

西藏晚二迭世几种腕足类化石

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一、緒 言

本文所描述的几种腕足动物化石,是李璞教授等 1952 年在西藏采集的。标本采自珠穆朗瑪峯以北西藏曲背和尊布一带,其地质时代为晚二迭世(图 1)。

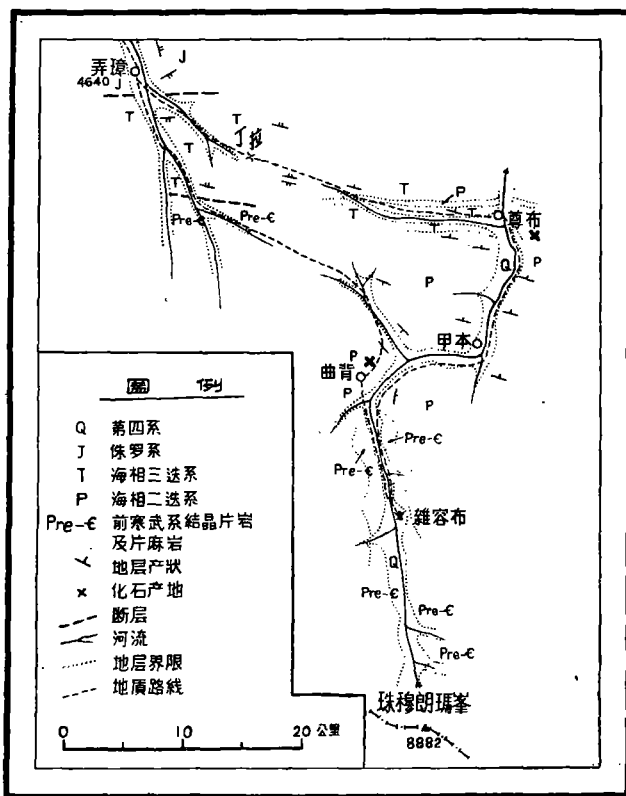


图 1 珠穆朗瑪峯以北地区化石产地及路線图(据李璞等)

根据李璞等的資料,在沿杂嘎曲河谷两岸曲背至尊布一带,二迭系露出較好。地层的主要走向近东西偏北,傾斜向北,傾角平緩,一般在 20° 左右。此处二迭系按岩性可划分为四层,层序自上而下如次(图 2):

4. 棕灰色泥灰岩及深灰色石灰岩,富产腕足动物化石,化石多被挤压而扭曲;
3. 黑色頁岩、石英砂岩或砂岩互层;
2. 褐色砂岩、黑色頁岩夹砂质石灰岩;砂质灰岩中产腕足动物化石;
1. 黑色頁岩与砂岩,頂部为黑色石灰岩。

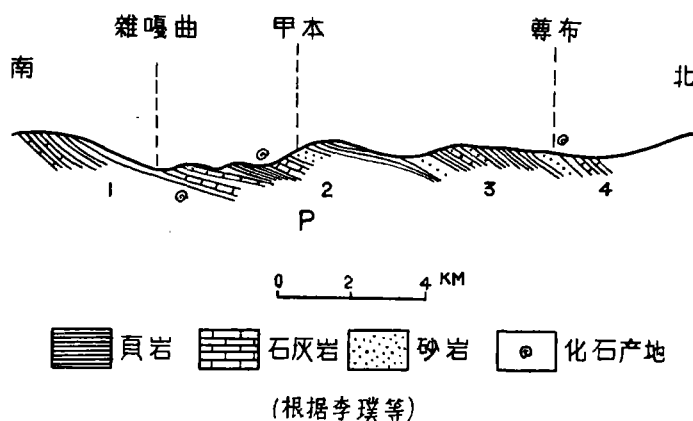


图 2 珠穆朗瑪峯以北由曲背至尊布沿杂嘎曲河谷上二迭統剖面图

这套地层总厚达 1,600 米, 上部渐变为三迭紀砂頁岩, 下部与老地层成不整合接触。本文描述的腕足动物化石計 5 属 8 种, 列举如下:

Neospirifer moosakhailensis (Davidson)

Neospirifer kübeiensis sp. nov.

Neospirifer tibetensis sp. nov.

Spiriferella salteri Tschernychew

Dictyoclostus cf. *indica* (Waagen)

? *Dictyoclostus* sp. indet.

Buxtonia sp.

Schellwienella acutangula Huang

这些属种中 *Neospirifer moosakhailensis*, *Spiriferella salteri*, *Dictyoclostus indica* 等, 曾发现于盐岭地区; 前二者見于內蒙哲斯羣。后者与 *Schellwienella acutangula* Huang 曾見于华南的乐平組。动物羣的总貌应属于晚二迭世。

笔者感謝李璞教授等贈送标本进行研究; 尹贊勛教授、楊遵儀教授热心的指导并閱讀原稿; 魯巨川工程师繪制图件, 景式范技术員摄制图版。

二、种的描述

石燕貝目 *Spiriferida* Moore, 1952

石燕貝超科 *Spiriferacea* King, 1846

石燕貝科 *Spiriferidae* King, 1846

石燕貝亚科 *Spiriferinae* King, 1846

新石燕属 *Neospirifer* Fredericks, 1919

漠沙海新石燕 *Neospirifer moosakhailensis* (Davidson) emend.

(图版 I, 图 1—6)

1862 *Spirifer moosakhailensis*, Davidson, Quart. Journ. Geol. Soc. London, Vol. XVIII, p. 28, pl. II, fig. 2.

1883 *Spirifer musakhaylensis*, Waagen, Palaeont. Indica, Ser. XIII, Vol. I, Pt. 4, p. 512, pl. XLV, figs.

1—6.

1897 *Spirifer musakheylensis*, Diener, *ibid.* Ser. XV, Vol. I, Pt. 4p. 63, Pl. V, figs. 1—5.

1931 *Spirifer moosakhailensis*, Grabau, Nat. Hist. Cent. Asia, Vol. IV, p. 168, pl. XXIII, figs. 5—9.

1941 *Neospirifer moosakhailensis*, Muir-Wood, Palaeont. Indica, New ser. Vol. 31, Memoir 1, p. 30, pl. II, figs. 12—13.

材料：代表本种的标本有六块，但全是腹瓣。标本保存不十分完整，壳饰保存程度也不一致。有的壳饰清楚，有的因遭受风化而剥落了最外层壳饰。

描述：壳体外形呈斜方圆形或菱形。IGAS, 3602 标本测量，腹瓣高 60 毫米，宽 90 毫米，厚 23 毫米，铰合线为壳的最大宽度。

腹瓣中等程度凸起。基面宽，上面生有横纹。喙尖小，向内弯，并高出基面之上，喙下有三角孔，三角孔宽大，底边大于侧边。中槽发育，始于喙顶，向前约 1 厘米处开始逐渐变宽，至最前缘中槽宽达 35 毫米，槽底尖角状。腹壳表面具粗放射壳线，壳线自喙顶开始，经三次分叉构成束状组合。自中槽中线观察，两侧区各有五个放射束。中槽中线为一条较粗的壳线。最近中线的一对放射束向前衰退，成次一级的放射束，与第二对放射束共同构成中槽的侧壁。其他各束有时因分叉成次一级放射束。束脊为尖角状，束间隔以尖深的沟。每个放射束经第二次分叉后，有 6—8 条壳线，至前缘各线再分枝成 12—14 条壳线，但所有壳线并不完全都多次分叉，故前部每束放射线的数目不等。壳面密布同心生长壳层，愈近前缘愈显著。

内部构造：经过切片观察，腹瓣牙板粗强，长达 20 毫米，宽 5 毫米（参看图 5）。

讨论：当前的标本与盐岭地区的标本，在外形轮廓、壳饰、主要放射束数目、宽大基面以及宽阔三角孔等方面都完全相同。瓦根(Waagen, 1883)指出后者的基本特征是壳面上密布同心生长壳层，在前缘呈显著的迭瓦状排列。我们西藏的标本也具同样的特征。所不同的是西藏的标本，成年个体上较盐岭地区的还大些；放射束更宽大显著，放射褶强，放射束凸起。此外补述了腹瓣的内部构造。

产地和层位：西藏曲背和尊布(珠穆朗玛峰以北)，上二迭统。

登记号：IGAS. 3585, 3595, 3593, 3550, 3583；采集号：F 5006, 5013, 5007, 5001.

曲背新石燕(新种) *Neospirifer kübeiensis* Ting (sp. nov.)

(图版 II, 图 1—3)

材料：代表本种的标本有三块。腹瓣保存比较完整，背瓣仅保留后部。但标本受了挤压，基面变狭窄。

描述：个体很大，外形横宽。铰合线为壳的最大宽度。腹瓣强凸。基面因挤压而变成线状，三角孔也因挤压而看不到。喙向内弯。中槽很宽大，始于喙顶，向前显著增宽，中槽前缘宽达 45 毫米，放射束特别粗强，中槽两侧各有四个主要放射束。每束的后部有五或六条壳肋，向前再分叉成 12—14 条。槽底钝角状，槽内有 32—36 条壳肋(图 3)。束顶钝角状，束间亦以钝沟分开。壳面有同心迭瓦状壳层，近前缘部特别显著。

腹瓣(IGAS. 3602)测量：高 58 毫米，宽 95 毫米，厚 25 毫米。

背瓣由残留部分观察，其壳饰特征与腹瓣相同。

腹瓣内部构造与下文所描述的 *Neospirifer tibetensis* 种相同。

討論：本新种在壳体輪廓、鉸合綫长等方面与 *Neospirifer moosakhailensis* (Davidson) 相似。它与后者不同之点是个体巨大，放射束粗強，每个放射束所具的壳綫較多，中槽更加寬闊，槽內壳綫数目也多，槽底和束頂角鈍。

产地和层位：西藏曲背(珠穆朗瑪峯以北)，上二迭統。

共型标本登記号：IGAS. 3602, 3592；采集号：F 5014。

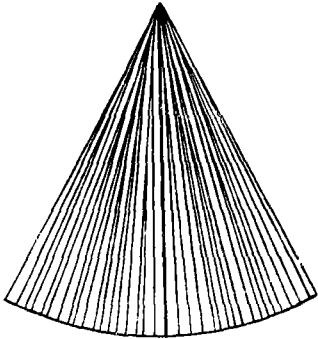


图 3 曲背新石燕中槽壳綫分布示意图

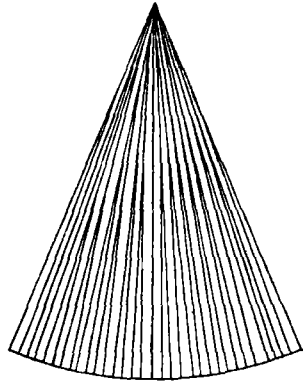


图 4 西藏新石燕中槽壳綫分布示意图

西藏新石燕(新种) *Neospirifer tibetensis* Ting (sp. nov.)

(图版 II, 图 4—5)

材料：代表本种的标本有三块。腹瓣保存完整，背瓣殘留喙部和部分中隆。

描述：个体很大，外形半圓。鉸合綫短于壳的最大寬度。

腹瓣高凸，基面寬，略內弯，基面上生有橫紋。鉸合綫直，短于壳的最大寬度。喙部高突；喙頂尖向內弯，略高于基面之上。喙下有寬大三角孔，底边大于側边。腹瓣縱向凸度較橫向为大。中槽十分发育，始于喙頂，向前逐渐变寬。槽底半稜角状，前緣向背方延伸。中槽中綫为一条較粗壳綫。两侧区在后部观察各有四个放射束。最近中綫的一对放射束至壳的前部退化成次一級的放射束。在前緣此束趋向消失，与第二对放射束共同构成中槽的側壁。故在前緣看，側区只有三个主要放射束。束脊半稜角状至鈍角状。翼区放射束寬大，脊束低凸，鈍角状。每个束在中部经过第二次分叉后，有 6—8 条壳綫，至前部各綫再分叉而成 12—16 条。但在前部多半是两条壳綫密生在一起；有时分枝現象不显著，壳綫即加粗。中槽前緣寬 40 毫米；包括壳綫 32 条(图 4)。

背瓣由殘存部分观察，背喙高突出鉸合綫之上，喙頂尖向对方弯曲。中隆高聳，后部两侧各有壳綫 12 条。

腹瓣內部构造：經切片观察，壳层很厚，喙部通常厚 15 毫米，前部厚达 10 毫米，牙板自三角孔壁側生长，牙基粗強，牙亦肥大，长达 20 毫米，前部寬达 5 毫米(图 5)。

IGAS. 3609 腹瓣的測量：鉸合綫长 72 毫米，壳寬 79 毫米，壳高 53 毫米，壳厚 25 毫米，基面高 12 毫米。

討論：本新种的主要特征是：鉸合綫短于壳的最大寬度，外形輪廓为半圓形，中槽寬闊，側区有四个主要放射束。而以鉸合綫短于壳的最大寬度为本新种的突出特点。

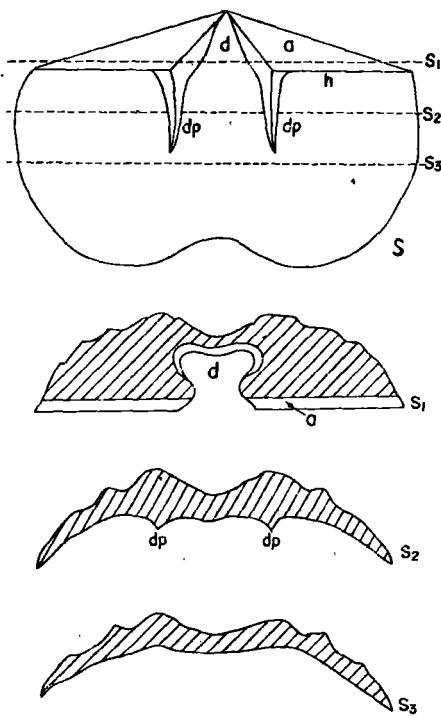


图 5 西藏新石燕腹瓣内部构造及横切面图

S——根据 S₁, S₂, S₃ 横切面西藏新石燕内部构造再造图 S₁ 断面距喙顶 10 毫米; S₂ 断面距喙顶 20 毫米; S₃ 断面距喙顶 30 毫米 a, 基面; d, 三角孔; h, 铰合线; dp, 牙板

产地和层位：西藏曲背和尊布(珠穆朗玛峰以北), 上二迭统。

正型标本登记号: IGAS. 3609, 3587; 采集号: F5023, 5001.

为了便于识别上述三个种的异同, 列表如下:

特 点 \ 种 名	漠 沙 海 新 石 燕 <i>Neospirifer moosakhailensis</i>	西 藏 新 石 燕 <i>Neospirifer tibetensis</i>	曲 背 新 石 燕 <i>Neospirifer kübeiensis</i>
个体度量	高 60 毫米, 宽 90 毫米, 厚 23 毫米	高 53 毫米, 宽 79 毫米, 厚 25 毫米	高 58 毫米, 宽 90—95 毫米, 厚 25 毫米
铰合綫长	90 毫米	72 毫米	95 毫米
主要放射束数目	5 条	4 条	4 条
前缘中槽宽	35 毫米	40 毫米	45 毫米
中槽内壳綫数目	28 条	32 条	32—36 条
槽底束頂形状	稜角状—半稜角状	半稜角状—鈍角状	鈍角状

小石燕属 *Spiriferella* Tschernyschew, 1902
薩尔小石燕 *Spiriferella salteri* Tschernyschew

(图版 III, 图 2a—c)

1902 *Spiriferella salteri*, Tschernyschew, Mém. Com. Geol. Russe, Vol. XIV, No. 2, p. 528, pl. XII, figs. 5—6.

1955 *Spiriferella salteri*, 王钰, 中国标准化石, 第二分册, 頁 166, 图版 99, 图 5—7.

材料: 仅有一块标本,而且只保存后部,前部断去。

描述: 双凸形。铰合綫短于壳的最大寬度。腹瓣极度凸起。喙高起,向内弯。基面高突,并成拱状弯曲,构成 90 度或更大的弧度。喙下有三角孔。中槽自喙頂开始,向前扩大,两侧界以粗放射肋,槽中具放射肋,两侧全复粗放射肋,部分分叉。背瓣如腹瓣一样高凸,背喙亦向内弯,中隆自喙頂开始,向前扩大,其上具放射肋,两侧壳飾如腹瓣。

討論: 葛利普 (Grabau, 1931)曾根据本种在中槽中有无放射肋、肋多或少、简单或复杂,分成四个变种。当前的标本不完整,不能确定中槽中放射肋的数目,不能判断它究属于那一个变种。

产地和层位: 西藏曲背,上二迭統。

登記号: IGAS. 3598; 采集号: F5012。

长身貝目 *Productida* Sarycheva et Sokolskaja, 1959

长身貝超科 *Productacea* Waagen, 1883

网格长身貝科 *Dictyoclostidae* Stehli, 1954

网格长身貝属 *Dictyoclostus* Muir-Wood, 1930

印度网格长身貝 *Dictyoclostus* cf. *indica* (Waagen)

(图版 III, 图 1a, b)

1862 *Productus costatus*, Davidson, Quart. Jour. Soc. London, Vol. XVIII, p. 31, pl. 1, figs. 20—21.

1884 *Productus indica*, Waagen, Palaeont. Indica, Ser. XIII, Pt. 4, Fasc. 4, p. 683, pl. 70, fig. 1.

材料: 只有一块标本,保存不够完整,遭受挤压。

描述: 壳体中等大小,外形近圓形或橫橢圓形。

腹瓣強凸,縱橫向凸率相似。铰合綫直长,为壳的最大寬度。耳大,端鈍。喙小而尖,向内弯越过铰合綫。近喙頂中槽开始发育,延伸向前。后部具同心綫与放射綫,成网格状組合。前延部仅具放射肋,粗強圓滑,分布不甚規則,有时两条或三条合并成一条。尤其在中槽中部,数条放射肋收斂于一点,其他相邻的放射綫繼續向前,并代替已收斂放射綫的空間位置。壳面尚有分布不規則的壳刺。

背瓣特征不詳。

产地和层位: 同前。

登記号: IGAS. 3584; 采集号: F5088。

? 网格长身貝 ?*Dictyoclostus* sp. indet.

(图版 III, 图 3a—d)

材料: 代表本未定种的标本只有一块背瓣。此背瓣仅保存了其最外层壳层,内部壳层及内部肌痕完全剝落。因此这块背瓣的壳飾与其外模相同。

描述: 根据这块外层背瓣观察,体腔盘平坦,两侧略凸,中部略凹,前延部膝状弯曲。壳寬大于高,外形呈橫方形。背基面甚狹,近綫状,铰合綫直,为壳的最寬处。主突起殘存。壳面飾以清晰的同心皺与放射肋。同心皺仅在体腔盘內发育,与放射肋組成网格状壳飾。前延部密布波状同心生长紋。壳肋在后部較細,越过体腔盘則显著变粗。在中綫

的两侧,有两对壳綫汇合于体腔盘的边缘;其近中綫的壳肋分別向中綫放射,并代替已消失的壳肋的空間位置;近两侧的壳肋則分別向外放射。故以中綫为界,側区各成一个扇形分布的壳肋。

討論：根据背瓣壳飾的特征,可以推知腹瓣壳飾也呈双扇状分布的壳肋。这种特征在长身貝中是少見的。可惜标本不足,不能充分正确鉴定,仅将其特征記載如此。

产地和层位：同前。

登記号：IGAS. 3588; 采集号：F5002。

輪刺貝科 *Echinoconchidae* Stehli, 1954

波斯通貝属 *Buxtonia* Thomas, 1914

波斯通貝 *Buxtonia* sp.

(图版 IV, 图 1—2)

材料：两块不完整的腹瓣內模,两耳和前部断去。其中一块标本的側部保留了部分壳飾。

描述：个体較大,长 65—70 毫米,寬 60—70 毫米;外形近圓五角形。由这块內模观察,腹瓣強凸,喙部尖而向內弯曲。壳頂較窄,喙部两侧平凹,前部壳面凸度均匀,側部壳面亦凸起。中槽浅平,始于壳頂附近,向前增寬。壳綫圓凸,若断若續,其上保留圓形的刺基。

腹瓣內部在中槽中距喙頂直距約 20 公分处,有寬約 0.3 公分、長約 1 公分的閉筋痕,在閉筋痕的外側稍前处,有寬約 0.5 公分、長約 1 公分的开筋痕;前者成狹长卵状,后者为卵圓状。在后部两侧生有若干纖維状或綫状脉痕。

比較：根据这几块內模标本观察,个体发育的大小和外形可以与青海德令哈巴音河地区所产的 *Buxtonia costataconcentrica* 种相比較。

产地和层位：同前。

登記号：IGAS. 3499, 3515; 采集号：F5001。

扭月貝目 *Strophomenida* Moore, 1952

直形貝超科 *Orthotetacea* Williams, 1953

直形貝科 *Orthotetidae* Waagen, 1884

帅尔文氏属 *Schellwienella* Thomas, 1914

銳角帅尔文氏貝 *Schellwienella acutangula* Huang

(图版 IV, 图 3a—b)

1933 *Schellwienella acutangula*, Huang, Palaeont. Sinica, Ser. B, Vol. IX, Fasc. 2, p. 24, pl. III, figs. 12—18.

材料：代表本种的标本只有一块比較完整的腹瓣。

描述：个体較大,寬約 55 毫米,高約 45 毫米。外形橫长,近半圓形。腹瓣后部略凹,前部略凸。喙甚小,尖凸。基面矮三角形,頂角 170° ,基面陡斜,鉸合綫为壳的最大寬度。喙下有凸起的三角板,在此板的两侧有副三角板。壳面飾有細的、均匀的壳綫,向前多次

插生而壳綫增多。在前部每 5 毫米内有壳綫 7—8 条。此外有显著的同心皺层,将壳面分成不等距的同心皺痕。

腹瓣内部有粗短牙板,自三角板底边两端左右分开。

比較: 当前的标本与貴州 *Leptodus nobilis* 层所产的完全相同,唯个体較大。

产地与层位: 同前。

登記号: IGAS. 3610; 采集号: F5006。

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SOME UPPER PERMIAN BRACHIOPODS FROM TIBET

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(Summary)

The few brachiopods treated here were collected in 1952 by Prof. Lee Pu from the Permian deposits in Kübei and Tsunbu districts, north of the noted Mount. Jolmolungma, Tibet. According to Prof. Lee Pu, the Permian deposits there are well exposed, striking about 270 degrees and dipping north with an angle of 20 degrees. They may be divided into four divisions, described in descending order as follows:

- (4) Brownish gray argillaceous limestone and dark red limestone rich in brachiopods which are compressed and distorted;
- (3) Black shale interbedded with quartzite and sandstone;
- (2) Pale purple sandstone, black shale intercalated with sandy limestone containing brachiopoda;
- (1) Black and sandstone with limestone in the uppermost part.

These four divisions amount to 1,600—1,650 meters thick. They lie unconformable on schists, slates and gneisses, but pass imperceptible into the Triassic sandstones.

The Brachiopoda described in this paper consist of 8 species in 5 genera as given below:

Neospirifer moosakhailensis (Davidson) emend.

Neospirifer kübeiensis sp. nov.

Neospirifer tibetensis sp. nov.

Spiriferella salteri Tschernychew

Dictyoclostus cf. *indica* (Waagen).

?*Dictyoclostus* sp. indet.

Buxtonia sp.

Schellowienella acutangula Huang

Among these species *Neospirifer moosakhailensis* (Davidson), *Spiriferella salteri* Tschernychew, *Dictyoclostus indica* (Waagen) have been reported from the Salt-Range, the first two species also from the Jisu Honguer formation of Inner Mongolia, while the last one and *Schellowienella acutangula* Huang are known from Kueichou, South China. As a whole they indicate an Upper Permian age.

DESCRIPTION OF SPECIES

Genus *Neospirifer* Fredericks, 1919

Neospirifer moosakhailensis (Davidson) emend.

(Pl. I, Figs. 1—6)

1862 *Spirifer moosakhailensis*, Davidson, Quart. Journ. Geol. Soc. London, Vol. XVIII, p. 28, pl. II, fig. 2.

- 1883 *Spirifer musakheylensis*, Waagen, Palaeont. Indica, Ser. XIII, Vol. I, Pt. 4, p. 512. pl. XLV, figs. 1—6.
 1897 *Spirifer musakheylensis*, Diener, *ibid.* Ser. XV, Vol. I, Pt. 4, p. 63, pl. V, figs. 1—5.
 1931 *Spirifer moosakhailensis*, Grabau, Nat. Hist. Cent. Asia, Vol. IV, p. 168, pl. XXIII, figs. 5—8.
 1941 *Neospirifer moosakhailensis*, Muir-Wood, Palaeont. Indica, New Series, Vol. 31, Memoir 1, p. 30, pl. II, figs. 12—13.

Description: The shell is of transversely subrhomboidal outline with a hingeline equals to the greatest breadth of the valve.

Pedicle valve moderately convex, ventral area is of moderate width and the umbonal region projects beyond the hingeline; beak pointed and incurved, with a broad delthyrium below it. The sulcus is broad, beginning at the beak and gradually widening towards the front; its bottom tends to be sharply angular. The whole shell surface is marked by radial fasciculate ribs with five bundles of plications on each flank and each bundle consists of 6—8 ribs. The median pair of bundles originating from the umbonal region being faintly developed towards the front, giving rise to secondary bundles of plications which mark the sulcal flanks; the other bundles sometimes divided into minor bundles of ribs, give to the valve the appearance of a double fasciculate plications. The shell surface is closely intersected by a great number of sharp, projected, concentric growth-laminae.

The interior of the ventral valve is marked by a pair of stout dental lamellae having a length of 20 mm.

Discussion: Our specimens are identified with Waagen's species originally described from Salt-Range. According to Waagen this species is characterized by numerous close-set growth lamellae arranged over both valves. Besides, there appear near the margin of the shell some irregular but strongly developed imbricated growth-lamellae which are well shown on our specimens from Tibet. Our specimens however are larger and marked by more and larger bundle of plications.

Locality and Horizon: Specimens collected from Tsunbu and kübei districts, north of the Mount. Jolmolungma, Tibet; Upper permian in age.

Cat. Nos. IGAS. 3585, 3595, 3593, 3550, 3583; Col. Nos. F5006, 5013, 5007, 5001.

***Neospirifer kübeiensis* Ting (sp. nov.)**

(Pl. II, Figs. 1—3)

Description: Shell larger than *Neospirifer moosakhailensis* and more transverse in outline. A typical specimen has a breadth of 90—95 mm and a length of 58—60 mm. The median sulcus and fold are much broader than that of the proceeding form, their anterior margin widening at about 45 mm. The bundle of plications are coarser and more convex than those of *Neospirifer moosakhailensis*. There are four bundles of plications on each side of the sulcus. Both the top of the bundles and the bottom of the sulcus are obtus. Each bundle consists of 5—6 coarse ribs near the posterior part and 30—36 ribs in the sulcus near its margin. The concentric, imbricating growth-lamellae are more prominent at the anterior part of the shell. The measurements of the shell are given below:

Height of pedicle valve	58—60 mm.
Width of pedicle valve	90—95 mm.
Length of interarea	95 mm.

Internal structure is identical to that of *Neospirifer tibetensis*.

Discussion: The present new species is readily distinguished from the preceding form by the larger and transverse form, coarse and projected bundles of plications as well as the more developed sulcus.

Occurrence: Specimens found in Kübei district, north of the Mount. Jolmolungma; Upper Permian in age.

Syntypes: Cat. Nos. IGAS. 3602, 3592; Col. No. F5014.

***Neospirifer tibetensis* Ting (sp. nov.)**

(Pl. II, Figs. 4—5)

Description: Shell of large size and semi-circular in outline with a hingeline shorter than the greatest width.

The pedicle valve is very convex, more convex in longitudinal direction than the transverse one, its umbonal region projecting beyond the hingeline; beak pointed and incurved. Interarea very broad and marked by numerous horizontal striations and divided medially by an broad delthyrium. The sulcus is very prominent commencing from the beak and gradually widening towards the front, its bottom is subangular. The entire surface is marked by radial fasciculate ribs. The meadian line of sulcus is a coarse rib not bifurcated; and four bundles of plications appearing on each side of the median line. The median pair of bundles is faintly developed towards the front and gives to rise a second pair of bundles occupying each flank of the sulcus-All the other lateral bundles are similarly marked. Each main bundle of plications has 6—8 ribs at the posterior half and 12—16 ribs stemming from bifurcation near the anterior part; there are 32 ribs in the sulcus. The whole shell surface is further intersected by numerous concentric imbricating lamellae of growth. The measurements of ventral valve (IGAS. 3609) are as follow:

Lengh of hingeline	72 mm.
Width of pedicle valve	79 mm.
Height of pedicle valve	53 mm.
Thickness of pedicle valve	25 mm.

The interior of the pedicle valve is provided with a pair of stout dental plates which measures 20 mm in length and 5 mm in width.

Discussion: The present new form differs from the preceding species in its shorter hingeline and semi-circular outline. The shorter hingeline is a diagnostic feature of this new species.

Comparison of the three species is given in the following table:

Species	<i>Neospirifer moosakhailensis</i>	<i>Neospirifer tibetensis</i>	<i>Neospirifer kübeiensis</i>
Characters			
Dimensions of pedicle valve	Height 60mm., Width 90mm., Thickness 23mm.	Height 53mm., Width 79mm., Thickness 25mm.	Height 58mm., Width 90—95mm., Thickness 25mm.
Length of hingeline	More than 90mm.	72mm.	More than 95mm.
Numbers of main bundles	5	4	4
Marginal width of sulcus	35mm.	40mm.	45mm.
Numbers of costae in sulcus	28	32	32—36
Shape of bundles of plications	Acute—subangular	Subangular—obtuse	Obtuse

Locality and Horizon: The species occur in Kübei and Tsunbu districts, north of the Mount. Jolmolungma, Tibet; Upper Permian in age.

Holotypes: Cat. Nos. IGAS. 3609, 3587; Col. Nos. F5023, 5001.

Genus *Spiriferella* Tschernyschew, 1902

***Spiriferella salteri* Tschernyschew**

(Pl. III, Figs. 2a—c)

1902 *Spiriferella salteri*, Tschernyschew, *Mém. Com. Geol. Russe*, Vol. XVI, No. 2, p. 528, pl. XII, figs. 5—6.

1955 *Spiriferella salteri*, Wang, *Index Fossils of China, Invertebrate*, Vol. II, p. 166, pl. LXXXXIX, figs. 5—7.

Description: The shell is biconvex with hingeline much shorter than the greatest width. The interarea is highly projected and arched describing an arc of 90 degrees or more, and is divided medially by a narrow delthyrium. The sulcus begins at the beak and is bounded by strong and rounded plications and ribs on either sides.

The brachial valve is also extremely convex marked by rounded radial plications. The fold begins at the beak and enlarges forward by a bundling plications. Near the umbonal region there are 6 radial ribs on each side of fold.

Discussion: The present species is represented by only one incomplete specimens.

Occurrence: Found in the same locality and horizon as the preceding species.

Cat. Nos. IGAS. 3598; Col. No. F5012.

Genus *Dictyoclostus* Muir-Wood, 1930

***Dictyoclostus* cf. *indica* (Waagen)**

(Pl. III, Figs. 1a—b)

1862 *Productus costatus*, Davison, *Quart. Journ. Soc. London*, Vol. XVIII, p. 31, pl. I, figs. 20—21.

1884 *Productus indica*, Waagen, *Palaeont. Indica*, Ser. XIII, Pt. IV, Fasc. 4, p. 683, pl. 70, fig. 1.

Description: Shell of moderate size having a rounded or somewhat transversely oval outline. Ventral valve is very strongly convex in the longitudinal as well as in the transverse direction. The ears large and marking about the greatest breadth of the shell. The beak is pointed, incurved, not much prominent and curved over but very little the hingeline. A strong and deep sulcus commences very near to the apex and extends down to the front. The posterior part of the shell is marked with reticulate pattern of tubercles formed by intersecting costae and concentric wrinkles; the anterior part is ornamented only with high, rounded, grandish costae. In the sulcus several ribs often disappear entirely while others converge towards the front to take up the place of those that have disappeared.

Locality and Horizon: The same as the former species.

Cat. Nos. IGAS. 3584; Col. No. F5088.

? *Dictyoclostus* sp. indet.

(Pl. III, Figs. 3a—d)

Description: There is but one exfoliated brachial valve with its internal muscular impressions almost stripped off, and the cardinal process only partial preserved.

The brachial valve is plano-convex, sharply geniculate with the visceral area, hinge-line straight, lineal and marking the greatest width of the valve. The ears are large and prominent forming an acute angle at the cardinal extremities, marked off from the remainder of the valve by a concavity. The surface sculpture consists of numerous stout costae and prominent concentric wrinkles, the latter but developed in the visceral disc while only coarse costae at the anterior part. Near the median line two pairs of ribs converge and entirely disappear but the others diverge towards the front to take the place of those that have disappeared. The costae near the middle line of the valve radiate inwards: while those at the lateral position radiate outwards, thus assuming a fan-shape at both slopes.

Remarks: As the material is scanty, no specific identification is possible.

Occurrence: The one species obtained from Kübei district, north of the Mount. Jolmolunma, Tibet. Upper Permian in age.

Cat. Nos. IGAS 3588; Col. No. F5002.

Genus *Buxtonia* Thomas, 1914

Buxtonia sp.

(Pl. IV, Figs. 1—2)

Description: Shell of large size, rotundato-quadrata in outline. Length 65—70 mm, breadth 60—70 mm.

Pedicle valve very strongly and regularly inflated. Beak pointed and incurved. The umbonal slopes and main flanks are somewhat steep. Hingeline straight. Not far from the beak commences the shallow but broad median sulcus which becomes more pronounced upon the anterior part of the shell.

Shell ornamentation almost exfoliated, which only a little portion of the flank marked by a spine and several costae.

Internally, there are some oval muscular impressions at the posterior part.

Locality and Horizon: The same as the former.

Cat Nos. 3499, 3515; Col. No. F5001.

Genus *Schellwienella* Thomas, 1914

Schellwienella acutangula Huang

(Pl. IV, Figs. 3a—b)

1933 *Schellwienella acutangula*, Huang, Palaeont. Sinica, Ser. B, Vol. IX, Fasc. 2, p. 24, pl. III, figs. 12—18.

Description: Shell above medium size, transverse and characterized by mucronate cardinal angles with the hingeline making the greatest width of the shell. The ventral cardinal area is rather low, steeply inclined and medially by a slightly arched deltidium and a perideltidial Plate elevated slightly above the plane of the lateral part of the cardinal area. Pedicle valve slightly concave at the posterior part and slightly convex at anterior margin. Shell surface marked by fine, regularly radiating striae which increase in number by intercalation, 7—8 of them may occur in a space of 5 mm. near

the anterior. The surface is further ornamented by several strong growth interruptions or wrinkles which are of unequal strength and are space at unequal intervals.

Internally, there are two straight diverging dental lamellae below the deltidium, this undoubtedly represent characteristic of the genus *Schellwienella*.

Occurrence: The same as the former.

Cat. Nos. IGAS. 3610; Col. No. F5006.

图 版 說 明

所有图版均系原大,标本儲存于中国科学院地質研究所。景式范同志摄影。

图 版 I

图 1—6. *Neospirifer moosakhailensis* (Davidson)

1, 腹視,放射束頂脊尖銳和次級束发育的情形,左下角附有 *Spiriferella* sp.的腹瓣。2—3, 腹視,示发育的同心生长壳层。4—5, 腹視,示幼年个体放射束发育的情形。图 6, 后視。示寬基面和寬三角孔。

登記号: IGAS. 3585, 3595, 3593, 3550, 3583。

Explanation of plates

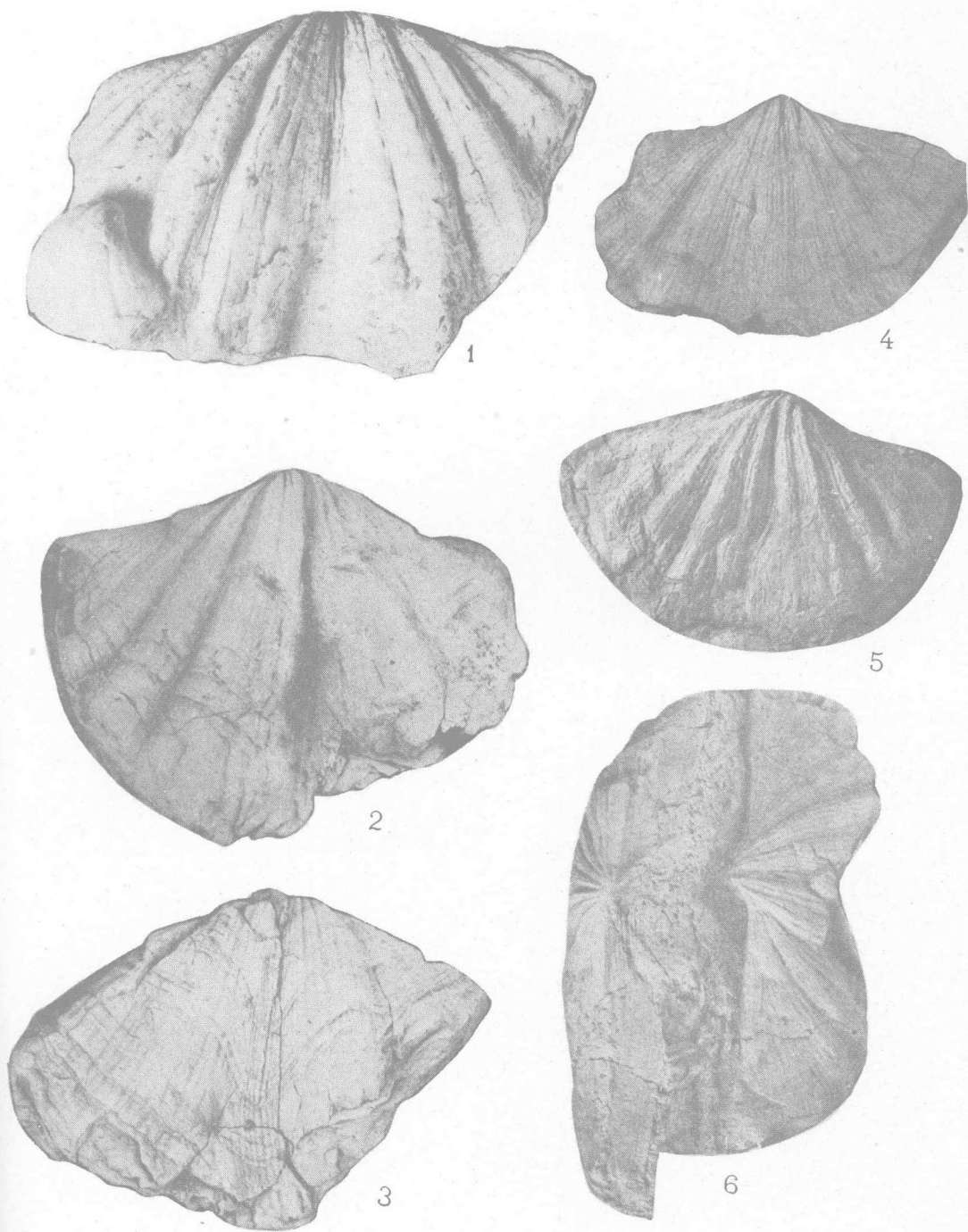
All the figures are of natural size; specimens are kept in the Institute of Geology, Academia Sinica. Poto. by Mr. Ching Shis-fan.

Plate I

Figs. 1—6. *Neospirifer moosakhailensis* (davidson)

1, Ventral view, showing the main and secondary bundles of plications, a ventral valve of *Spiriferella* sp. on the left-lower corner; 2—3, Ventral view, showing the concentric imbricating growth lamellae; 4—5, Ventral view, showing shell ornamentations of young individuals; 6, Posterior view, showing the wide cardinal area and large, broad delthyrium in pedicle.

Cat. Nos. IGAS. 3585, 3595, 3593, 3550, 3583.



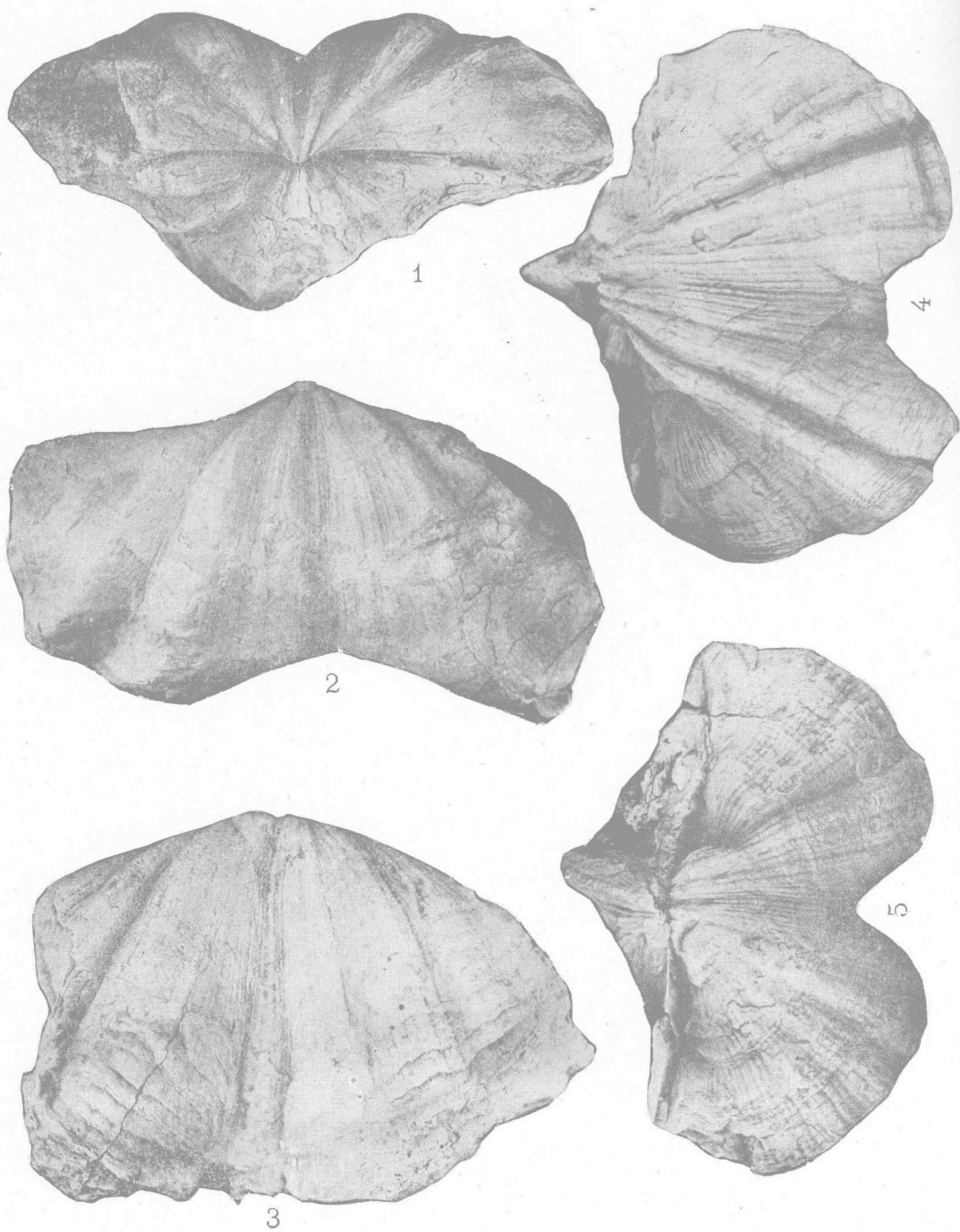


图 版 II

图 1—3. *Neospirifer kūbeiensis* Ting (新种)

1, 后视, 基面因受挤压而变狭窄。2, 同一标本的腹视, 示粗强的放射束。3, 腹视, 示前缘发育的同心生长壳层及粗强宽大的放射束。

共型标本, 登记号: IGAS. 3602, 3592。

图 4—5. *Neospirifer tibetensis* Ting (新种)

4—5, 腹视及扭曲的背喙。

正型标本, 登记号: IGAS. 3609, 3587。

Plate II

Figs. 1—3. *Neospirifer kūbeiensis* Ting (sp. nov.)

1, Posterior view, valves compressed, area very narrow; 2, Ventral view of the same shell, showing the much coarser and more strong bundles; 3, Ventral view, showing the concentric growth lamellae developed at the margin.

Syntypes: Cat Nos. IGAS. 3602, 3592.

Figs. 4—5, *Neospirifer tibetensis* Ting (sp. nov.)

4—5, Ventral view and distorted brachial remains.

Holotypes: Cat. Nos. IGAS. 3609, 3587.

图 版 III

图 1a—b. *Dictyoclostus* cf. *indica* (Waagen)

1a, 腹视, 1b, 后视; 标本受挤压而扭曲。

登记号: IGAS. 3584.

图 2a—c. *Spiriferella salteri* Tschernyschew

2a, 腹视, 2b, 后视; 示强烈弯曲的喙部和拱状基面。 2c, 侧视。

登记号: IGAS. 3598.

图 3a—d. ? *Dictyoclostus* sp. indet.

3a, 背视; 示特殊的双扇状分布的放射肋; 3b 前视; 3c 后视; 3d 侧视。

登记号: IGAS. 3588.

Plate III

Figs. 1a—b. *Dictyoclostus* cf. *indica* (Waagen)

1a, Ventral view, 1b, Posterior view; shell distorted. Cat. No. IGAS. 3584.

Figs. 2a—c. *Spiriferella salteri* Tschernyschew

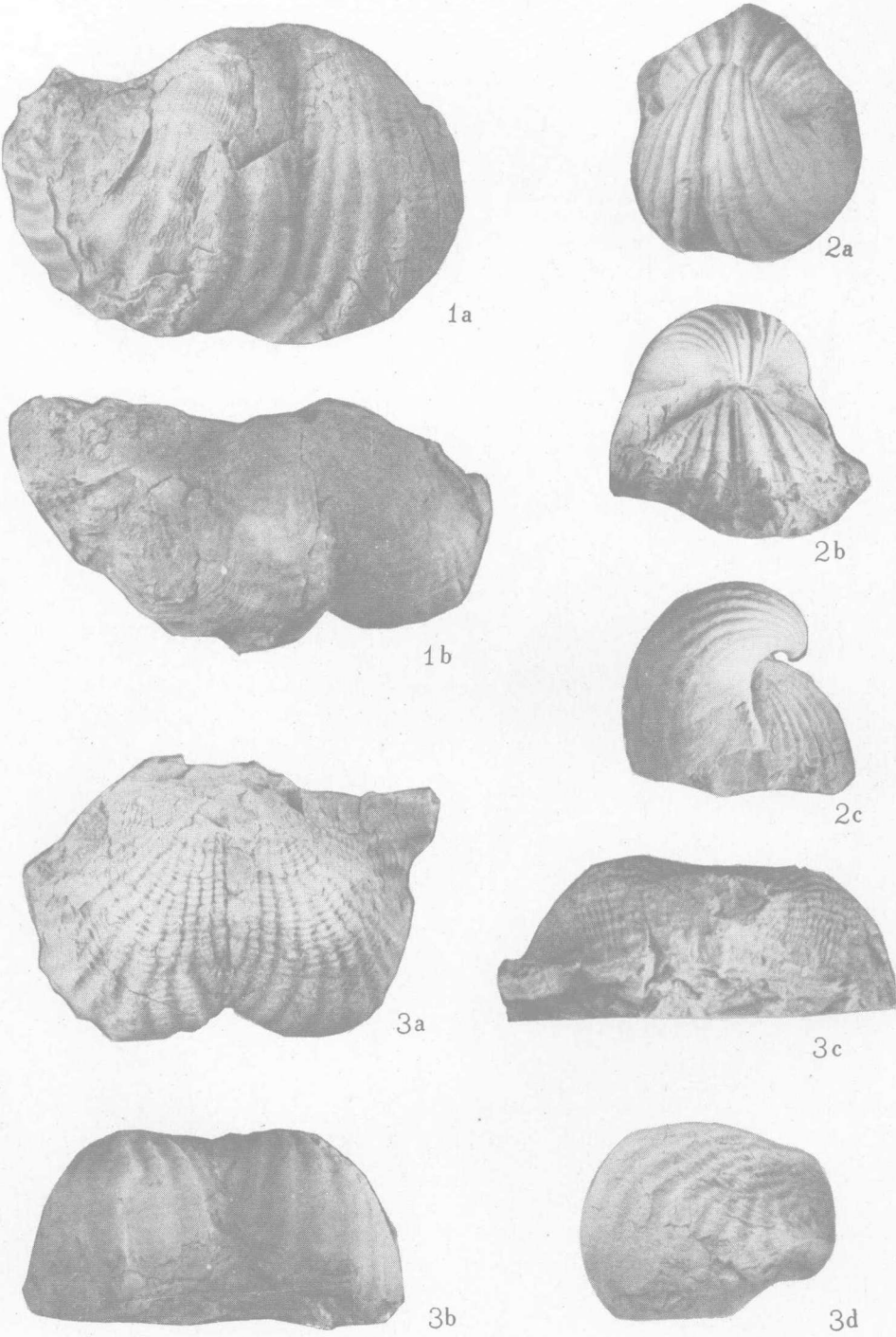
2a, Ventral view, 2b, Posterior view; showing the arched interarea and strongly incurved umbo, 2c, Lateral view, Anterior part broken off.

Cat. No. IGAS. 3589.

Figs. 3a—d (?) *Dictyoclostus* sp. indet.

3a, Dorsal view, showing the fan-shaped radial ribs; 3b, Anterior view, showing the remains of the cardinal process; 3c, Posterior view; 3d, Lateral view.

Cat. No. IGAS. 3588.



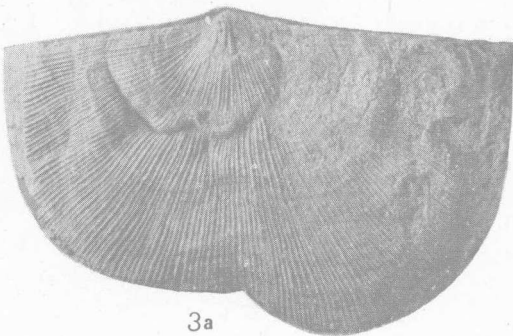
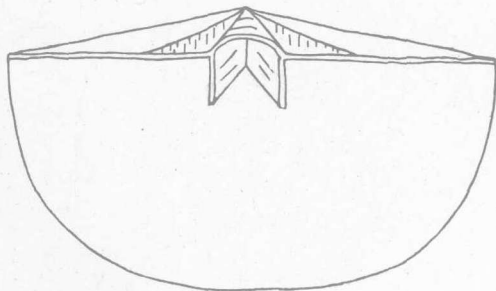
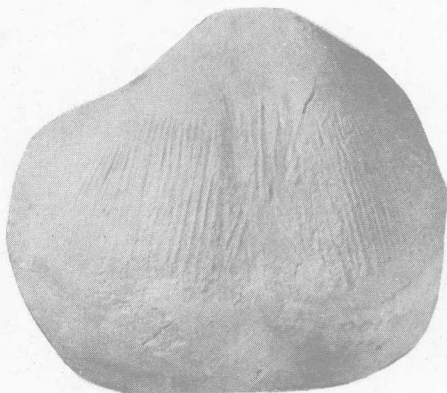
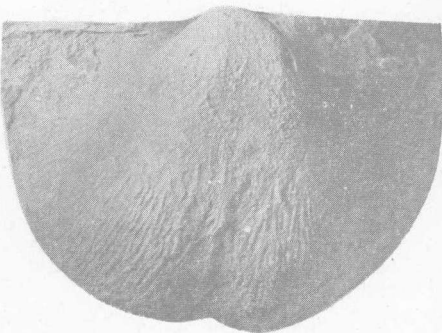


图 版 IV

图 1—2. *Buxtonia* sp. 腹瓣内模, 局部保存壳层。

1a, 侧视; 1b, 腹视, 示卵圆形筋痕和横脉痕。

2a, 腹视; 示筋痕; 2b, 侧视, 示断续的壳线。

登记号: IGAS. 3499, 3515.

图 3a—b *Schellwienella acutangula* Huang

3a, 腹视; 3b, 腹瓣内部粗强牙板、腹基面和三角板, 附三角板的素描。

登记号: IGAS. 3610.

Plate IV

Figs. 1—2. *Buxtonia* sp.

Internal mold of pedicle valve with partially preserved shell layers.

1a, Lateral view, 1b, Ventral view, Showing the oval muscle scars and linear pallial impressions; 2a, Ventral view, showing muscle scars; 2b, Lateral view, showing the spinose and costae.

Cat. nos. IGAS. 3499, 3515.

Figs. 3a—b *Schellwienella acutangula* Huang

3a, Ventral view; 3b, Internal structure of the same pedicle valve, showing the diverging dental plates.

Cat. No. IGAS. 3610.