. gengeli*, in which the size of the angle  $\gamma$  varies about 130 degrees.

#### **Conclusion and methodical remarks.**

The statistical biometrical methods have proved a significant differentiation of the samples of single species at least on the basis of two morphological features. The variability changes are interesting. Synchronous assemblages usually show little variability. On the contrary, heterochronous associations are much more variable. Especially *Polidevcia attenuata* shows a great variability. It appears that the changes of one feature in the same species may be typical of some horizon (in our case e.g. *Polidevcia attenuata* from Enna marine bands).

Statistical biometrical studies carried on by means of mathematical analysis are undoubtedly rather laborious for applied paleontology. However, a paleontologist working in a basin should consistently use at least graphical methods of study of the morphology of fossils, which demand

less time and are sufficiently exact for practical purposes. Use of these methods (graphical illustration of morphological features, which correlate with each other, in a correlation field, use of diagrams of the distribution of frequencies of single features etc.) will bring about the explication of the dependence of variability on individual horizons and will help to clear up the facial development of fossil basins.

#### SIGNIFICANCE OF NUCULANID PELECYPODS FOR THE STRATIGRAPHY OF NAMURIAN OF THE UPPER SILESIAN FORE-DEEP

The biostratigraphical evaluation of the most abundant marine faunal group of the Namurian—taxodont pelecypods of the Czechoslovak part of the Upper Silesian basin is lacking. The existing opinion of the application of the pelecypod fauna for a more detailed stratigraphical division of the Ostrava beds are mainly skeptical. V. Šusta (1928) believes that the fauna of the so called "marine bands" of the Ostrava beds is on the whole homogenous and, therefore, it is impossible to distinguish these horizons on the basis of faunal analysis. This author reached the conclusion that only the thickness of these horizons can in some cases serve as a reliable means of identification.

M. Schwarzbach (1939) first pointed out that this opinion is untenable. He presented a stratigraphical scheme of the occurrence of taxodont pelecypods in single horizons with marine fauna on the basis of the material of the Polish part of the basin. This author quite correctly observes the frequency of taxodont pelecypods in individual horizons as well as the changes in size of their shells, basing on the opinion that the assemblages of taxodont pelecypods react quickly on every environmental change.

From our studies it becomes evident that the morphological changes of shells in geological time in our assemblages may be useful for distinguishing individual horizons containing marine fauna. Owing to the close dependence of the evolution of these assemblages on the environmental factors it is obvious that conclusions drawn in one part of the basin need not be valid for a different facial development in other parts.

*Polidevcia attenuata* is known from both marine bands Nanetta of the mines Stalin, Šverma and Bezruč, and from the outcrops near the mine Urx at Petřkovice, from the Františka marine band from the mines Stalin II and Beruč and from the Bores Staříč NP 133 and NP 123, from the third Enna marine band from the mines Zárubek and Cingr and from undesignated Enna marine bands from the mines Václav, Alexander and Jeremenko and from the bore Staříč 133, from the third Barbora marine band from the mine Václav, from an undesignated Barbora marine band from the mine Fučík II and from the Gabriela marine band. An especially interesting development of the assemblages of this species is that of the Nanetta marine bands and of the third Enna marine band. The specimens of *Polidevcia attenuata* of the Nanetta marine bands usually have the posterior line sloping conspicuously upwards, the angle  $\beta$  attaining up to 20 degrees (in average 18.5 degrees in our sample). Furthermore,

some of the forms of these marine bands have the beaks situated nearer to the middle like the majority of specimens of *Polidevcia sharmani* (Etheridge, 1878). This is especially evident in the form no. 91 from the mine Jiří, which is morphologically rather similar to the majority of specimens of *P. sharmani* known from the marine bands Nanetta I and Nanetta II. In this specimen the point of maximum convexity lies in the portion of the valve between the beak and the anterior extreme point. The beak is nearer to the middle—at about the forth tenth of the valve length from the anterior extreme point. On the whole the assemblage of *Polidevcia attenuata* is considerably variable in the marine bands Nanetta I and II, so that forms with subcentral umbos are present together with forms with anterior umbos. Specimens of *Polidevcia attenuata* with subcentral beaks are not known from other horizons with marine fauna.

A characteristic assemblage of this species is known from the third Enna marine band. Its specimens are identical with those of the un-designated marine bands of the Enna seam from the Ostrava District. The majority of forms which we are able to study prove that in the Enna marine bands the specimens with the posterior part of the valve less sloping upwards (the angle  $\beta$  attaining the size of about 16,5 degrees) predominate. Furthermore, the specimens of *P. attenuata* of the Enna marine bands are characterized by the connecting line of the anterior and posterior extreme point intersecting the valve height more or less below its middle.

As to the frequency of *Polidevcia attenuata*, two maxima of occurrence can be observed: marine bands Nanetta I and II (7 specimens in our sample) and the third Enna marine band (8 specimens). In the Františka and Barbora marine bands their occurrence decreases. An interesting development appears here in comparison with the marine bands Nanetta and Enna. In these marine bands *P. attenuata* occurs isolated while in the Františka marine band of the mine Urš and Barbora marine band of the mine Václav it is found together with other groups of invertebrate fossils. In these layers carbonized plant rests of relatively great size also often occur. The accumulation of the faunal shells is in places so great that the rock appears to have a pseudolumachellous character. This is evidently due to redeposition and assemblages found here are consequently pseudoassociations. The agitated sedimentation conditions were probably the cause of the smaller frequency of *P. attenuata* in these marine bands.

The size of shells of *P. attenuata* decreases gradually from the Nanetta marine band to the Barbora marine band. Only one representative of this species is known from the Gabriela marine band of the mine Evžen. With this marine band the occurrence of *P. attenuata* in the Ostrava part of the basin seems to finish.

*Polidevcia čepeki nov. spec.* seems to be limited only on the Bohdan marine band of the Petřkovice beds. Specimens of our collection come from the mines Urš and Lidice at Petřkovice.\*)

\*]) One uncertain specimen is known from the Enna II marine band from the mine Alexandr at Kunčičky.

*Polidevcia gengeli nov. spec.* as well as *P. attenuata* pass from the Nanetta marine band to Gaebler's marine bands. Unlike *P. čepeki*, however, it is notably less abundant. It appears to be more frequent only in Roemer's marine bands where specimens typical especially by the absence of keel, the uniformly vaulted posterior part of the valve with a slight depression near the posterior margin, and by considerably distant beaks are found. The changes in size of shells are interesting. In the marine bands Nanetta II, Koks and Roemer's marine band specimens of the length of about 1 cm. are known. In the Enna marine band the shells attain the length of more than 2 cm. *Polidevcia gengeli* like *P. attenuata* attains evidently the maximum size in the Enna marine bands.

*Polidevcia vašíčeki nov. spec.* occurs only in the lowermost horizons of the Petřkovice zone. It is very abundant especially in the Stur's marine band from the bores at Staříč. It rarely occurs also in the Bohdan marine band of the mine Lídice. It is interesting that unlike the rest of nuculanid pelecypods *P. vašíčeki* is found mostly in the sandy or strongly sandy shales. In this case the specimens have an extremely produced and narrow posterior part of the valve. The specimens of the Bohdan marine band are posteriorly less produced, their rostrum is shorter and the undulation of the ribs is less distinct. They are found in a more clayey material with a smaller sandy fraction.

*Polidevcia sharmani* (Etheridge, 1878) is known only from the Petřkovice zone of the Ostrava beds, where it begins with the Bohdan marine band and ends with the marine band Nanetta II. It is especially abundant in the marine bands Nanetta I and II in which it is often predominant. With these horizons, however, its occurrence abruptly ends. In the stratigraphically higher horizons it has not been ascertained.

*Phestia bellicostata* (Schwarzbauch, 1939) is known to be abundant in the Petřkovice zone where it ranges similarly as *P. sharmani* from the Vilém marine band to the marine bands Nanetta I and II. Here its occurrence reaches the maximum. In the Františka marine band the specimens of *Phestia bellicostata* decrease in number but increase in size—their length is more than 20 mm. In the Ostrava part of the basin the occurrence of this species ends with the last mentioned marine band. It was also ascertained in the upper horizons of the Poruba zone in the Koks marine band, where it is again abundant, and in Roemer's marine bands. After having seen some new samples from the new fields of the southern (Staříč) part of the basin we can state that the stratigraphical position of *Phestia bellicostata* is here different from that of the Ostrava part of the basin. The species is here found even in horizons in which it has not been ascertained in the Ostrava part of the basin (e.g. in the Enna marine band). This is evidently due to the different facial development of this part of the basin. [Schwarzbauch [1939] indicates the maximum occurrence of his subspecies *Leda sharmani bellicostata* in the upper part of the Poruba zone.]

On the whole, in the entire assemblage of nuculanid pelecypods from the Ostrava beds a certain regularity in the course of their development in geological time can be observed. In the forms of Petřkovice zone the keel is prominent to extremely acute (e.g. *Polidevcia čepeki nov. spec.*).

On the contrary, in the stratigraphically younger forms (*Polidevcia gengeli* from the higher part of the Poruba zone and *Phestia bellicostata* from the same horizons) the keel is almost lacking and the posterior part of the shells is evenly vaulted. Besides, a gradual decrease in size of the shells during the sedimentation of the Ostrava beds can be observed.

An interesting break in the development of nuculanid pelecypods in the Ostrava beds took place on the boundary between the Petřkovice and Hrušov zone. In this period, as far as we could ascertain, *Polidevcia sharmani* disappears completely and a sudden reduction in number or temporary disappearing of *Phestia bellicostata* comes about. The forms of the Petřkovice zone differ in several features from those of the upper parts of the Poruba zone. They are distinctly larger, apical angle attains the size of about 115 degrees, keel ranges from distinct to acute. On the contrary the specimens from the upper parts of the Poruba zone are very small (length about 0.75 cm., apical angle only slightly exceeding 90 degrees), and their posterior part is more evenly vaulted, without a distinct keel.

The first horizon with rich marine fauna above this boundary—Františka marine band—has a special, from other horizons slightly different association of taxodont pelecypods which will be dealt with in a special work.

Also an interesting change of fossilization can be observed on the boundary of the Petřkovice and Hrušov zone. Fauna of the Petřkovice zone is predominantly preserved as sculptural molds. Exception is made only by the forms of the Bohdan marine band, which have preserved the shell matter. Starting from the Františka marine band the fauna of our collection has the shell matter more or less altered. In Roemer's marine band the filling of the shells is often pyritized. As was already mentioned, in the Františka and Barbora marine bands the fauna is in contrast to other horizons often redeposited and accumulated in pseudolumachellas.

Finally we point out that the assemblages of taxodont pelecypods are not a constant component of the marine fauna of the Ostrava beds. A complete stratigraphical scheme of the species under study cannot be given owing to the small number of specimens. Our remarks concerning their stratigraphical value are therefore only preliminar. It appears, however, that in certain marine bands assemblages of a certain species are either predominant (*Polidevcia sharmani* in the Nanetta marine bands, *Phestia bellicostata* in the Koks marine band) or have a special development typical of these horizons. Some assemblages seem even to be limited only to one or two horizons (*Polidevcia vašíčekii* and *Polidevcia čepeki*).

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## EXPLANATIONS OF PLATES

### Plate I:

- Fig. 1 — *Polidevcia attenuata* (Fleming, 1828), studied type no. 118, mine Stalin II, Nanetta marine band. X 1,9  
Fig. 2 — *Polidevcia attenuata* (Fleming, 1828), studied type no. 589, bore NP 210, depth 636 m, Františka marine band. X 4,2  
Fig. 3 — *Polidevcia attenuata* (Fleming, 1828), studied type no. 590, bore Starič NP 184. X 2,6  
Fig. 4 — *Polidevcia attenuata* (Fleming, 1828), studied type no. 126, mine Václav, Enna marine band. X 2,1  
Fig. 5 — *Polidevcia attenuata* (Fleming, 1828), studied type no. 577, bore Paskov NP 154, Františka marine band. X 2,4  
Fig. 6 — *Polidevcia attenuata* (Fleming, 1828), studied type no. 71, mine Šverma, Nanetta marine band. X 2,4  
Fig. 7 — *Polidevcia attenuata* (Fleming, 1828), studied type no. 565, bore NP 213, depth 448 m, Enna marine band. X 2,4  
Fig. 8 — *Polidevcia attenuata* (Fleming, 1828), studied type no. 91, mine Jiří, Nanetta marine band. X 2  
Fig. 9 — *Polidevcia attenuata* (Fleming, 1828), studied type no. 1131, mine Zárubek, Enna marine band. X 1,9  
Fig. 10 — *Polidevcia attenuata* (Fleming, 1828), studied type no. 129, mine Šverma Nanetta marine band. X 1,8

### Plate II:

- Fig. 1 — *Polidevcia attenuata* (Fleming, 1828), studied type no. 11, bore Ostrava NP 133, Františka marine band. X 2,6  
Fig. 2 — *Polidevcia attenuata* (Fleming, 1828), studied type no. 579, bore NP 414, depth 1006 m, Františka marine band. X 2,4  
Fig. 3 — *Polidevcia attenuata* (Fleming, 1828), studied type no. 111, outcrops near the mine Urx, Nanetta marine band. X 1,8  
Fig. 4 — *Polidevcia attenuata* (Fleming, 1828), studied type no. 137, mine P. Cingr, Enna II marine band. X 1,9  
Fig. 5 — *Polidevcia attenuata* (Fleming, 1828), studied type no. 140, mine Jermenko, Enna marine band. X 2  
Fig. 6 — *Polidevcia attenuata* (Fleming, 1828), studied type no. 137 mine P. Cingr, Enna II marine band. Dorsal view of the specimen figured on fig. 4. X 2  
Fig. 7 — *Polidevcia čepeki nov. spec.*, studied type no. 170, mine Urx, Bohdan marine band. Holotype. X 2  
Fig. 8 — *Polidevcia čepeki nov. spec.*, studied type no. 69, mine Urx, Bohdan marine band. X 2  
Fig. 9 — *Polidevcia cf. čepeki nov. spec.*, studied type no. 29, mine Alexandr, Enna II marine band. X 2,5  
Fig. 10 — *Polidevcia gengeli nov. spec.*, studied type no. 16, mine Šverma, Nanetta II marine band. X 3  
Fig. 11 — *Polidevcia gengeli nov. spec.*, studied type no. 134, mine P. Cingr, Enna IV marine band. X 2,3  
Fig. 12 — *Polidevcia gengeli nov. spec.*, studied type no. 98, mine Doubrava, Roemer's marine band. Holotype. X 2,9

### Plate III:

- Fig. 1 — *Polidevcia sharmani* (Etheridge, 1878), studied type no. 85, outcrops near the mine Urx, Nanetta II marine band. X 2,9  
Fig. 2 — *Polidevcia sharmani* (Etheridge, 1878), studied type no. 162, mine Šverma, Nanetta marine band. X 2,9  
Fig. 3 — *Polidevcia sharmani* (Etheridge, 1878), studied type no. 161, mine Šverma, Nanetta marine band. X 2,9

- Fig. 4 — *Polidevcia sharmani* (Etheridge, 1878), studied type no. 150 bore Zábřeh NP 92, Nanetta marine band. X 3  
 Fig. 5 — *Polidevcia sharmani* (Etheridge, 1878), studied type no. 90, outcrops near the mine Urx, Nanetta marine band. X 2,6  
 Fig. 6 — *Polidevcia sharmani* (Etheridge, 1878), studied type no. 70, mine Jiří, Nanetta II marine band. X 2,7  
 Fig. 7 — *Polidevcia sharmani* (Etheridge, 1878), studied type no. 133, mine Šverma, Nanetta II marine band. X 2,7  
 Fig. 8 — *Polidevcia sharmani* (Etheridge, 1878), studied type no. 131, mine Šverma, Nanetta II marine band. X 2,6  
 Fig. 9 — *Polidevci sharmani* (Etheridge, 1878), studied type no. 124, mine Stalin II, Nanetta I marine band. X 2,6  
 Fig. 10 — *Polidevcia sharmani* (Etheridge, 1878) studied type no. 130, mine Šverma, Nanetta II marine band. X 2,7  
 Fig. 11 — *Polidevcia sharmani* (Etheridge, 1878), studied type no. 171, mine Šverma, Nanetta II marine band. X 2,5  
 Fig. 12 — *Polidevcia sharmani* (Etheridge, 1878), studied type no. 4, mine Jindřich, Nanetta marine band. X 2,9  
 Fig. 13 — *Polidevcia sharmani* (Etheridge, 1878), studied type no. 67, mine Šverma, Nanetta II marine band. X 2,6  
 Fig. 14 — *Polidevcia sharmani* (Etheridge, 1878), studied type no. 138, mine Šverma, Nanetta II marine band. X 2,7  
 Fig. 15 — *Polidevcia sharmani* (Etheridge, 1878), studied type no. 139, mine Šverma, Nanetta marine band. X 2,6  
 Fig. 16 — *Polidevcia sharmani* (Etheridge, 1878), studied type no. 120, mine Stalin II, Nanetta I marine band. X 2,6  
 Fig. 17 — *Polidevcia sharmani* (Etheridge, 1878), studied type no. 160, Jestřábí, Bilovec beds. X 2,7  
 Fig. 18 — *Polidevcia sharmani* (Etheridge, 1878), studied type no. 35, mine Lidice, Bohdan marine band. X 2,9  
 Fig. 20 — *Polidevcia sharmani* (Etheridge, 1878), studied type no. 23, mine Šverma, Nanetta marine band. X 2,6  
 Fig. 21 — *Polidevcia sharmani* (Etheridge, 1878), studied type no. 76, mine Urx, Nanetta marine band. X 2,6

#### Plate IV:

- Fig. 1 — *Polidevcia vašíčekii nov. spec.*, studied type no. 142a, bore Staříč NP 178, Stur's marine band. X 2,9  
 Fig. 2 — *Polidevcia vašíčekii nov. spec.*, studied type no. 142b, bore Staříč NP 178, Stur's marine band. Holotype. X 2,7  
 Fig. 3 — *Polidevcia vašíčekii nov. spec.*, studied type no. 10, bore Staříč NP 178, Stur's marine band. X 3  
 Fig. 4 — *Polidevcia vašíčekii nov. spec.*, studied type no. 145, bore Staříč NP 181, Stur's marine band. X 2,7  
 Fig. 5 — *Polidevcia vašíčekii nov. spec.*, studied type no. 147, bore Staříč NP 100, Stur's marine band. X 3  
 Fig. 6 — *Polidevcia vašíčekii nov. spec.*, studied type no. 144, bore Staříč NP 184, Stur's marine band. X 3,1  
 Fig. 7 — *Polidevcia vašíčekii nov. spec.*, studied type no. 591, bore Staříč NP 184, Stur's marine band. X 2,6  
 Fig. 8 — *Polidevcia vašíčekii nov. spec.*, studied type no. 143, bore Staříč NP 184, Stur's marine band. X 3,1  
 Fig. 9 — *Phestia bellicostata* (Schwarzbach, 1939), studied type no. 9, mine P. Bezruč, Nanetta marine band. X 2,9  
 Fig. 10 — *Phestia bellicostata* (Schwarzbach, 1939), studied type no. 65, mine Pionýr, Koks marine band. X 2,5  
 Fig. 11 — *Phestia bellicostata* (Schwarzbach, 1939), studied type no. 156, mine Šverma, Nanetta marine band. X 2,8  
 Fig. 12 — *Phestia bellicostata* (Schwarzbach, 1939), studied type no. 94, mine Jiří, Nanetta marine band. X 2,7

- Fig. 13 — *Phestia bellicostata* (Schwarzbach, 1939), studied type no. 77, mine Pionýr, Koks marine band. X 2,8
- Fig. 14 — *Phestia bellicostata* (Schwarzbach, 1939) studied type no. 104, mine Koks marine band. X 3,4
- Fig. 15 — *Phestia bellicostata* (Schwarzbach, 1939), studied type no. 74, mine Pionýr, Koks marine band. X 3,4
- Fig. 16 — *Phestia bellicostata* (Schwarzbach, 1939), studied type no. 74, dorsal view. X 3,3
- Fig. 17 — *Phestia bellicostata* (Schwarzbach, 1939), studied type no. 104, mine Pionýr, Koks marine band, dorsal view of the specimen figured on fig. 14. X 3,4
- Fig. 18 — *Phestia bellicostata* (Schwarzbach, 1939), studied type no. 114, outcrops near the mine Urx, Nanetta marine band. X 2,8
- Fig. 19 — *Phestia bellicostata* (Schwarzbach, 1939), studied type no. 63, mine Pionýr, Koks marine band. X 2,7
- Fig. 20 — *Phestia bellicostata* (Schwarzbach, 1939), studied type no. 78, mine Pionýr, Koks marine band. X 2,7

TABLE I

Calculation of the correlation coefficient and of the regression coefficients of the relationship between  $v$  and  $d$  in *Polidevicia attenuata* [Fleming, 1828].

$n$	Stud. type No	$d$	$v$	$\xi d$	$\eta v$	$\xi \cdot \eta$	$\xi^2$	$\eta^2$	Faunal band
1	18P	14,20	5,30	-1,04	-0,48	0,50	1,0733	0,234	Nanetta II
2	26L	13,60	4,80	-1,64	-0,98	1,61	2,6765	0,9004	Františka
3	36P	15,80	6,15	0,56	0,36	0,20	0,3181	0,1296	Františka
4	55L	16,00	6,30	0,76	0,51	0,39	0,5837	0,2601	Enna
5	59L	11,75	4,50	-3,49	-1,28	4,48	12,1522	1,6384	Barbora
6	68P	20,70	7,80	5,46	2,01	11,00	29,8593	4,0401	Gabriela
7	71P	17,05	6,20	1,81	0,41	0,75	3,2906	0,1681	Nanetta
8	91P	15,55	5,85	0,31	0,06	0,20	0,0986	0,0036	Nanetta
9	93P	15,60	6,20	0,36	0,42	0,15	0,1325	0,1681	Nanetta
10	96L	10,00	4,00	-5,23	-1,78	9,35	27,4157	3,1684	Barbora III
11	111P	17,95	7,10	2,71	1,31	3,56	7,3657	1,7161	Nanetta
12	118P	24,80	9,10	9,36	3,31	31,69	91,4701	10,9561	Nanetta I
13	128L	16,65	5,75	1,41	-0,03	-0,05	1,9994	0,0009	Enna III
14	129L	15,85	5,95	0,61	0,16	0,10	0,3770	0,0256	Nanetta II
15	136L	13,70	5,10	-1,53	-0,68	1,05	2,3593	0,4624	Enna III
16	140P	7,00	3,05	-8,23	-2,73	22,53	67,8316	7,4529	Enna
17	155L	14,40	5,50	-0,83	-0,28	0,23	0,6989	0,0784	Františka
18	141L	13,70	5,50	-1,53	-0,28	0,44	2,3593	0,0784	Františka
$\Sigma =$		274,35	104,15			88,20	252,0578	31,5380	
$\frac{\Sigma}{n} =$		15,24	5,78				14,0032	1,75	
$\sigma_d = 3,75$					$\sigma_v = 1,32$				
$K_{dv} = 0,99$									
$b_{dv} = 2,81$									
$b_{vd} = 0,35$									

TABLE II

Calculation of correlation coefficient and of the regression coefficients of the relationship between  $v$  and  $d$  in *Polidevcia gengeli nov. spec.*

$n$	Stud. type No	$d$	$v$	$\xi d$	$\eta v$	$\xi \cdot \eta$	$\xi^2$	$\eta^2$	Faunal band
1	61L	7,25	2,55	-1,55	-0,37	0,5735	2,4035	0,1369	Roemer's
2	89L	6,70	2,55	-2,10	-0,37	0,7770	4,4100	0,1369	Koks
3	97P	8,35	2,65	-0,45	-0,27	0,1215	0,2025	0,0728	Nanetta II
4	98P	7,30	2,40	-1,50	-0,52	0,7800	2,2500	0,2704	Roemer's
5	134L	14,40	4,45	5,60	1,53	8,5680	31,3600	2,3409	Enna IV
$\Sigma =$		44,00	14,60			10,8200	40,6250	2,9580	
$\frac{\Sigma}{n} =$		8,80	2,92				8,12	0,59	

TABLE III

Calculation of the correlation coefficient and of the regression coefficients of the relationship between  $v$  and  $d$  in *Polidevcia vašičekii nov. spec.*

$n$	Stud. type No	$d$	$v$	$\xi d$	$l_v$	$\xi \cdot \eta$	$\xi^2$	$\eta^2$	Faunal band
1	142L	14,60	4,15	6,67	1,62	10,8054	44,4889	2,6244	Štúr's
2	143L	3,60	1,25	-4,33	-1,28	5,5424	18,7489	1,6384	Štúr's
3	144L	9,80	3,15	1,87	0,62	1,1594	3,4969	0,3844	Štúr's
4	145P	7,80	2,30	-0,13	-0,23	0,0299	0,0169	0,0529	Štúr's
5	146P	2,55	1,05	-5,38	-1,48	7,9624	28,9444	2,1904	Štúr's
6	159P	9,25	3,30	1,32	0,77	1,0164	1,7424	0,5929	Štúr's
	$\Sigma =$	47,60	15,20	-0,02	+0,02	26,5159	97,4384	7,4834	
	$\frac{\Sigma}{n} =$	7,93	2,53				16,24	1,25	

$$\sigma_d = 4,03$$

$$\sigma_v = 1,12$$

$$K_{dv} = 0,98$$

$$b_{vd} = 0,27$$

$$b_{dv} = 3,52$$

TABLE IV

Calculation of the correlation coefficient and of the regression coefficients of the relationship between  $v$  and  $d$  in *Polidevicia sharmani* (R. Etheridge jun., 1878).

$n$	Stud. type No	$d$	$v$	$\xi d$	$\eta v$	$\xi \cdot \eta$	$\xi^2$	$\eta^2$	Faunal band
1	2L	6,75	2,60	-1,62	-0,74	1,20	2,6244	0,5476	Nanetta
2	3P	6,95	2,70	-1,42	-0,64	0,91	2,0164	0,4096	Nanetta
3	4L	6,30	2,65	-2,07	-0,69	1,43	4,2849	0,4761	Nanetta
4	21L	5,85	2,30	-2,52	-1,04	2,62	6,3504	1,0816	Nanetta
5	23P	7,15	2,70	-1,22	-0,64	0,78	1,4984	0,4096	Nanetta
6	67P	7,25	3,10	-1,12	-0,24	0,27	1,2544	0,0576	Nanetta II
7	70L	8,15	3,65	0,22	0,31	-0,07	0,0484	0,0961	Nanetta II
8	80P	8,10	3,10	-0,27	-0,24	0,06	0,0789	0,0576	Nanetta II
9	81L	7,30	3,15	-1,07	-0,19	0,20	1,1449	0,0361	Nanetta II
10	85P	10,35	4,40	1,98	1,06	2,10	3,9204	1,1236	Nanetta II
11	88P	6,40	2,60	-1,97	-0,74	1,46	3,8809	0,5476	Nanetta II
12	90P	9,50	3,80	1,13	0,46	0,52	1,2769	0,2116	Nanetta
13	101P	5,55	2,40	-2,82	-0,94	2,65	7,9524	0,8836	Nanetta II
14	109L	7,90	3,70	-0,47	0,36	-0,17	0,2209	0,1296	Nanetta II
15	117P	9,45	4,15	1,08	0,81	0,87	1,1664	0,6561	Nanetta
16	120L	11,90	4,60	3,53	1,26	4,45	12,4609	1,5876	Nanetta I
17	124L	9,10	3,60	0,73	0,26	0,19	0,5329	0,0676	Nanetta I
18	130L	8,20	3,45	-0,17	0,11	-0,02	0,0289	0,0121	Nanetta II
19	131P	9,40	3,40	1,03	0,06	0,06	1,0609	0,0036	Nanetta II
20	132P	5,80	2,30	-2,57	-1,04	2,67	6,6049	1,0816	Nanetta II
21	133L	9,20	3,90	0,83	0,56	0,46	0,6889	0,3136	Nanetta II
22	138P	10,35	4,00	1,98	0,66	1,31	3,9204	0,4356	Nanetta II
23	139P	8,25	3,55	-0,12	0,21	-0,03	0,0144	0,0441	Nanetta II
24	148P	11,80	4,05	3,43	0,71	2,44	11,7649	0,5041	Nanetta
25	149L	9,55	3,25	1,18	-0,09	-0,11	1,3924	0,0082	Nanetta
26	150P	11,00	3,75	2,63	0,41	1,08	6,9169	0,1681	Nanetta
$\Sigma =$		217,50	86,85			27,33	83,0954	10,9502	
$\frac{\Sigma}{n} =$		8,37	3,34			3,20	0,42		
$\sigma_d = 1,79$					$\sigma_v = 0,65$				
$K_{dv} = 0,90$					$b_{dv} = 2,48$				
$b_{vd} = 0,33$									

TABLE V

Calculation of the correlation coefficient and of the regression coefficients of the relationship between  $v$  and  $d$  in *Phestia bellicostata* (Schwarzbach, 1939) — sample I.

$n$	Stud. type No	$d$	$v$	$\xi d$	$\eta v$	$\xi \cdot \eta$	$\xi^2$	$\eta^2$	Faunal band
1	9L	8,80	4,10	0,47	0,09	0,0423	0,2209	0,0081	Nanetta
2	15P	5,80	2,70	-2,53	-1,31	3,3143	6,4009	1,7161	Františka
3	43L	9,55	4,60	1,22	0,59	0,7198	1,4884	0,3481	Nanetta
4	45L	10,25	4,90	1,92	0,89	1,7088	3,6864	0,7921	Nanetta II
5	73L	10,65	5,00	2,32	0,99	2,2968	5,3824	0,9801	Nanetta
6	94P	6,45	3,05	-1,88	-0,96	1,8048	3,5344	0,9216	Nanetta
7	114L	5,75	2,85	-2,58	-1,16	2,9928	6,6564	1,3456	Nanetta II
8	156L	9,10	4,60	0,77	0,59	0,4543	0,5929	0,3481	Nanetta
9	158L	8,60	4,30	0,27	0,29	0,0783	0,0729	0,0841	Nanetta
$\Sigma =$		74,95	36,10			13,4122	28,0356	6,5439	
$\frac{\Sigma}{n} =$		8,33					3,12	0,73	
$\sigma_d = 1,76$					$\sigma_v = 0,85$				
$K_{dv} = 0,99$					$b_{dv} = 2,05$				
$b_{vd} = 0,48$									

TABLE VI

Calculation of the correlation coefficient and of the regression coefficients of the relationship between  $v$  and  $d$  in *Phestia bellicostata* (Schwarzbach, 1939) — sample II.

$n$	Stud. type No	$d$	$v$	$\xi d$	$\eta v$	$\xi \cdot \eta$	$\xi^2$	$\eta^2$	Faunal band
1	63L	5,05	2,50	-0,64	-0,19	0,1216	0,4096	0,0361	Koks
2	65P	6,35	3,10	0,66	0,41	0,2706	0,4356	0,1681	Koks
3	72P	4,40	2,15	-1,29	-0,54	0,6966	1,6641	0,2916	Koks
4	74L	6,00	2,85	0,31	0,16	0,0496	0,0961	0,0256	Koks
5	77P	7,10	3,40	1,41	0,71	1,0011	1,9881	0,5041	Koks
6	78P	5,80	2,60	0,11	-0,79	-0,0099	0,0121	0,0081	Koks
7	84L	5,50	2,65	-0,19	-0,04	0,0076	0,0361	0,0016	Koks
8	92P	5,70	2,50	0,01	-0,19	-0,0019	0,0001	0,0361	Roemer's
9	104L	5,45	2,60	-0,24	-0,09	0,0216	0,0576	0,0081	Koks
10	107P	4,95	2,40	-0,74	-0,29	0,2146	0,5476	0,0841	Koks
11	115P	6,30	2,90	0,61	0,21	0,1281	0,3721	0,0441	Koks
$\Sigma =$		62,60	29,65			2,5232	5,6191	1,2076	
$\frac{\Sigma}{n} =$		5,69	2,69			0,51	0,11		

$$\sigma_d = 0,71$$

$$\sigma_v = 0,33$$

$$K_{dv} = 0,98$$

$$b_{dv} = 2,11$$

$$b_{vd} = 0,46$$

TABLE VIII.

Table of  $t(v)$  and  $t(t)$  values of the difference of the regression coefficients of the relationship between  $v$  and  $d$ .

	Polidevcia gengeli	Polidevcia vašíčeky	Polidevcia sharmani	Phestia bellicostata I	Phestia bellicostata II	
$t(v) =$	[2,14]	[2,35]	0,61	[5,30]	[4,78]	Polidevcia attenuata
$t(t) =$	2,09	2,09	1,96	2,09	2,06	
$t(v) =$	0,20		1,37	[4,78]	[4,44]	Polidevcia gengeli
$t(t) =$	2,57		1,96	2,23	2,23	
$t(v) =$		1,40		[5,52]	[6,21]	Polidevcia vašíčeky
$t(t) =$		1,96		2,23	2,23	
$t(v) =$				[4,05]	[3,59]	Polidevcia sharmani
$t(t) =$				1,96	1,96	
$t(v) =$					0,71	Phestia bellicostata I
$t(t) =$					2,13	

TABLE VIII

Calculation of the correlation coefficient and of the regression coefficients of the relationship between  $p_1$  and  $p_2$  in *Polidevicia attenuata* (Fleming, 1828).

n	Stud. type No	$p_2$	$p_1$	$\xi p_2$	$\eta p_1$	$\xi \cdot \eta$	$\xi^2$	$\eta^2$	Faunal band
1	18P	8,85	4,0	-0,77	-0,34	0,26	0,59	0,12	Nanetta II
2	26L	8,7	3,85	-0,92	-0,49	0,45	0,85	0,24	Františka
3	36P	10,1	4,1	0,48	-0,24	-0,12	0,23	0,06	Františka
4	55L	9,25	4,9	-0,37	0,56	-0,21	0,14	0,31	Enna
5	59L	7,85	3,25	-1,77	-1,09	1,93	3,13	1,19	Barbora
6	68P	12,3	6,65	2,68	2,31	6,19	7,18	5,34	Gabriela
7	71P	11,75	3,7	2,13	-0,64	-1,36	4,54	0,41	Nanetta
8	91P	8,85	5,5	-0,77	-1,16	-0,89	0,59	1,35	Nanetta
9	93P	9,15	5,25	-0,47	0,91	-0,43	0,22	0,83	Nanetta
10	96L	6,55	2,65	-3,07	-1,69	5,19	9,42	2,86	Barbora III
11	111P	11,8	5,0	2,18	0,66	1,44	4,75	0,44	Nanetta
12	118P	15,4	7,2	5,78	2,86	16,53	33,29	8,18	Nanetta I
13	128L	10,9	4,95	1,28	0,61	0,78	1,64	0,40	Enna III
14	129L	10,65	4,05	1,03	-0,29	-0,30	1,06	0,08	Nanetta II
15	136L	8,8	3,7	-0,82	-0,64	0,52	0,67	0,41	Enna III
16	140P	4,3	1,8	-5,32	-2,54	13,51	28,30	6,45	Enna
17	115L	9,55	3,7	-0,07	-0,64	0,04	0,01	0,41	Františka
18	141L	8,4	3,8	-1,22	-0,54	0,66	1,49	0,29	Františka
	$\Sigma =$	173,15	78,05			44,46	98,10	29,37	
	$\frac{\Sigma}{n} =$	9,62	4,34			5,45	1,63		
	$\sigma p_2 =$	2,33				$\sigma p_1 =$	1,29		
						K $p_1 p_2 =$	0,82		
						b $p_2 p_1 =$	1,48		
						b $p_1 p_2 =$	0,45		

TABLE IX

Calculation of the correlation coefficient and of the regression coefficients of the relationship between  $p_1$  and  $p_2$  in *Polidenvicia gengeli nov. spec.*

n	Stud. type No	$p_2$	$p_1$	$\xi p_2$	$\eta p_1$	$\xi \cdot \eta$	$\xi^2$	$\eta^2$	Faunal band
1	61L	4,65	1,95	-1,21	-0,28	0,3388	1,4641	0,0784	Roemer's
2	89L	4,00	2,00	-1,86	-0,23	0,4278	3,4596	0,0529	Koks
3	97P	5,80	1,95	-0,06	-0,28	0,0168	0,0036	0,0784	Nanetta II
4	98P	5,20	1,50	-0,66	-0,73	0,4818	0,4356	0,5329	Roemer's
5	134L	9,65	3,75	3,79	1,52	5,7608	13,3641	2,3104	Enna IV
$\Sigma =$		29,30	11,15	0,00	0,00	7,0260	18,7270	3,0530	
$\frac{\Sigma}{n} =$		5,86	2,23				3,7454	0,61	

$$\sigma p_2 = 1,93$$

$$\sigma p_1 = 0,78$$

$$Kp_1p_2 = 0,78$$

$$bp_1p_2 = 0,32$$

$$bp_2p_1 = 1,93$$

TABLE X

Calculation of the correlation coefficient and of the regression coefficients of the relationship between  $p_1$  and  $p_2$  in *Polidevcia vašíček nov. spec.*

n	Stud. type No	$p_2$	$p_1$	$\xi p_2$	$\eta p_1$	$\xi \cdot \eta$	$\xi^2$	$\eta^2$	Faunal band
1	142L	10,50	3,95	5,23	1,64	8,5772	27,3529	2,6896	Štúr's
2	143L	2,05	1,20	-3,24	-1,11	3,5964	10,4976	1,2321	Štúr's
3	144L	6,25	3,05	0,98	0,74	0,7252	0,9604	0,5476	Štúr's
4	145P	5,40	2,10	0,13	-0,21	0,0273	0,0169	0,0441	Štúr's
5	146P	1,55	0,75	-3,72	-1,56	5,8032	13,8384	2,4336	Štúr's
6	159P	5,90	2,80	0,63	0,49	0,3087	0,3969	0,2401	Štúr's
$\Sigma =$		31,65	13,85	0,01	-0,01	18,9834	53,0631	7,1871	
$\frac{\Sigma}{n} =$		5,27	2,31				8,84	1,20	
$\sigma p_2 = 2,97$					$\sigma p_2 = 1,09$				
$Kp_1p_2 = 0,99$ $bp_1p_2 = 0,36$ $bp_2p_1 = 2,70$									

TABLE XI

Calculation of the correlation coefficient and of the regression coefficients of the relationship between  $p_1$  and  $p_2$  in *Polidevcia sharmani* (R. Etheridge jun., 1878).

<i>n</i>	Stud. type No	$p_2$	$p_1$	$\xi p_2$	$\eta p_1$	$\xi \cdot \eta$	$(\xi p_2)^2$	$(\eta p_1)^2$	Faunal band
1	2L	3,90	2,20	-0,70	-0,65	0,45	0,4900	0,4225	Nanetta
2	3P	4,00	2,20	-0,60	-0,65	0,39	0,3600	0,4225	Nanetta
3	4L	3,70	1,85	-0,90	-1,00	0,90	0,8200	1,0000	Nanetta
4	21L	3,20	1,95	-1,40	-0,90	1,26	1,9600	0,8200	Nanetta
5	23P	4,30	2,30	-0,30	-0,55	0,17	0,0900	0,3025	Nanetta
6	67P	4,20	2,25	-0,40	-0,60	0,24	0,1600	0,3600	Nanetta II
7	70L	4,45	2,65	-0,15	-0,20	0,03	0,0225	0,0400	Nanetta II
8	80P	4,70	2,80	0,10	-0,05	-0,01	0,0100	0,0025	Nanetta II
9	81L	4,10	2,20	-0,50	-0,65	0,32	0,2500	0,4225	Nanetta II
10	85P	5,00	3,95	0,40	1,10	0,44	0,1600	1,2100	Nanetta II
11	88P	3,90	1,80	-0,70	-1,05	0,73	0,4900	1,1025	Nanetta II
12	90P	5,20	3,35	0,60	0,50	0,30	0,3600	0,2500	Nanetta
13	101P	3,25	1,60	-1,35	-1,25	1,69	1,8225	1,5625	Nanetta II
14	109L	4,10	2,40	-0,50	-0,45	0,22	0,2500	0,2025	Nanetta II
15	117P	5,20	3,00	0,60	0,15	0,09	0,3600	0,0225	Nanetta
16	120L	6,30	4,40	1,70	1,55	2,63	2,8900	2,4025	Nanetta I
17	124L	4,45	3,60	-0,15	0,75	0,11	0,0225	0,5625	Nanetta I
18	130L	4,75	2,55	0,15	-0,30	-0,05	0,0225	0,0900	Nanetta II
19	131P	4,95	3,50	0,35	0,65	0,23	0,1225	0,4225	Nanetta II
20	132P	3,45	1,75	-1,15	-1,10	1,26	1,3225	1,2100	Nanetta II
21	133L	5,40	2,70	0,80	-0,15	-0,12	0,6400	0,0225	Nanetta II
22	138P	5,50	3,70	0,90	0,85	0,76	0,8200	0,7225	Nanetta II
23	139P	4,45	2,70	-0,15	-0,15	0,02	0,0225	0,0225	Nanetta II
24	148P	6,00	4,80	1,40	1,95	2,73	1,9600	3,8025	Nanetta
25	149L	4,60	4,25	0,00	1,40	0,00	0,0000	1,9600	Nanetta
26	150P	6,55	3,75	1,95	0,90	1,75	3,8025	0,8200	Nanetta
	$\Sigma =$	119,60	74,20	0,00	-0,10	16,54	19,23	20,1800	
	$\frac{\Sigma}{n} =$	4,60	2,85				0,74	0,78	
				$\sigma p_2 = 0,86$		$\sigma p_1 = 0,88$			
					$K_{p_1 p_2} = 0,84$				
					$b_{p_2 p_1} = 0,82$				
					$b_{p_1 p_2} = 0,86$				

TABLE XII

Calculation of the correlation coefficient and of the regression coefficients of the relationship between  $p_1$  and  $p_2$  in *Phestia bellicostata* (Schwarzbach, 1939) — sample I.

$n$	Stud. type No	$p_2$	$p_1$	$\xi p_2$	$\eta p_1$	$\xi \cdot \eta$	$(\xi p_2)^2$	$(\eta p_1)^2$	Faunal band
1	9L	5,35	2,55	0,68	0,07	0,0476	0,4624	0,0049	Nanetta
2	15P	3,20	1,80	-1,47	-0,68	0,9996	2,1609	0,4624	Františka
3	43L	5,55	2,65	0,88	0,17	0,1496	0,7744	0,0289	Nanetta
4	45L	6,15	2,70	1,48	0,22	0,3256	2,1904	0,0484	Nanetta II
5	73L	6,15	3,10	1,48	0,62	0,9176	2,1904	0,3844	Nanetta
6	94P	3,85	1,85	-0,82	-0,63	0,5166	0,6724	0,3969	Nanetta
7	114L	3,10	1,95	-1,57	-0,53	0,8321	2,4649	0,2809	Nanetta II
8	156L	4,50	2,90	-0,17	0,42	-0,0714	0,0289	0,1764	Nanetta
9	158L	4,15	2,80	-0,52	0,32	-0,1664	0,2704	0,1024	Nanetta
$\Sigma =$		42,00	22,30	-0,03	-0,02	3,5509	11,2151	1,8856	
$\frac{\Sigma}{n} =$		4,67	2,48				1,25	0,21	
					$\sigma p_2 = 1,12$	$\sigma p_1 = 0,46$			
					$Kp_1 p_2 = 0,77$	$b p_1 p_2 = 0,32$			
					$b p_2 p_1 = 1,87$				

TABLE XIII

Calculation of the correlation coefficient and of the regression coefficients of the relationship between  $p_1$  and  $p_2$  in *Phestia bellicostata* (Schwarzbach, 1939) — sample II.

$n$	Stud. type No	$p_2$	$p_1$	$\xi p_2$	$\eta p_1$	$\xi \cdot \eta$	$\xi^2$	$\eta^2$	Faunal band
1	63L	2,75	1,55	-0,36	-0,16	0,0576	0,1296	0,0256	Koks
2	65P	3,30	2,15	0,19	0,44	0,0836	0,0361	0,1936	Koks
3	72P	2,40	1,35	-0,71	-0,36	0,2556	0,5041	0,1296	Koks
4	74L	3,45	1,80	0,34	0,09	0,0306	0,1156	0,0081	Koks
5	77P	4,10	1,95	0,99	0,24	0,2376	0,9801	0,0576	Koks
6	78P	3,15	1,70	0,04	-0,01	-0,0004	0,0016	0,0001	Koks
7	84L	3,00	1,60	-0,11	-0,11	0,0121	0,0121	0,0121	Koks
8	92P	3,15	1,65	0,04	-0,06	-0,0024	0,0016	0,0036	Roemer's
9	104L	2,85	1,70	-0,26	-0,01	0,0026	0,0676	0,0001	Koks
10	107P	2,60	1,55	-0,51	-0,16	0,0816	0,2601	0,0256	Koks
11	115P	3,50	1,80	0,39	0,09	0,0351	0,1521	0,0081	Koks
$\Sigma =$		34,25	18,80	0,04	-0,01	0,7936	2,2606	0,4641	
$\frac{\Sigma}{n} =$		3,11	1,71				0,21	0,0422	
					$\sigma p_2 = 0,45$		$\sigma p_1 = 0,20$		
					$Kp_1 p_2 = 0,80$				
					$bp_1 p_2 = 0,35$				
					$bp_2 p_1 = 1,8$				

TABLE XIV

Table of  $t(v)$  and  $t(t)$  values of the difference of the regression coefficients of the relationship between  $p_1$  and  $p_2$ .

	Polidevcia gengeli	Polidevcia vašičeki	Polidevcia sharmani	Phestia bellicostata I	Phestia bellicostata II	
$t_v =$	0,81	1,04	3,23	1,05	1,26	Polidevcia attenuata
$t_t =$	2,09	2,09	1,96	2,09	2,06	
	$t_v =$	0,27	3,10	0,00	0,21	Polidevcia gengeli
	$t_t =$	2,57	1,96	2,23	2,23	
	$t_v =$	4,59		0,04	0,24	Polidevcia vašičeki
	$t_t =$	1,96		2,23	2,23	
	$t_v =$	3,85		4,95		Polidevcia sharmani
	$t_t =$	1,96		1,96		
	$t_v =$		0,31			Phestia bellicostata I
	$t_t =$		2,13			

TABLE XV

Calculation of the correlation coefficient and of the regression coefficients of the relationship between  $v_1$  and  $v_2$  in *Polidevicia attenuata* (Fleming, 1828).

$n$	Stud. type No	$v_2$	$v_1$	$\xi v_2$	$\eta v_1$	$\xi \eta$	$\eta^2$	$\xi^2$	Faunal band
1	18P	2,5	2,8	-0,46	-0,02	0,09	0,0004	0,2116	Nanetta II
2	26L	2,4	2,4	-0,56	-0,42	0,24	0,1764	0,3136	Františka
3	36P	3,0	3,15	0,04	0,33	0,01	0,1089	0,0016	Františka
4	55L	2,7	3,6	-0,26	0,78	-0,20	0,6084	0,0676	Enna
5	59L	2,65	1,85	-0,31	0,97	-0,30	0,9409	0,0961	Barbora
6	68P	3,9	3,9	0,94	1,08	1,02	1,1664	0,8836	Gabriela
7	71P	3,1	3,1	0,14	0,28	0,04	0,0784	0,0196	Nanetta
8	91P	3,05	2,8	0,09	-0,02	0,00	0,0004	0,0082	Nanetta
9	93P	3,2	3,0	0,24	0,18	0,04	0,0324	0,0576	Nanetta
10	96L	2,3	1,7	-0,66	-1,12	0,74	1,2544	0,4356	Barbora
11	111P	4,1	3,0	1,14	0,18	0,21	0,0324	1,2996	Nanetta
12	118P	4,4	4,7	1,44	1,88	2,71	3,5344	2,0736	Nanetta I
13	128L	3,45	2,3	0,49	-0,52	-0,25	0,2704	0,2401	Enna III
14	129L	3,2	2,75	0,24	-0,07	-0,02	0,0049	0,0576	Nanetta II
15	136L	2,5	2,6	-0,46	-0,22	0,10	0,0484	0,2116	Enna III
16	140P	1,55	1,5	-1,41	-1,32	1,86	1,7424	1,9881	Enna
17	155L	3,0	2,5	0,04	-0,32	-0,01	0,1024	0,0016	Františka
18	157P	2,3	3,1	-0,66	0,28	-0,18	0,0784	0,4356	Enna
$\Sigma =$		53,3	50,75			$\Sigma = 6,10$	$\Sigma = 10,1807$	$\Sigma = 8,4029$	
$A_{v_2} =$		2,96	$A_{v_1} =$ 2,82				0,5655	0,4668	
$\sigma_{v_1} = 0,75$					$\sigma_{v_2} = 0,68$				
$K_{v_1 v_2} = 0,66$					$b_{v_2 v_1} = 0,59$				
$b_{v_1 v_2} = 0,73$									

TABLE XVI

Calculation of the correlation coefficient and of the regression coefficients of the relationship between  $v_1$  and  $v_2$  in *Polidevcia gengeli nov. spec.*

$n$	Stud. type No	$v_2$	$v_1$	$\xi v_2$	$\eta v_1$	$\xi \eta$	$\xi^2$	$\eta^2$	Faunal band					
1	61L	1,20	1,35	-0,17	-0,20	0,0340	0,0289	0,0400	Roemer's					
2	89L	1,10	1,45	-0,27	-0,10	0,0270	0,0729	0,0100	Koks					
3	97P	1,25	1,40	-0,12	-0,15	0,0180	0,0144	0,0225	Nanetta II					
4	98P	1,20	1,20	-0,17	-0,35	0,0595	0,0289	0,1225	Roemer's					
5	134L	2,10	2,35	0,73	0,80	0,5840	0,5329	0,6400	Enna IV					
$\Sigma =$		6,85	7,75	0,00	0,00	0,7225	0,6780	0,8350						
$\frac{\Sigma}{n} =$		1,37	1,55				0,1356	0,167						
$\sigma_{v_2} = 0,37$					$\sigma_{v_1} = 0,41$									
$K_{v_1 v_2} = 0,95$														
$b_{v_1 v_2} = 1,05$														
$b_{v_2 v_1} = 0,86$														

TABLE XVII

Calculation of the correlation coefficient and of the regression coefficients of the relationship between  $v_1$  and  $v_2$  in *Polidevcia vašičekii nov. spec.*

$n$	Stud. type No	$v_2$	$v_1$	$\xi v_2$	$\eta v_1$	$\xi \eta$	$\xi^2$	$\eta^2$	Faunal band
1	142L	2,25	1,9	0,86	0,76	0,6536	0,7399	0,5776	Štúr's
2	143L	0,55	0,7	-0,84	-0,44	0,3696	0,7056	0,1936	Štúr's
3	144L	1,7	1,45	0,31	0,31	0,0961	0,0961	0,0961	Štúr's
4	145P	1,4	0,9	0,01	-0,24	-0,0024	0,0001	0,0576	Štúr's
5	146P	0,55	0,5	-0,84	-0,64	0,5376	0,7056	0,4086	Štúr's
6	159P	1,9	1,4	0,51	0,26	0,1326	0,2601	0,0676	Štúr's
$\Sigma =$		8,35	6,85			1,7871	2,5074	1,4021	
$\frac{\Sigma}{n} =$		1,39	1,14				0,4179	0,2336	

$$\sigma_{v_2} = 0,65$$

$$\sigma_{v_1} = 0,48$$

$$K_{v_1 v_2} = 0,95$$

$$b_{v_1 v_2} = 0,70$$

$$b_{v_2 v_1} = 1,29$$

TABLE XVIII

Calculation of the correlation coefficient and of the regression coefficients of the relationship between  $v_1$  and  $v_2$  in *Polidevicia sharmani* (R. Etheridge jun., 1878).

$n$	Stud. type No	$v_2$	$v_1$	$\xi v_2$	$\eta v_1$	$\xi \cdot \eta$	$\xi^2$	$\eta^2$	Faunal band
1	2L	1,25	1,35	-0,28	-0,46	0,1288	0,0784	0,2116	Nanetta
2	3P	1,20	1,50	-0,33	-0,31	0,1023	0,1089	0,0961	Nanetta
3	4L	1,30	1,35	-0,23	-0,46	0,1058	0,0529	0,2116	Nanetta
4	21L	1,00	1,30	-0,53	-0,51	0,2703	0,2809	0,2601	Nanetta
5	23P	1,40	1,30	-0,13	-0,51	0,0663	0,0169	0,2601	Nanetta
6	67P	1,30	1,80	-0,23	-0,01	0,0023	0,0529	0,0001	Nanetta II
7	70L	1,70	1,95	0,17	0,14	0,0238	0,0289	0,0196	Nanetta II
8	80P	1,60	1,50	0,07	-0,31	-0,0217	0,0049	0,0961	Nanetta II
9	81L	1,40	1,75	-0,13	-0,06	0,0078	0,0169	0,0036	Nanetta II
10	85P	1,85	2,55	0,32	0,74	0,2368	0,1024	0,5476	Nanetta II
11	88P	1,25	1,35	-0,28	-0,46	0,1288	0,0784	0,2116	Nanetta II
12	90P	1,90	1,90	0,37	0,09	0,0333	0,1369	0,0082	Nanetta
13	101P	1,15	1,25	-0,38	-0,56	0,2128	0,1444	0,3136	Nanetta II
14	109L	1,60	2,10	0,07	0,29	0,0203	0,0049	0,0841	Nanetta II
15	117P	1,95	2,20	0,42	0,39	0,1638	0,1764	0,1521	Nanetta
16	120L	2,15	2,45	0,62	0,64	0,3968	0,3844	0,4096	Nanetta I
17	124L	1,55	2,05	0,02	0,24	0,0048	0,0004	0,0576	Nanetta I
18	130L	1,65	1,80	0,12	-0,01	-0,0012	0,0144	0,0001	Nanetta II
19	131P	1,40	2,00	-0,13	0,19	0,0247	0,0169	0,0361	Nanetta II
20	132P	1,10	1,20	-0,43	-0,61	0,2623	0,1849	0,3721	Nanetta II
21	133L	1,80	2,10	0,27	0,29	0,0783	0,0729	0,0841	Nanetta II
22	138P	1,70	2,30	0,17	0,49	0,0833	0,0289	0,2401	Nanetta II
23	139P	1,60	1,95	0,07	0,14	0,0098	0,0049	0,0196	Nanetta II
24	148P	1,70	2,30	0,17	0,49	0,0833	0,0289	0,2401	Nanetta
25	149L	1,45	1,80	-0,08	-0,01	0,0008	0,0064	0,0001	Nanetta
26	150P	1,80	1,85	0,27	0,04	0,0108	0,0729	0,0016	Nanetta
	$\Sigma =$	39,75	46,95			2,4352	2,1009	3,9372	
	$\frac{\Sigma}{n} =$	1,53	1,81				0,081	0,151	
				$\sigma_{v_2} = 0,28$			$\sigma_{v_1} = 0,38$		
					$K_{v_1 v_2} = 0,88$				
					$b_{v_2 v_1} = 0,65$				
					$b_{v_1 v_2} = 1,19$				

TABLE XIX

Calculation of the correlation coefficient and of the regression coefficients of the relationship between  $v_1$  and  $v_2$  in *Phestia bellicostata* (Schwarzbach, 1939) — sample I.

$n$	Stud. type No	$v_2$	$v_1$	$\xi v_2$	$\eta v_1$	$\xi \cdot \eta$	$\xi^2$	$\eta^2$	Faunal band
1	9L	2,20	1,90	0,26	-0,16	-0,0416	0,0676	0,0256	Nanetta
2	15P	1,30	1,40	-0,64	-0,66	0,4224	0,4096	0,4356	Františka
3	43L	2,30	2,30	0,36	0,24	0,0864	0,1296	0,0576	Nanetta
4	45L	2,45	2,45	0,51	0,39	0,1989	0,2601	0,1521	Nanetta II
5	73L	2,50	2,50	0,56	0,44	0,2464	0,3136	0,1936	Nanetta
6	94P	1,50	1,50	-0,44	-0,56	0,2464	0,1936	0,3136	Nanetta
7	114L	1,45	1,40	-0,49	-0,66	0,3234	0,2401	0,4356	Nanetta II
8	156L	2,05	2,55	0,11	0,49	0,0539	0,0121	0,2401	Nanetta
9	158L	1,75	2,55	-0,19	0,49	-0,0931	0,0361	0,2401	Nanetta
$\Sigma =$		17,50				1,4431	1,6624	2,0939	
$\frac{\Sigma}{n} =$		2,06					0,18	0,23	
$\sigma_{v_2} = 0,42$					$\sigma_{v_1} = 0,47$				
$K_{v_1 v_2} = 0,81$					$K_{v_1 v_2} = 0,81$				
$b_{v_1 v_2} = 0,91$					$b_{v_1 v_2} = 0,91$				
$b_{v_2 v_1} = 0,72$					$b_{v_2 v_1} = 0,72$				

TABLE XX

Calculation of the correlation coefficient and of the regression coefficients of the relationship between  $v_1$  and  $v_2$  in *Phestia bellicostata* [Schwarzbach 1939]. — sample II.

$n$	Stud. type No	$v_2$	$v_1$	$\xi v_2$	$\eta v_1$	$\xi \cdot \eta$	$\xi^2$	$\eta^2$	Faunal band
1	63L	1,20	1,30	-0,06	-0,13	0,0078	0,0036	0,0169	Koks
2	65P	1,50	1,60	0,24	0,17	0,0408	0,0576	0,0289	Koks
3	72P	1,00	1,15	-0,26	-0,28	0,0728	0,0676	0,0784	Koks
4	74L	1,45	1,40	0,19	-0,03	-0,0057	0,0361	0,0009	Koks
5	77P	1,60	1,80	0,34	0,37	0,1258	0,1156	0,1369	Koks
6	78P	1,10	1,50	-0,16	0,07	-0,0112	0,0256	0,0049	Koks
7	84L	1,25	1,35	-0,01	-0,08	0,0008	0,0001	0,0064	Koks
8	92P	1,05	1,45	-0,21	0,02	-0,0042	0,0441	0,0004	Roemer's
9	104L	1,20	1,40	-0,06	-0,03	0,0018	0,0036	0,0009	Koks
10	107P	1,15	1,25	-0,11	-0,18	0,0198	0,0121	0,0324	Koks
11	115P	1,35	1,55	0,09	0,12	0,0108	0,0081	0,0144	Koks
$\Sigma =$		13,85	15,75	-0,01	0,02	0,2461	0,3741	0,3214	
$\frac{\Sigma}{n} =$		1,26	1,43				0,034	0,0292	

$$\sigma_{v_2} = 0,18$$

$$\sigma_{v_1} = 0,17$$

$$\begin{aligned} K_{v_1 v_2} &= 0,73 \\ b_{v_2 v_1} &= 0,77 \\ b_{v_1 v_3} &= 0,69 \end{aligned}$$

TABLE XXI

Table of  $t(v)$  and  $t(t)$  values of the difference of the regression coefficients of the relationship between  $v_1$  and  $v_2$ .

	Polidevcia gengeli	Polidevcia vašičekí	Polidevcia sharmani	Phestia bellicostata I	Phestia bellicostata II	
$t_v =$	0,69	0,06	0,98	0,04	0,1	
$t_t =$	2,09	2,09	1,96	2,09	2,09	Polidevcia attenuata
	$t_v =$	1,30	0,53	0,27	2,06	
	$t_t =$	2,57	1,96	2,23	2,23	Polidevcia gengeli
		$t_v =$	1,70	0,63	0,05	
		$t_t =$	1,96	2,23	2,23	Polidevcia vašičekí
		$t_v =$	0,85	2,47		
		$t_t =$	1,96	1,96		Polidevcia sharmani
		$t_v =$	0,81			
		$t_t =$	2,13			Phestia bellicostata I

TABLE XXII

Calculation of the arithmetic mean, of the deviations, and of the variability limits of  $\alpha$  in *Polidevicia attenuata* (Fleming, 1828).

<i>n</i>	Stud. type No	$a^\circ$	$\xi_\alpha$	$\xi^2$	Faunal band
1	18P	-5,0	-10,37	107,54	Nanetta II
2	26L	5,0	-0,37	0,14	Františka
3	36P	9,0	3,63	13,18	Františka
4	55L	4,0	-1,37	1,88	Enna
5	59L	7,0	1,63	2,66	Barbora
6	68P	4,0	-1,37	1,88	Gabriela
7	71P	17,0	11,63	135,26	Nanetta
8	91P	7,0	1,63	2,66	Nanetta
9	93P	-5,0	-10,37	107,54	Nanetta
10	96L	3,5	-1,87	3,50	Barbora III
11	111P	10,0	4,63	21,44	Nanetta
12	118P	-4,5	-9,87	97,42	Nanetta I
13	128L	17,0	11,63	135,26	Enna III
14	129L	8,5	3,13	9,80	Nanetta II
15	136L	4,5	-0,87	0,76	Enna III
16	140P	0,0	-5,37	28,84	Enna
17	141L	8,0	2,63	6,92	Františka
18	155L	6,0	0,63	0,40	Františka
19	157P	6,0	0,63	0,40	Enna
$\Sigma =$		102,0		678,08	
$\frac{\Sigma}{n} =$		5,37		35,69	

$$\begin{aligned}
 A_\alpha &= 5^\circ 22' \\
 \sigma_\alpha &= 5,9 \\
 h_\alpha &= -12^\circ 30' \div 23^\circ \\
 \sigma_{\alpha v} &= 6,1 \\
 \sigma_{\alpha A} &= 1,4 \\
 R_\alpha &= 3^\circ 58' \div 6^\circ 48'
 \end{aligned}$$

TABLE XXIII

Calculation of the arithmetic mean, of the deviations, and of the variability limits of  $\alpha$  in *Polidevcia gengeli nov. spec.*

$n$	Stud. type No	$\alpha$	$\xi_\alpha$	$\xi^2$	Faunal band
1	61L	9	0,7	0,49	Roemer's
2	89L	2	-6,3	39,69	Koks
3	97P	6,5	-1,8	3,24	Nanetta II
4	98P	9	0,7	0,49	Roemer's
5	134L	15	6,7	44,89	Enna IV
$\Sigma =$		41,5		88,80	
$\frac{\Sigma}{n} =$		8,3		17,76	

$$A_\alpha = 8^\circ 18'$$

$$\sigma_\alpha = 4,21$$

$$h_\alpha = -4^\circ 33' \div 20^\circ 38'$$

$$\sigma_{\alpha v} = 4,71$$

$$\sigma_{\alpha A} = 2,10$$

$$R_\alpha = 2^\circ \div 14^\circ 36'$$

TABLE XXIV

Calculation of the arithmetic mean, of the deviations, and of the variability limits of  $\alpha$  in *Polidevcia vašičekii nov. sp.*

$n$	Stud. type No	$\alpha^\circ$	$\xi_\alpha$	$\xi^2$	Faunal band
1	142L	0	-5	25	Štúr's
2	143L	-2	-7	49	Štúr's
3	144L	9	4	16	Štúr's
4	145L	11,5	6,5	42,25	Štúr's
5	146L	2	-3	9	Štúr's
6	159P	9,5	4,5	20,25	Štúr's
$\Sigma =$		30,0		161,50	
$\frac{\Sigma}{n} =$		5,0		26,92	

$$A_\alpha = 5^\circ$$

$$\sigma_\alpha = 5,19$$

$$h_\alpha = -10^\circ 34' \div 20^\circ 34'$$

$$\sigma_{\alpha v} = 5,69$$

$$\sigma_{\alpha A} = 2,32$$

$$R_\alpha = -1^\circ 58' \div 11^\circ 58'$$

TABLE XXV

Calculation of the arithmetic mean, of the deviations, and of the variability limits of  $\alpha$  in *Polidevcia sharmani* (R. Etheridge jun., 1878).

<i>n</i>	Stud. type No	$a^\circ$	$\xi_\alpha$	$\xi^2$	Faunal band
1	2L	-1	4,31	18,5761	Nanetta
2	3P	-3	2,31	5,3361	Nanetta
3	4L	4	9,31	86,6761	Nanetta
4	21L	-1	4,31	18,5761	Nanetta
5	23P	3	8,31	69,0561	Nanetta
6	67P	-2	3,31	10,9561	Nanetta II
7	70L	0	5,31	28,1961	Nanetta II
8	80P	5	10,31	106,2961	Nanetta II
9	81L	-7	-1,69	2,8561	Nanetta II
10	85P	-18,5	-13,19	173,9761	Nanetta II
11	88P	8	13,31	177,1561	Nanetta II
12	90P	-13	-7,69	59,1361	Nanetta
13	101P	-2	3,31	10,9661	Nanetta II
14	109L	3	8,31	69,0561	Nanetta II
15	117P	-3,5	1,81	3,2761	Nanetta
16	120L	-14	-8,69	75,5161	Nanetta I
17	124L	-20	-14,69	215,7961	Nanetta I
18	130L	0	5,31	28,1961	Nanetta II
19	131P	-11	-5,69	32,3761	Nanetta II
20	132P	-2	3,31	10,9561	Nanetta II
21	133L	8	13,31	177,1561	Nanetta II
22	138P	-9,5	-4,19	17,5561	Nanetta II
23	139P	-19	-13,69	187,4161	Nanetta II
24	148P	-11	-5,69	32,3761	Nanetta
25	149L	-25	-19,69	387,6961	Nanetta
26	150P	-7	-1,69	2,8561	Nanetta
$\Sigma =$		138	0,44	2007,9786	
$\frac{\Sigma}{n} =$		-5,31		77,23	

$$A_\alpha = -5^\circ 18'$$

$$\sigma_\alpha = 8,7$$

$$h_\alpha = 20^\circ 47' \div (-31^\circ 24')$$

$$\sigma_{\alpha v} = 8,9$$

$$\sigma_{\alpha A} = 1,74$$

$$R_\alpha = -0^\circ 06' \div (-10^\circ 32')$$

TABLE XXVI

Calculation of the arithmetic mean, of the deviations, and of the variability limits of  $\alpha$  in *Phestia bellicostata* (Schwarzbach, 1939) — sample I.

$n$	Stud. type No	$\alpha^\circ$	$\xi_\alpha$	$\xi^2$	Faunal band	
1	9L	3	0,61	0,3721	Nanetta	$A_\alpha = 2^\circ 23'$
2	15P	5	2,61	6,8121	Františka	$\sigma_\alpha = 3,96$
3	43L	0	-2,39	5,7121	Nanetta	$h_\alpha = -9^\circ 30' \div 14^\circ 16'$
4	45L	7	4,61	21,2521	Nanetta II	$\sigma_{\alpha v} = 4,17$
5	73L	8,5	6,11	37,3321	Nanetta	$\sigma_{\alpha A} = 1,39$
6	94P	0	-2,39	5,7121	Nanetta	$R_\alpha = -1^\circ 47' \div 6^\circ 34'$
7	114	-2	-4,39	19,2721	Nanetta II	
8	156L	4	1,61	2,5921	Nanetta	
9	158L	-4	-6,39	40,8321	Nanetta	
$\Sigma =$		21,5		139,8889		
$\frac{\Sigma}{n} =$		2,39		15,54		

TABLE XXVII

Calculation of the arithmetic mean, of the deviations, and of the variability limits of  $\alpha$  in *Phestia bellicostata* (Schwarzbach, 1939) — sample II.

$n$	Stud. type No	$a^\circ$	$\xi_\alpha$	$\xi^2$	Faunal band
1	63L	2	0,27	0,0729	Koks
2	65P	6	4,27	18,2329	Koks
3	72P	0	-1,73	2,9929	Koks
4	74L	0	-1,73	2,9929	Koks
5	77P	0	-1,73	2,9929	Koks
6	78P	3	1,27	1,6129	Koks
7	84L	3	1,27	1,6129	Koks
8	92P	3	1,27	1,6129	Roemer's
9	104L	0	-1,73	2,9929	Koks
10	107P	0	-1,73	2,9929	Koks
11	115P	2	0,27	0,0729	Koks
$\Sigma =$		19		38,1819	
$\frac{\Sigma}{n} =$		1,73		3,47	

TABLE XXVIII

Table of  $t(v)$  and  $t(t)$  values of the difference between arithmetic means of  $\alpha$ .

	Polidevcia gengeli	Polidevcia vašičekii	Polidevcia sharmani	Phestia bellicostata I	Phestia bellicostata II	-
$t_v =$	1,13	0,06	4,47	1,31	1,90	
$t_t =$	2,06	2,06	1,96	2,09	2,06	Polidevcia attenuata
	$t_v =$	1,03	3,24	2,38	3,95	
	$t_t =$	2,33	1,96	2,23	2,23	Polidevcia gengeli
	$t_v =$	2,66		1,02	1,77	
	$t_t =$	1,96		2,23	2,23	Polidevcia vašičekii
	$t_v =$		2,45	2,48		
	$t_t =$	1,96		1,96		Polidevcia sharmani
	$t_v =$			0,46		
	$t_t =$	2,13				Phestia bellicostata I

TABLE XXIX

Calculation of the arithmetic mean, of the deviations, and of the variability limits of  $\beta$  in *Polidevcia attenuata* (Fleming, 1828).

$n$	Stud. type No	$\beta^\circ$	$\xi_\beta$	$\xi^2$	Faunal band
1	18P	17	-0,5	0,25	Nanetta II
2	26L	16	-1,5	2,25	Františka
3	36P	17	-0,5	0,25	Františka
4	55L	16	-1,5	2,25	Enna
5	59L	18,5	2,5	6,25	Barbora
6	68P	17,5	0,0	0,00	Gabriela
7	71P	18	0,5	0,25	Nanetta
8	91P	18,5	1,0	1,00	Barbora
9	93P	19,5	2,0	4,00	Nanetta
10	96L	19,5	2,0	4,00	Barbora III
11	111P	20	2,5	6,25	Nanetta
12	118P	18,5	1,0	1,00	Nanetta I
13	128L	17	-0,5	0,25	Enna III
14	129L	17	-0,5	0,25	Nanetta II
15	136L	16	-1,5	2,25	Enna III
16	140P	18	0,5	0,25	Enna
17	141L	7	-0,5	0,25	Františka
18	155L	17,5	0,0	0,00	Františka
19	157P	14	-3,5	12,25	Enna
$\Sigma =$		332,5		43,25	
$\frac{\Sigma}{n} =$		17,5		2,28	

$$\begin{aligned}
 A_\beta &= 17^\circ 30' \\
 \sigma_\beta &= 1,5 \\
 h_\beta &= 13^\circ \div 22^\circ \\
 \sigma_{\beta v} &= 1,55 \\
 \sigma_{\beta A} &= 0,35 \\
 R_\beta &= 16^\circ 27' \div 18^\circ 33'
 \end{aligned}$$

TABLE XXX

Calculation of the arithmetic mean, of the deviations, and of the variability limits of  $\beta$  in *Polidevcia gengeli nov. spec.*

$n$	Stud. type No	$\beta$	$\xi_\beta$	$\xi^2$	Faunal band
1	61L	13,5	0,5	0,25	Roemer's
2	89L	14	1	1	Koks
3	97P	12,5	-0,5	0,25	Nanetta II
4	98P	13	0	0	Roemer's
5	134L	12	-1	1	Enna IV
$\Sigma =$		65,0		2,50	
$\frac{\Sigma}{n} =$		13		0,50	

$$\begin{aligned} A_\beta &= 13^\circ \\ \sigma_\beta &= 0,71 \\ h_\beta &= 10^\circ 52' \div 15^\circ 08' \\ \sigma_{\beta v} &= 0,79 \\ \sigma_{\beta A} &= 0,35 \\ R_\beta &= 12^\circ 01' \div 13^\circ 59' \end{aligned}$$

TABLE XXXI

Calculation of the arithmetic mean, of the deviations, and of the variability limits of  $\beta$  in *Polidevcia vašíčekii nov. spec.*

$n$	Stud. type No	$\beta^\circ$	$\xi_\beta$	$\xi^2$	Faunal band
1	142L	13	-2,75	7,5625	Štúr's
2	143L	15	-0,75	0,5625	Štúr's
3	144L	15,5	-0,25	0,0625	Štúr's
4	145P	15	-0,75	0,5626	Štúr's
5	146P	19	3,25	10,5625	Štúr's
6	159P	17	1,25	1,5625	Štúr's
$\Sigma =$		94,5		20,8750	
$\frac{\Sigma}{n} =$		16,75		3,48	

$$\begin{aligned} A_\beta &= 15^\circ 45' \\ \sigma_\beta &= 1,86 \\ h_\beta &= 10^\circ 10' \div 21^\circ 20' \\ \sigma_{\beta v} &= 2,04 \\ \sigma_{\beta A} &= 0,83 \\ R_\beta &= 13^\circ 14' \div 18^\circ 14' \end{aligned}$$

TABLE XXXII

Calculation of the arithmetic mean, of the deviations, and of the variability limits of  $\beta$  in *Polidevcia sharmani* (R. Etheridge jun., 1878).

$n$	Stud. type No	$\beta^\circ$	$\xi_\beta$	$\xi^2$	Faunal band
1	2L	18	-0,35	0,1225	Nanetta
2	3P	18	-0,35	0,1225	Nanetta
3	4L	19	0,65	0,4225	Nanetta
4	21L	17,5	-0,85	0,7225	Nanetta
5	23P	18	-0,35	0,1225	Nanetta
6	67P	17	-1,35	1,8225	Nanetta II
7	70L	20,5	2,15	4,6225	Nanetta II
8	80P	18,5	0,15	0,0225	Nanetta II
9	81L	19	0,65	0,4225	Nanetta II
10	85P	18,5	0,15	0,0225	Nanetta II
11	88P	17,5	-0,85	0,7225	Nanetta II
12	90P	19,5	1,15	1,3225	Nanetta
13	101P	20	1,65	2,7225	Nanetta II
14	109L	20,5	2,15	4,6225	Nanetta II
15	117P	21	2,65	7,0225	Nanetta
16	120L	19	0,65	0,4225	Nanetta I
17	124L	18,5	0,15	0,0225	Nanetta I
18	130L	19	0,65	0,4225	Nanetta II
19	131P	16	-2,35	5,5225	Nanetta II
20	132P	18,5	0,15	0,0225	Nanetta II
21	133L	18,5	0,15	0,0225	Nanetta II
22	138P	17,5	-0,85	0,7225	Nanetta II
23	139P	19	0,65	0,4225	Nanetta II
24	148P	16	-2,35	5,5225	Nanetta
25	149L	16,5	-1,85	3,4225	Nanetta
26	150P	16	-2,35	5,5225	Nanetta
$\Sigma =$		477,0		46,8850	
$\frac{\Sigma}{n} =$		18,35		1,80	

TABLE XXXIII

Calculation of the arithmetic mean, of the deviations, and of the variability limits of  $\beta$  in *Phestia bellicostata* (Schwarzbach, 1939) — sample I.

$n$	Stud. type No	$\beta^\circ$	$\xi_\beta$	$\xi^2$	Faunal band	
1	9L	23,0	0,11	0,0121	Nanetta	$A_\beta = 22^\circ 53'$
2	15P	22,0	-0,89	0,7921	Františka	$\sigma_\beta = 0,88$
3	43L	22,5	-0,39	0,1521	Nanetta	$h_\beta = 20^\circ 15' \div 25^\circ 32'$
4	45L	22,5	-0,39	0,1521	Nanetta II	$\sigma_{\beta v} = 0,93$
5	73L	22,0	-0,89	0,7921	Nanetta	$\sigma_{\beta A} = 0,31$
6	94P	22	-0,89	0,7921	Nanetta	$R_\beta = 21^\circ 58' \div 23^\circ 49'$
7	114L	24	1,11	1,2321	Nanetta II	
8	156L	24,5	1,61	2,5921	Nanetta	
9	158L	23,5	0,61	0,3721	Nanetta	
$\Sigma =$		206,00		6,8889		
$\frac{\Sigma}{n} =$		22,89		0,77		

TABLE XXXIV

Calculation of the arithmetic mean, of the deviations, and of the variability limits of  $\beta$  in *Phestia bellicostata* (Schwarzbach, 1939) — sample II.

$n$	Stud. type No	$\beta^\circ$	$\xi_\beta$	$\xi^2$	Faunal band
1	63L	24	1,55	2,4025	Koks
2	65P	25,5	3,05	9,3025	Koks
3	72P	24	1,55	2,4025	Koks
4	74L	23	0,55	0,3025	Koks
5	77P	22	-0,45	0,2025	Koks
6	78P	20	-2,45	6,0025	Koks
7	84L	22,5	0,05	0,0025	Koks
8	92P	19	-3,45	11,9025	Roemer's
9	104L	22	-0,45	0,2025	Koks
10	107P	24	1,55	2,4025	Koks
11	115P	21	-1,45	2,1025	Koks
$\Sigma =$		247		37,2275	
$\frac{\Sigma}{n} =$		22,45		3,38	

$$\begin{aligned} A_\beta &= 22^\circ 27' \\ \sigma_\beta &= 1,83 \\ h_\beta &= 16^\circ 58' \div 27^\circ 56' \\ \sigma_{\beta v} &= 1,92 \\ \sigma_{\beta A} &= 0,58 \\ R_\beta &= 20^\circ 43' \div 24^\circ 12' \end{aligned}$$

TABLE XXXV

Table of  $t(v)$  and  $t(t)$  values of the difference between arithmetic means of  $\beta$ .

	Polidevcia gengeli	Polidevcia vašičeki	Polidevcia sharmani	Phestia bellicostata I	Phestia bellicostata II	
$t_v =$	6,21	2,23	1,95	9,58	7,74	Polidevcia attenuata
$t_t =$	2,09	2,09	1,96	2,09		
	$t_v =$ 2,82	6,46	20,1	10,40		Polidevcia gengeli
	$t_t =$ 2,57	1,96	2,23	2,23		
	$t_v =$ 3,8	9,24	6,70			Polidevcia vašičeki
	$t_t =$ 1,96	2,23	2,23			
	$t_v =$ 9,17	7,13				Polidevcia sharmani
	$t_t =$ 1,96	1,96				
	$t_v =$ 0,62					Phestia bellicostata I
	$t_t =$ 2,13					

TABLE XXXVI

Calculation of the arithmetic mean, of the deviations, and of the variability limits of  $\gamma$  in *Polidevicia attenuata* (Fleming, 1828).

$n$	Stud. type No	$\gamma^\circ$	$\xi_\gamma$	$\xi^2$	Faunal band
1	18P	128	-0,06	0,00	Nanetta II
2	26L	124	-4,06	16,48	Františka
3	36P	130	1,94	3,76	Františka
4	55L	130,5	2,44	5,95	Enna
5	59L	133	4,94	24,41	Barbora
6	68P	127	-1,06	1,12	Gabriela
7	71P	120	-8,06	64,96	Nanetta
8	91P	122	-6,06	36,72	Nanetta
9	93P	137,5	9,44	89,11	Nanetta
10	96L	127	-1,04	1,08	Barbora III
11	111P	132	3,94	15,54	Nanetta
12	118P	114,5	-13,56	183,87	Nanetta I
13	129L	121	-7,04	49,56	Nanetta II
14	136L	127	-1,04	1,08	Enna III
15	140P	131	2,94	8,64	Enna
16	141L	135,5	7,44	55,36	Františka
17	157	137	8,94	79,92	Enna
$\Sigma =$		2177,0		637,56	
$\frac{\Sigma}{n} =$		128,06		37,5	

TABLE XXXVII

Calculation of the arithmetic mean, of the deviations, and of the variability limits of  $\gamma$  in *Polidevcia gengeli nov. spec.*

$n$	Stud. type No	$\gamma$	$\xi_\gamma$	$\xi^2$	Faunal band
1	61L	141	8	64	Roemer's
2	89L	124	-9	81	Koks
3	97P	132	-1	1	Nanetta II
4	98P	134	1	1	Roemer's
5	134L	134	1	1	Enna IV
$\Sigma =$		665		148	
$\frac{\Sigma}{n} =$		133		29,6	

TABLE XXXVIII

Calculation of the arithmetic mean, of the deviations, and of the variability limits of  $\gamma$  in *Polidevcia vašíčekii nov. spec.*

$n$	Stud. type No	$\gamma^\circ$	$\xi_\gamma$	$\xi^2$	Faunal band
1	142L	148	7,17	51,4089	Štúr's
2	143L	132	-8,83	77,9689	Štúr's
3	144L	143	2,17	4,7083	Štúr's
4	145P	145	4,17	17,3889	Štúr's
5	146P	132	-8,83	77,9689	Štúr's
6	159P	145	4,17	17,3889	Štúr's
$\Sigma =$		845		246,8334	
$\frac{\Sigma}{n} =$		140,83		41,14	

TABLE XXXIX

Calculation of the arithmetic mean, of the deviations, and of the variability limits of  $\gamma$  in *Polidevcia sharmani* (R. Etheridge jun., 1878).

$n$	Stud. type No	$\gamma^\circ$	$\xi_\gamma$	$\xi^2$	Faunal band
1	2L	125,0	-2,62	6,8644	Nanetta
2	3P	126,0	-1,62	2,6244	Nanetta
3	4L	124,0	-3,62	13,1044	Nanetta
4	21L	127,0	-0,62	0,3844	Nanetta
5	23P	139,0	11,38	129,5044	Nanetta
6	67P	126,0	-1,62	2,6244	Nanetta II
7	70L	120,0	-7,62	58,0644	Nanetta II
8	80P	134,5	6,88	47,3344	Nanetta II
9	81L	113,0	-14,62	213,7444	Nanetta II
10	85P	121,0	-6,62	43,8244	Nanetta II
11	88P	128,0	0,38	0,1444	Nanetta II
12	90P	133,0	5,38	28,9444	Nanetta
13	101P	124,5	-3,12	9,7344	Nanetta II
14	109L	119,0	-8,62	74,3044	Nanetta II
15	117P	121,0	-6,62	43,8244	Nanetta
16	120L	120,0	-7,62	58,0644	Nanetta I
17	124L	114,5	-13,12	172,1344	Nanetta I
18	130L	137,5	9,88	97,6144	Nanetta II
19	131P	138,0	10,38	107,7444	Nanetta II
20	132P	132,0	4,38	19,1844	Nanetta II
21	133L	125,0	-2,62	6,8644	Nanetta II
22	138P	126,0	-1,62	2,6244	Nanetta II
23	139P	127,0	-0,62	0,3844	Nanetta II
24	148P	138,0	10,38	107,7444	Nanetta
25	149L	138,0	10,38	107,7444	Nanetta
26	150P	141,0	13,38	179,0244	Nanetta
$\Sigma =$		3318,0		1534,1544	
$\frac{\Sigma}{n} =$		127,62		59,01	

TABLE XL

Calculation of the arithmetic mean, of the deviations, and of the variability limits of  $\gamma$  in *Phestia bellicostata* (Schwarzbach, 1939) — sample I.

$n$	Stud. type No	$\gamma$	$\xi\gamma$	$\xi^2$	Faunal band
1	9L	118	3,5	12,25	Nanetta
2	43L	113	-1,5	2,25	Nanetta
3	45L	118	3,5	12,25	Nanetta II
4	73L	114	-0,5	0,25	Nanetta
5	94P	113	-1,5	2,25	Nanetta
6	114L	113	-1,5	2,25	Nanetta II
7	156L	110	-4,5	20,25	Nanetta
8	158	117	2,5	6,25	Nanetta
$\Sigma =$		916		58,00	
$\frac{\Sigma}{n} =$		114,50		7,25	

$$\begin{aligned}
 A_\gamma &= 114^\circ 30' \\
 \sigma_\gamma &= 2,69 \\
 h_\gamma &= 106^\circ 26' \div 122^\circ 34' \\
 \sigma_{\gamma v} &= 2,88 \\
 \sigma_{\gamma A} &= 1 \\
 R_\gamma &= 111^\circ 30' \div 117^\circ 30'
 \end{aligned}$$

TABLE XLI

Calculation of the arithmetic mean, of the deviations, and of the variability limits of  $\gamma$  in *Phestia bellicostata* (Schwarzbach, 1939) — sample II.

<i>n</i>	Stud. type No	$\gamma^\circ$	$\xi\gamma$	$\xi^2$	Faunal band	
1	63L	97	-7,1	50,41	Koks	$A_\gamma = 104^\circ 06'$
2	65P	116	11,9	141,61	Koks	$\sigma_\gamma = 6,48$
3	72P	100	-4,1	16,81	Koks	$h_\gamma = 84^\circ 39' \div 123^\circ 35'$
4	74L	102	-2,1	4,41	Koks	$\sigma_{\gamma v} = 6,80$
5	77P	110	5,9	34,81	Koks	$\sigma_{\gamma A} = 2,05$
6	78P	102	-2,1	4,41	Koks	$R_\gamma = 97^\circ 57' \div 110^\circ 25'$
7	84L	95	-9,1	82,81	Koks	
8	92P	115	10,9	118,81	Roemer's	
9	104L	102	-2,1	4,41	Koks	
10	107P	102	-2,1	4,41	Koks	
11	115	104	-0,1	0,01	Koks	
$\Sigma =$		1145		462,91		
$\frac{\Sigma}{n} =$		104,10		42,08		

TABLE XLII

Table of  $t(v)$  and  $t(t)$  values of the difference between arithmetic means of  $\gamma$ .

	Polidevcia gengeli	Polidevcia vašíčekii	Polidevcia sharmani	Phestia bellicostata I	Phestia bellicostata II	
$t_v =$	1,63	4,2	0,20	5,75	9,52	Polidevcia attenuata
$t_t =$	2,09	2,09	1,96	2,09	2,06	
	$t_v =$	1,94	1,45	7,55	8,10	Polidevcia gengeli
	$t_t =$	2,23	1,96	2,23	2,23	
	$t_v =$	3,78	9,63	10,52		Polidevcia vašíčekii
	$t_t =$	1,96	2,23	2,23		
	$t_v =$	4,64	8,41			Polidevcia sharmani
	$t_t =$	1,96	1,96			
	$t_v =$	4,13				Phestia bellicostata I
	$t_t =$	2,13				

Distribution of *Polidevciinae* in the faunal bands of the Ostrava Beds in the Ostrava-Karviná Coal District

ZONE	THE PETŘKOVICE ZONE				THE HRUŠOV ZONE				JAKLOVEC	THE PORNUBA ZONE																		
FAUNAL BAND	ŠTÚRIS	BODDAN	LEONARD	POUSTEVNÍČ	BRUNO I.	BRUNO II.	VITĚZMA	PAVEL	NANETTA I.	NANETTA II.	FRANTIŠKA	ROLAND	OSMANIA	ENNA I.	ENNA II.	ENNA III.	ENNA IV.	BARBORA I.	BARBORA II.	BARBORA III.	BARBORA IV.	GABRIELA	KOKSOVÁ	JINDŘICH	KONTRÁD	LOWER ROEMERS	UPPER ROEMERS	GÄEBLER'S
SPECIES																												
POLIDEVCIA ATTENUATA																												
POLIDEVCIA CENCELI																												
POLIDEVCIA VAŠÍČEKI																												
POLIDEVCIA ČEPEKI																												
POLIDEVCIA SHARMANI																												
PHESTIA BELLICOSTATA																												

TABLE III

**SBORNÍK NÁRODNÍHO MUSEA V PRAZE — ACTA MUSEI NATIONALIS  
PRAGAE**

XVI, 1960 — B (PŘÍRODOVĚDNÝ) No. 1—2

Redaktor ALBERT PILÁT, doktor biologických věd

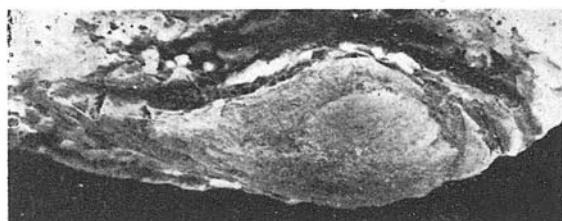
Z. U r b a n: Mikromycety nové pro Československo —  
Micromycetes new for Czechoslovakia

O. K u m p e r a, F. P r a n t l, B. R ů ţ i ć k a:

Revise čeledi Nuculanidae z ostravsko-karvinské pánve (Pelecypoda) —  
Revision of the Nuculanidae from the Ostrava-Karviná District (Pelecypoda)

V březnu 1960 vydalo svým nákladem v počtu 800 výtisků Národní museum v Praze  
Výtiskl Knihtisk 1, n. p., v Praze 1. — Cena brožovaného výtisku 15,— Kčs

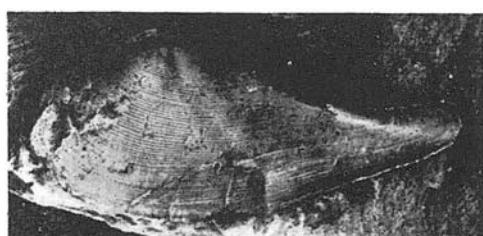
O. Kumpera, F. Prantl & B. Růžička: Revision of the Nuculanidae.



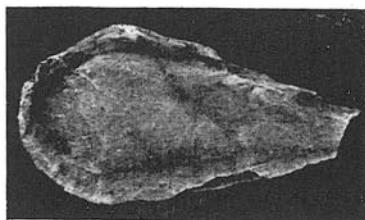
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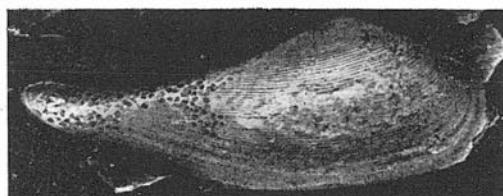
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4



5



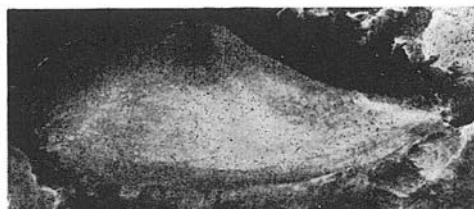
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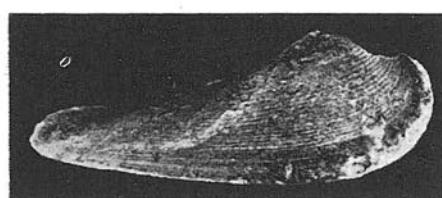
8



9



10



1



2



3



4



5



6



7



8



9



10



11



12

O. Kumpera, F. Prantl &amp; B. Růžička: Revision of the Nuculanidae.

