

# 对藏南曲布组舌羊齿植物群三种新植物归属 的质疑兼论曲布组的时代问题\*

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西藏南部定日、定结县一带的曲布组,由于有冈瓦纳古陆特有的舌羊齿植物群的发现,引起了地学界的很大重视。这个植物群经徐仁(1973, 1976)研究,计有7属、9种和一未定名的真蕨: *Glossopteris communis* Feistm., *G. angustifolia* Bgt. *G. indica* Schimper, *Sphenophyllum speciosum* (Royle) McCl., *Raniganjia qubuensis* Hsü sp. nov., *Dizeugotheca qubuensis* Hsü sp. nov., *Dichotomopteris qubuensis* Hsü sp. nov., *Sphenopteris* cf. *hughesii* (Feistm.) Arber, *Pecopteris* sp., an unnamed fern.

有关这一植物群所在地层-曲布组的时代问题,因其中的三种舌羊齿、美楔叶都是分布较广、地质历程较长(至少在早、晚二叠世均可生存),而其他几种种名未能确定的植物又无何地层意义,徐氏主要依据其中的三个新种与印度某些植物相似来论证其时代。例如,他在1976年一文(327页)写道:“……在南亚次大陆,盘叶、对囊蕨和叉脉蕨都局限于腊尼冈季组,其地质时代为晚二叠世早期”;他接着又说:“这个植物群内早二叠世常见的恒河羊齿(*Gangamopteris*)又未见到。……因而,曲布组完全可以与印度的腊尼冈季组对比,同属于冈瓦纳大陆的沉积,地质时代也应属于晚二叠世早期”。

徐氏的这种意见虽一直坚持至今,仍只获得少数人的支持(尹集祥等,1976)。更多的地质古生物学者根据对曲布组上覆、下伏海相沉积所产大量动物化石的研究,认为曲布组及其植物群的时代应为早二叠世晚期(章炳高,

1974;吴望始,1975;张守信等,1976)或早二叠世早期(金玉珩等,1977;王玉净、穆西南,1980)。因为不只曲布组上覆的曲布日嘎组,所含以腕足类为主的动物群,表明其时代为早二叠世,而且伏于曲布组之下的基龙组的以 *Stapanoviella* 为代表的腕足类动物群的面貌,又与南亚次大陆的乌马利亚海相层或广义的 *Eurydesma* 动物群相近,后者常归于晚石炭世或晚石炭世到早二叠世。

为了明瞭这个争议的原因,笔者最近将曲布组舌羊齿植物群已发表的论文、图片,和其相关的重要文献,进行了较详的研究比较,首先发现这个植物群中三个新种的建立,是颇有问题或论据不足的。因而主要据此而定的地质时代,自然也属可疑。兹先将有关三种新植物鉴定、命名的问题简叙如下。

1. 曲布盘叶 *Raniganjia qubuensis* Hsü(1976, 324页,图版I,图4—7,插图1;1978,132页,图版2,图2)。

归于曲布盘叶的西藏标本的形态特点,据描述为,“枝条细直,……表面具纵肋数条,节间长1.5—2.2厘米。叶轮生,辐射排列,基部连合成平盘状,前部分离(插图1)。在幼枝上,叶(或裂片)侧面1/5连合,在成熟枝上,叶侧面1/3—2/3连合;每轮有叶14—22枚,叶等长,长3—4厘米,宽3—4毫米;前端渐尖,中脉不明显。”

\* 本文原拟在1980年5月于北京举行的“青藏高原科学讨论会”上宣读,后因故未成。现改刊于此。

依据以上描述,徐氏认为,西藏标本和已知的两种盘叶 *Raniganjia indica* (Srivastara) 和 *Raniganjia bengalensis* (Feistmantel) 虽相似,但有不少不同点(见下表),因而,……认为另属一种,建议叫它为曲布盘叶(新种)。

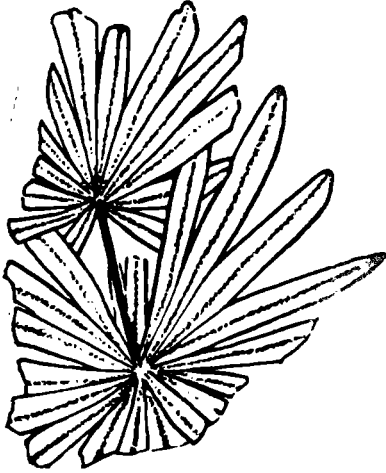


插图1 *Stellotheca qubuensis* (Hsü) n. comb.

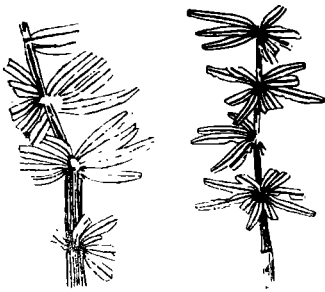


插图2 *Stellotheca robusta* 的带叶枝(右)茎、枝(左),  
×1.5 ± (据 Maithy et Mandal, 1978)

笔者认为以上论述,从徐氏已发表的化石图片及插图、附表来看,有几点是值得商榷的。(1)关于此种轮生叶的基部是否连合的问题:根据南半球的平星叶属 *Stellotheca* 的最近发现,过去被认为轮生叶在基部相连全属假象,和实际上是完全不相连的情况 (Maithy & Mandal, 1978, p. 281),曲布盘叶的轮生叶或裂片很可能也是直到基部都是彼此不相连的。这从徐氏的化石图片及插图 1 也多少可以看出。因同一叶轮的某几枚相邻裂片在基部略有重叠覆盖的现象,只有在基部也不相连合才属可能。这说

明它们之间的所谓“基部连合成平盘状……,在幼枝上,……侧面 1/5 连合,在成熟枝上……1/3—2/3 连合”都是一种假象。(2)每轮叶的数目和是否等长的问题,从徐氏所附插图 1 来看,每轮叶的数目不会多于 20 枚,也很难说他们是等长,靠近枝轴向下伸展的几个裂片显然短得多。需要附带指出的是,徐氏 (1976, 325页)用来表明西藏标本和印度盘叶等的形态特征对比表中,列举印度盘叶“每轮有裂片 25 枚或略多”也有颇大的误差。据他引用的文献 (Surange, 1966a, 页 52, 54) 所述一处是“每轮估计有裂片 40—50 枚”,一处是“每轮裂片数不多于 50 枚”;徐氏采用的“25 枚”,只是印度盘叶的约半轮叶的裂片数。此外,南亚次大陆的所有盘叶标本,还没有如西藏标本的叶轮直接着生在带节间枝轴上的发现。这种情况在平星叶标本上却很平常,而且其主轴或茎也是 *Paracalmite* 型的。因此,笔者认为,曲布盘叶应暂改名为曲布平星叶(新联合) (*Stellotheca qubuensis* (Hsü) n. comb.)。

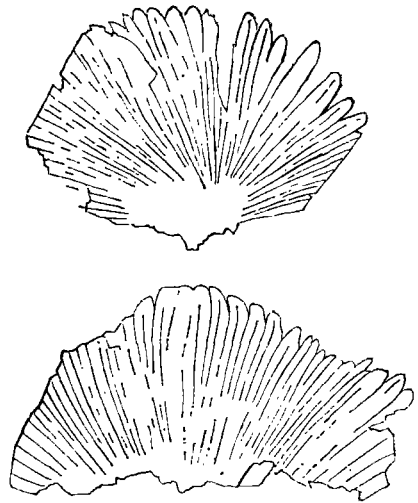


插图3 *Raniganjia indica* 和 *D. bengalensis* (下),  
×1 ± (据 Surange, 1966)

现将几个有关属种的形态特征列表如下。

曲布平星叶与其模式种粗壮平星叶的区别,主要在于每轮的裂片数目较多,叶脉稍弱。但这种不同点是否具有分种的价值,还待将来

形态特点 \ 属种名称	<i>Stellotheca robusta</i>	<i>Stellotheca qubuensis</i>	<i>Raniganja indica</i>	<i>Raniganja bengalensis</i>
叶轮形状	星状开展	近似星状开展	盘状、圆形	盘状、椭圆形
每轮裂片数目	2—14	14—22	40—50	50 或更多
裂片侧面连合情况	不相连,但在基部呈相连的假象	不相连,但在基部呈相连的假象	相连达 3/4 长度	相连达 2/3 长度
裂片是否等长	不相等	不相等	相 等	不相等
裂片宽度	1—3.1 毫米(最宽处)	3—4 毫米	3 毫米或更多	1.5—2 毫米
叶轮和茎枝	连在一起	连在一起	叶轮常单独保存	叶轮常单独保存
资料依据	maithy & Mandal, 1978	Hsü 1976, 有改动	Surange, 1966a	Surange, 1966a

发现的验证。

还应指出,归于曲布平星叶的西藏标本,如果不是与舌羊齿同层出现,则北半球古生代、中生代不少的其它属种,如 *Stellotheca schischurovskii* (Schmal.) Boureau, *Lobatannularia* Kaw. 1927, *Annulina* Neuburg 1954, *Neoannularia* Wang, 1977 等,在形态特征上,都有程度不同的相似,可以相比较。

2. 曲布对囊蕨 *Dizeugothea qubuensis* Hsü (1976, 325 页,图版 2,图 8—9,11—12,插图 2; 1978, 132 页,图版 2,图 3—4,5—6)

对囊蕨是 Archangelsky et Sota (1960, 99 页) 根据阿根廷早二叠世具有生殖器官和简单侧脉的栉羊齿型标本而建立的一个属名。它最主要的特点是生殖小羽片具有四合型 tetrasporangiate synangia 的聚合囊,即每个聚合囊由四个孢子囊组成,上面的一对覆盖在下面一对之上(插图4),因而不同于星囊蕨科的其它植物。

被描述为曲布对囊蕨的西藏标本全属裸羽片,对其生殖部分的形态结构毫无所知;仅因其裸小羽片的叶脉和产于印度腊尼冈季组的所谓 *Dizeugothea phegopteroides* (Feistm.) Maithy 很相似,而定为对囊蕨的新种。

这显然存在不少问题:(1)具简单侧脉的栉羊齿型裸羽片的植物,在南、北半球都有不少

属、种;在没有生殖部分发现的情况下,是不可辨认其为何属的。(2)曲布对囊蕨的建立所赖以对比的所谓 *Dizeugothea phegopteroides* 的印度标本 (Maithy 1975, 29 页,图版 1, 2, 图 1—4, 6),已经人 (Herbest, 1975, 126 页) 指出,其聚合囊结构和着生位置,与公认的对囊蕨标本颇不相同,西藏标本的归为对囊蕨自然更为可疑。(3)不管印度标本归为何属,西藏标本小羽片的叶脉形态,既与“D.” *phegopteroides* 颇相一致,则理当采用印度种名而不必另立新种。(4)实际上,印度这种有争议的植物在被 Maithy 误归于对囊蕨属后不久,就有另两个印度古植物学者 (Pant, D. D. & M. Lata, 1976), 根据其生殖器官特点另建一新属,名之为 *Asanolia phegopteroides* (Feistm.) Pant et Lata。有趣的是,这两个学者竟没有看到 Maithy 有关“D.” *phegopteroides* 的文章,而徐仁与 Herbst 也不了解 Pant 和 Lata 的有关观点。总之,在当前情况下,西藏标本只好暂名为,曲布栉羊齿(新联合) *Pecopteris qubuensis* (Hsü) nov. comb.

3. 曲布叉脉蕨 *Dichotomopteris qubuensis* Hsü (1976, 326 页,图版 3,图 13, 14, 插图 3; 1978, 132 页,图版 3,图 1, 2)

叉脉蕨 (*Dichotomopteris* Maithy) 是(1974)根据南亚次大陆的生殖羽片上的囊群,为 4—7

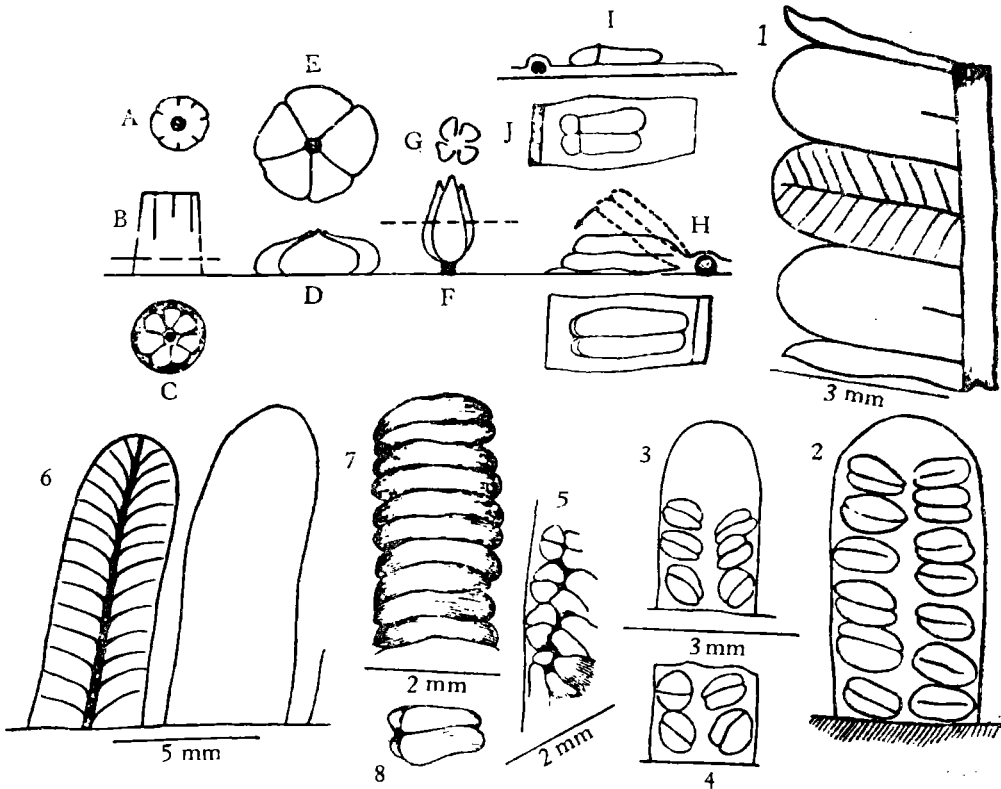


插图 4 对囊蕨及其聚合囊与星囊蕨科另几个属聚合囊的对比示意图: 1—5. *Dizeugothecca waltonii*. (1. 裸小羽片; 2—4. 生殖小羽片; 5. 聚合囊在小羽片边缘的侧视) 6—8. *D. neuburgiae*. (6. 裸小羽片; 7. 排列成行的聚合囊; 8. 单个聚合囊的顶视) A—C. *Psychocarpus* (A. 顶视; B. 侧视; C. 近底部的横切面); D, E. *Asterothecca* (D. 侧视; E. 顶视); F, G. *Scoleopteris* (F. 侧视; G. 中部横切面); H. *Dizeugothecca*, 两对孢子囊的顶视及侧视; I, J. 一种和对囊蕨相近的栉羊齿 *Pecopteris euneura* (I. 聚合囊的侧视, J. 顶视)。 (据 Archangelsky et Sota, 1960)

Showing comparisons for the synangia of *Dizeugothecca* and those of other related genera of the Asterotaceae: 1—5. *Dizeugothecca waltonii*, (1. portion of a sterile pinna; 2—4. fertile pinnae; 5. side-view of synangia disposed along the margin of a pinna). 6—8. *D. neuburgiae* (6. sterile pinnae; 7. synangia arranged in a row; 8. single synangium, top-view). A—C. *Psychocarpus* (A. top-view; B. side-view; C. horizontal section nearly of bottom-view). D, E. *Asterothecca* (D. side-view; E. top-view); F, G. *Scoleopteris* (F. side-view; G. horizontal section at the middle portion). H. *Dizeugothecca*, top- and side-views for the two pairs of sporangia. I, J. *Pecopteris euneura*, showing a close resemblance to *Dizeugothecca* (I, J. side- and top-views of a synangium). (After Archangelsky and Sota, 1960)

个彼此不连的孢子囊围绕一中心呈莲座状排列而建立的一个新属,模式种为 *D. major*(Feistm.)。这种植物的生殖器官未弄清楚以前,曾误归于 *Merianopteris* 属。曲布叉脉蕨的建立只基于一块破碎的裸羽片标本,而且在叉脉蕨模式种的两个相邻小羽片的第一对侧脉之间的那种明显的“缺失”或空白区也未见于西藏标本。它归于叉脉蕨自然可疑。按小羽片形态和叶脉类型,暂时似可改名为曲布枝脉蕨?(新联合) *Cladophlebis? qubuensis* (Hsü) nov. comb.

综上所述,曲布组舌羊齿植物群三个新种的建立都存在着不少的问题,曲布组时代归于晚二叠世早期自然可疑。而且,即使徐氏原定的三个新种无误,根据这些新种来论证其为晚二叠世早期产物,也难以令人信服。首先,新种化石在未经后续发现验证其地质历程与地理分布时,它们的地层意义是很有限的。再者,除 *Raniganjia* 在印度是仅见于腊尼冈季组外,另外两个属的地质分布均不限于晚二叠世。例如,对囊蕨的四个种 *Dizeugothecca waltoni* Arch. et

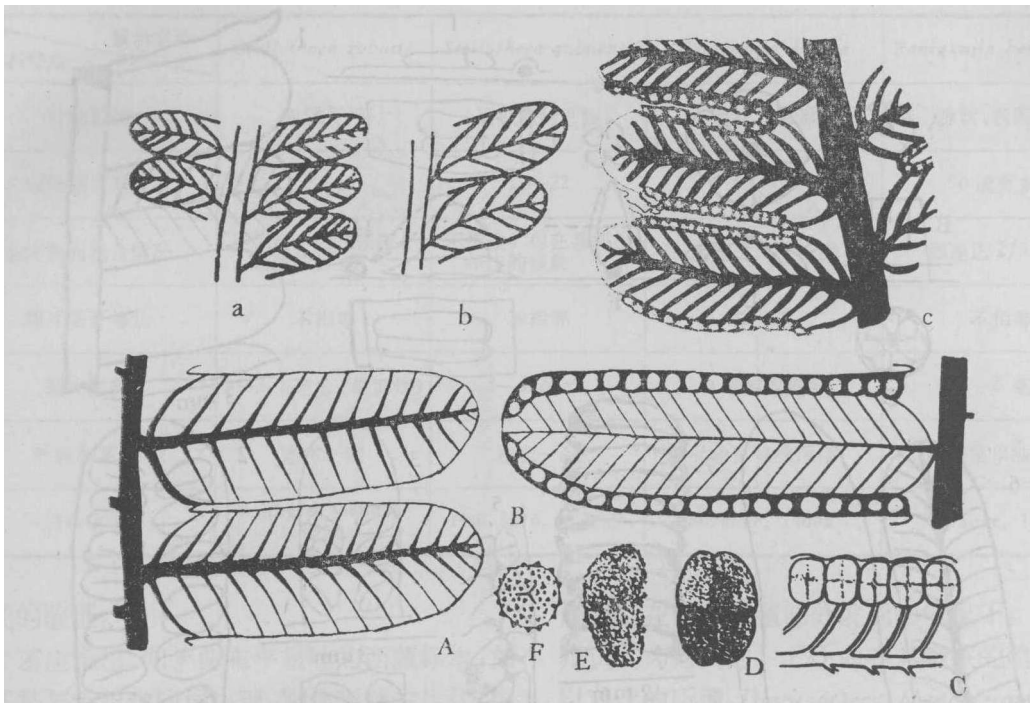


插图5 a, b. *Pecopteris qubuensis* (Hsü) n. comb.,  $\times 4$  (= *Dizeugothea qubuensis* Hsü) (据 Hsü, 1976); c. 印度的 *Asanolia phegopteroides* (Feistm.) Pant et al.,  $\times 4.5$  (据 Pant & Lata, 1976); A—F, 被 Maithy 定名为 *Dizeugothea phegopteroides* (Feistm.) 的印度标本: A. 裸小羽片,  $\times 5.5 \pm$ ; B. 生殖小羽片,  $\times 5.5 \pm$ ; C. 聚合囊在小羽片边缘,  $\times 9.5 \pm$ ; D. 单个聚合囊,  $\times 14 \pm$ ; E. 单个孢子囊,  $\times 19 \pm$ ; F. 单个孢子,  $\times 500 \pm$  (据 Maithy, 1973; 此处所称的聚合囊, Maithy 称为囊群)。

a, b. *Pecopteris qubuensis* (Hsü) n. comb., (= *Dizeugothea qubuensis* Hsü),  $\times 4$  (after Hsü, 1976); c. *Asanolia phegopteroides* (Feistm.) Pant et al., of India,  $\times 4.5$ . A—F. Indian specimens described by Maithy as *Dizeugothea phegopteroides* (Feistm.), (A. sterile pinnules,  $\times 5.5 \pm$ ; B. fertile pinnule,  $\times 5.5 \pm$ ; C. synangia disposed at the margin of a pinnule,  $\times 9.5 \pm$ ; D. single synangium,  $\times 14 \pm$ ; E. single sporangium,  $\times 19 \pm$ ; F. single spore,  $\times 500 \pm$ . (After Maithy, 1973; the sori in Maithy's paper are here described as synangia)

Sota, *D. neuburgiae* Arch. et Sota, *D. branissae* Arrondo 和 *D. furcates* Arrondo 都出于南美洲的早二叠世沉积。就生物地层学工作的一般方法来说,无论是新、老属种,用来作时代依据时,自然不能只与近邻相比而不考虑已知的其它地质历程。

此外,就曲布组时代的论证来说,徐氏所持的另一理由——恒河羊齿未在曲布组发现,也不是一种有力的论据。有人(Surange, 1966)统计,南亚次大陆下冈瓦纳系达谋达群中舌羊齿属与恒河羊齿属种数分布概况有如下表。

从表中可见,南亚次大陆腊尼冈季组的舌羊齿可达 29 种之多,在早二叠世的巴锐卡尔组有 11 种;恒河羊齿在腊尼冈季组有 6 种,在巴锐卡尔组实际只有 1 种。若以此分布数据为准而

达谋达群 属名	卡哈尔 巴里组	巴锐卡 尔组	铁石页岩	腊尼冈 季组
<i>Glossopteris</i>	6	11	6	29
<i>Gangamopteris</i>	14	1	1	6

进行分析,则西藏曲布组含有的 3 种舌羊齿的数量几乎只有腊尼冈季组的 1/10,而为巴锐卡尔组的 1/4 稍弱;对比之下,以恒河羊齿在这两组中种数均较少的情况下,在曲布组的尚未发现也是可以理解的。这种现象既不成为视其时代为晚二叠世的理由,至少也无碍于其时代的归于早二叠世。

根据以上论述,曲布组舌羊齿植物群原用来定其时代为晚二叠世早期的理由既不能成立



插图6 左和 A—F. *Dichotomopteris major*, 左. 裸羽片示小羽片和叶脉,  $\times 1.5$ ; A. 管胞示纹孔,  $\times 500 \pm$ ; B. 裸小羽片示叶脉,  $\times 5.5 \pm$ ; C. 生殖小羽片示聚合囊排列,  $\times 5.5 \pm$ ; D. 聚合囊及其孢子囊的排列,  $\times 90 \pm$ ; E. 单个孢子囊,  $\times 14 \pm$ ; F. 单个孢子,  $\times 500 \pm$  (据 Surange, 1966 和 Maithy, 1975)。右上角 *Cladophlebis? qubuensis* (Hsu) n. comb. 的裸小羽片, 示叶脉,  $\times 3$  (据 Hsü, 1976)。

Left and A—F. *Dichotomopteris major*: Left—sterile pinna,  $\times 1.5$ , showing pinnules and the venation; A. Tracheids,  $\times 500 \pm$ , showing pits; B. Sterile pinnules,  $\times 5.5 \pm$ , showing the venation; C. Fertile pinnule,  $\times 5.5 \pm$ , showing the arrangement of sporangia; D. Synangia and their disposition,  $\times 90 \pm$ ; E. Single sporangium,  $\times 14 \pm$ ; F. Single spore,  $\times 500 \pm$ . (After Surange, 1966; Maithy, 1975).

At the upper right corner, a piece of sterile pinnule of *Cladophlebis? qubuensis* (Hsü) n.comb.,  $\times 3$ , showing the venation. (After Hsü, 1976)

或很不充分,曲布组上、下地层中的大量海相无脊椎动物化石,又间接证明曲布组的时代不能新于早二叠世晚期,则目前最合理的结论只有将曲布组归为早二叠世。

最后,笔者也借此机会谈一下有关曲布组舌羊齿属种的鉴定问题。徐仁(1976, 328页; 1978, 136页)一再论述了北半球某些标本定为舌羊齿属的不当,并指出应以 Edwards (1955)

的下述意见为诫:“除非根据特征性的生殖器官,不应轻率地将北半球类似舌羊齿的叶子鉴定成舌羊齿。”在这里,笔者也愿引据 Surange & Chandra (1978, 513页)对鉴定舌羊齿之难的一段话供参考:“现在公认,舌羊齿是一个很松散的形态属名,而它的种名鉴定工作是庞杂得可怕的。一个人对一批材料甚至花上几年功夫之后,也不敢说他对舌羊齿某个种的鉴定是正

确无误的。因而,当发现了某种舌羊齿的叶子连生着生殖器官时,其生殖器官的属名应该放在较重要的地位来对待,原先为叶子建立的名称就成为前者的同义词。舌羊齿这个形态属名应该保留用来包括那些不能归于任何一个自然属而只知其叶子形态的标本。”Surange 等是著名的印度古植物学者。他们所说的当然是指南、北半球所有的舌羊齿标本而言。可惜的是,我们发现于西藏的标本,都只保存着叶子的外表形态,而且很破碎,至少还不如 Wagner (1962) 发现于土耳其哈兹罗 (Hazro) 植物群中的舌羊齿叶子那样的完好。因而,严格的说,西藏的舌羊齿标本只具有舌羊齿形态属的意义,而且有些标本的种名鉴定,还是以稍加保留为好。

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## NOTES ON THREE NEW SPECIES OF *GLOSSOPTERIS* FLORA FROM QUBU FORMATION, S. XIZANG (TIBET), WITH DISCUSSION ON THE AGE OF THE FORMATION

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### Abstract

The Qubu Formation of S. Xizang (Tibet) has been well-known in the field of Earth Sciences since the discovery of a *Glossopteris* flora in it. However, the age of the Qubu Formation is hitherto not quite settled. Some authors (Hsü = 1973, 1976, 1978; Yin *et al.*, 1976), basing mainly on the resemblance of a few elements of the *Glossopteris* flora of the Qubu Formation to those of the Raniganj Formation of India, insisted on regarding it as early Late Permian, while others (Zhang, 1974; Wu, 1975; Zhang *et Ching*, 1976; Wang *et Mu*, 1980) hold it to be Early Permian in accordance with a great number of marine fossil invertebrates occurring both in the immediately preceded and succeeded rock formations.

As a result of careful comparison of the Tibetan specimens described and figured by Hsü (1976, pp. 324—326; pls. 1, 2; pl. 3, figs. 13, 14; text-figs. 1—3; 1978) for the three new species, i.e., *Raniganjia qubuensis* Hsü, *Dizeugotheca qubuensis* Hsü and *Dichotomopteris qubuensis* Hsü with the type-specimens and other important published figures of the typical ones outside China, it may be found that the assignments of the three new species are almost all established on unsatisfactory grounds.

Firstly, the material described by Hsü as *Raniganjia qubuensis* might belong to the genus *Stellotheca*, namely *S. qubuensis* (Hsü) n. comb. The reasons for this view are: (1) the differences between the Tibetan form and the two typical species of *Raniganjia*, i.e., *R.*

*indica* (Sriv.) and *R. bengalensis* (Feistm.) found from the Permian of India and Australia are considerably great. For instance, the leaves (ribs or segments as named by Hsü) in each leaf-whorl of the typical species of *Raniganjia*, according to the description given by Surange in 1966, with which Hsü's description and comparison are made, are all around 50 in number, while those in the Tibetan form are 14—22; the leaves in each leaf-whorl of the latter stand nearly to those (8—14) of *Stellotheca* as recently described by Maithy and Mandal (1978) for its type-species *S. robusta* (Feistm.) Sur. and Prak. It should, however, be pointed out that the leaf number per whorl of *R. indica*, which has been stated as 40—50 or no more than 50 by Surange (1966, pp. 52, 54), was inattentively treated as only 25 or a little larger in number in each whorl by Hsü. (2) The statement of whorled leaves of the Tibetan species, as described by Hsü as "united at the base for about 1/3—2/3 of their length. ... all equal in size" (in Hsü's Chinese text, p. 325) is also somewhat doubtful. For the purpose of clarifying these problems, we may here remember the recognition of similar features shown on the leaves of *Stellotheca robusta* (Feistm.). It has recently (Maithy *et Mandal*, 1978, p. 281) been found that the leaves in a whorl formerly regarded by some authors as confluent at some length, are known all distinctly free up to the base. This seemingly also hold true for the leaves of "*R.*" *qubuensis*. As shown in the figures, especially its text-figure, given by Hsü, there



are a few leaves laterally but slightly overlapping with each other near their basal parts. This seems to be a case which can not occur in the leaves all growing free right down to the base. Besides, these figures also show that the leaves standing more adjacent to the leafy-branch axis and extending downwards are obviously shorter than the others. (3) The presence of *Paracalamites*-type stem associated with the leaf-whorl remains in the Tibetan material seems also to support our view, since the stem of *Stellotheca* has been found to be as good as the typical *Paracalamites*, while this paracalamitean stem has not yet been found together with leaves of *Ranigenjia*.

The second new species founded by Hsü as *Dizeugotheca qubuensis* not only involves the Tibetan specimens composed of all sterile pinnae insufficient for a definite determination of the genus *Dizeugotheca*, but also touches on the interesting question that the description and interpretation of the soral character for the Indian *Dizeugotheca phegopteroides* (Feistm.) given by Maithy in 1973, with which Hsü's new form is so closely compared, do not conform to the original definition of *Dizeugotheca*, as pointed out by Herbst in 1978 (p. 126). Furthermore it is of interest to note that early in 1976 two other Indian palaeobotanists, Pant and Lata, testified the distinctive differences of fructification between the Indian "*Diz.*" *phegopteroides* and the typical species of *Dizeugotheca*; and for the unique synangial disposition and sporangial characters, the two Indian authors proposed a new generic name *Asanolia* for the Indian species, i.e. *A. phegopteroides* (Feistm.). How-

ever, Pant and Lata did not see Maithy's paper of 1973, neither Hsü nor Herbst were aware of the important article by Pant and Lata. The material described originally as *Diz. qubuensis* Hsü is here treated as *Pecopteris qubuensis* (Hsü) n. comb.

The third new form, *Dichotomopteris qubuensis* Hsü has been established merely upon an imperfectly preserved sterile pinna fragment, in which the fertile evidences or the sporangial characters so well revealed in the typical specimens of *Dichotomopteris* are lacking. This fragment is tentatively named *Cladophlebis? qubuensis* (Hsü) n. comb., because it does not afford any evidences of the nature of fructifications to justify its relation to the genus *Dichotomopteris*.

Finally, I would like to give a few words about the age of the Qubu Formation: (1) As generally understood, new fossil forms, even if Hsü's identification for the three new plants were completely free from doubt, are of less significance in determining the geological age of the deposits where they are preserved. (2) No plant forms found from the Qubu Formation are known to be confined to an age younger than Early Permian; also all the definitely known species of *Dizeugotheca* were recorded in the Early Permian. (3) As other described species of the *Glossopteris* flora of the Qubu Formation are all of wide vertical distribution, therefore they may not be regarded as reliable evidence for an age of Late Permian.

All things considered, it is most convenient for the time being to consider the Qubu Formation to be of Early Permian age.