trary units, later converted to micrometers.

Three kinds of evidence support the conclusion that the archeological cottons were primitive forms of *Gossypium barbadense* L.

1) A useful taxonomic criterion for distinguishing *G. barbadense* from the only other species known to have been cultivated in the New World (*G. hirsutum* L.) is the presence or absence of fringe hairs surrounding the floral nectary (*3*). A floral nectary recovered from a single archeological boll was devoid of fringe hairs, as in *barbadense*.

2) Samples of unprocessed fibers obtained from Tank Site and Punta Grande could be grouped with some confidence into three distinct color classes—chocolate, reddish-brown, and "near-white." The chocolate-colored fibers had a very soft texture and disintegrated into dusty particles when handled. Soft textured fibers of this characteristic color are unknown in any present-day species of *Gossypium* other than *barbadense*, and even in this species the chocolate color is rarely found beyond the limits of coastal Peru and Ecuador.

3) Only four intact bolls were available for measurement. All were obtained from the Punta Grande site. Comparison with present-day standards showed that they did not differ significantly in shape or size from bolls of wild forms of *barbadense* (Fig. 1A).

Differences in the size of the boll reflect differences in boll contents, that is, in the number and size of seeds and in the amount of fiber borne on the seeds. These differences are illustrated in Fig. 1B where the seeds and fibers extracted from individual boll segments (individual locks) are compared. There is a progressive increase in the number of seeds, the size of the seeds, and the amount of fiber in the following sequence: var. *darwinii*, archeological sample, wild *barbadense*, cultivated *barbadense*.

Fiber samples were available from most strata, from the Playa Hermosa phase through the Initial Period. Carbonized seed samples were not found in the earliest (Playa Hermosa) phase but were available from most of the later levels. Thus data on fiber diameter and seed size could be recorded over a relatively long time sequence and compared with similar data from living standards. The results of these comparisons are summarized in the form of charts (Fig. 2). The charts show that fiber diameter and seed size tend to increase progressively from the earlier to the later levels. The magnitude of the increase is about 10 to 15 percent in both characters, which would probably be associated with a considerable increase in the yield of fiber (*6*). The range of mean fiber diameters in the archeological samples lies between the means of present-day wild and present-day dooryard standards. The range in seed size lies between those of wild Galápagos forms (var. *darwinii*) and wild mainland forms of *barbadense*. The archeological remains show that variations in fiber color (chocolate, reddish-brown, and possibly white) were established early in the chronological sequence, but that the primitive fuzzy-seeded condition was retained over the entire period represented by our samples (no smooth black seeds were found, although it is well known that simple genetic mutants determine fiber color and the presence or absence of fuzz on the seed coat).

Although these cotton remains are not the earliest to be recorded in the Americas, they seem to represent the earliest stages of domestication yet reported. Cotton obtained from the Tehuacán Valley of Mexico, and dated 3500 to 2500 B.C., was apparently "fully domesticated" (*7*).

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Permian Ammonoid Cyclolobus from the Zewan Formation, Guryul Ravine, Kashmir

Abstract. *Ammonoid cephalopods serve significantly as a basis for correlation of strata near the boundary between the Paleozoic and Mesozoic Erathems. This is a report of the diagnostically Late Permian (uppermost Paleozoic) ammonoid* Cyclolobus walkeri *(Diener, 1903) from the Zewan Formation 20 meters below the Permian-Triassic contact at the classic section in Guryul Ravine, Srinagar region, Kashmir.*

Since the first half of the 19th century, it has been apparent that assemblages of fossil organisms can be grouped as "ancient," "medial," or "recent" in overall aspect. These groupings formed the basis for Phillips' definition (*1*) of the geological eras: Palaeozoic, Mesozoic, and Kainozoic. Even casual comparison reveals basic differences between marine invertebrate faunas of those three eras, with the era boundaries representing intervals of faunal crisis (*2*).

The Paleozoic-Mesozoic boundary, between the Permian and Triassic systems, is commonly represented by a regional unconformity (*3*). However, there are a few areas where fossiliferous marine Permian and Triassic strata are thought to follow in a sequence devoid of major hiatus. Recent interest in the era boundaries has stimulated detailed biostratigraphic analysis of these few critical boundary successions, particularly those in Soviet and Iranian Armenia and in Central Iran (*4*); the Salt Range of Pakistan (*5*), Kashmir (*6–8*), South China (*9*), and East Greenland (*10*).

Richly fossiliferous Late Permian and Early Triassic strata have been known in the Srinagar area of Kashmir since the pioneering studies of Hayden (*11*) and of Middlemiss (*12, 13*). Subsequent detailed field investigations (*6–8*) have focused on Guryul Ravine, 10 km southeast of Srinagar near the village of Khunamuh. There the Permian-Triassic boundary is drawn where the "sandy shales" of the Zewan Formation (formerly Zewan Series) are succeeded by a "black shale," not yet named formally. Both otoceratid and ophiceratid ammonoid cephalopods, each definitive of the Early Triassic, occur 3.5 m above the base of the black shales in direct association with the distinctively Early Triassic pectinacean genus *Claraia* and several taxa of the characteristically Paleozoic productacean brachiopods. The productaceans extend down into the Permian Zewan Formation, and *Claraia* occurs as little as 1 m above the Zewan (*6*).

Ammonoid cephalopods have served for precise correlation of the Triassic portion of the section in Guryul Ravine, but hitherto no ammonoids were known from the Permian Zewan Formation. We report here the distinctive Permian ammonoid genus *Cyclolobus* from near the top of the Zewan at Guryul Ravine. Specific reference is to *C. walkeri* (Diener, 1903). This ammonoid was found in direct association with abundant bivalves ("*Palaeolima,*" *Permophorus, Phestia?, Astartella?, Schizodus?*) and less numerous bellerophontid gastropods, scaphopods (*Dentalium*), trepostome bryozoans, and strophomenid brachiopods (*Lissochonetes*). The specimen originated below the *Archignathus typicalis* conodont zone (*7*).

The single specimen of *Cyclolobus* (India Geological Survey Type No. 18676) known from Guryul Ravine was collected by one of us (H.M.K.), in situ, from a thin detrital limestone (Nakazawa Bed No. 31) 20 m below the top of the Zewan Formation (that is, below the base of the Early Triassic black shales). It is complete and exceptionally well preserved to a conch diameter of 75 mm; the remaining portions of an additional one-half volution indicate that the phragmocone achieved a diameter of at least 100 mm. At 75-mm conch diameter, the whorl width is 41 percent and the umbilical diameter is 13 percent of the conch diameter. The flanks are virtually flat, and converge from near the umbilical shoulder to the uniformly rounded ventrolateral shoulders and venter. Neither ribs nor constrictions are discernible. The suture at 70-mm conch diameter is portrayed by Fig. 1A; other similar-sized Himalayan representatives of *Cyclolobus walkeri* are illustrated for comparison (Fig. 1, B and C).

Cyclolobus walkeri was known previously in moderate abundance from scattered localities in the Himalayas, from Pakistan, and from Madagascar. All available representatives were restudied recently, and new descriptions and illustrations were published (*14*). The specimen from Guryul Ravine closely resembles the holotype and other representatives in all morphological details. Specifically definitive characters comprise the smooth shell, small umbilicus, and relatively small number of lobes. No evidence of constrictions or prominent ornament is apparent in the Kashmir specimen at 75-mm conch diameter, and at that size it is virtually identical to the holotype in conch proportions. Additionally, the two specimens are alike in the situation of the ninth "lateral" lobe on the umbilical shoulder. Assignment of the specimen from Guryul Ravine to *Cyclolobus walkeri* can thus be made with confidence.

The holotype of *Cyclolobus walkeri* is from an exotic limestone block in the Hundés region of Tibet. In those areas of the Himalayas where the exact stratigraphic occurrence of the species is known (*14*), *C. walkeri* is restricted to a narrow interval near the top of the Kuling (Productus) Shale. Typical is the classic section at Kuling, in the Spiti area, where the Kuling Shale is 45 m thick. There *Cyclolobus* occurs in a thin concretionary bed 9 m below the interbedded limestones and shales of the Triassic, with their definitive ammonoids *Otoceras* and *Ophiceras* (*11–13*). In the Salt Range of Pakistan, *C. walkeri* ranges 15 to 23 m below the Permian-Triassic boundary at the top of the Chhidru Formation (*14*). Inadequate exposures preclude the presentation of precise stratigraphic data for the abundant representatives from Madagascar.

The validity of the interpretation of *Cyclolobus* as a Late Permian index has been questioned (*15*), partly because of a claim that, in the Salt Range of Pakistan, the holotype of the type species of *Cyclolobus* is from the Kalabagh Member of the Wargal Limestone rather than from the overlying Chhidru Formation (*16*). However, a full review of the Salt Range successions (*5*) tends to confirm the traditional view that

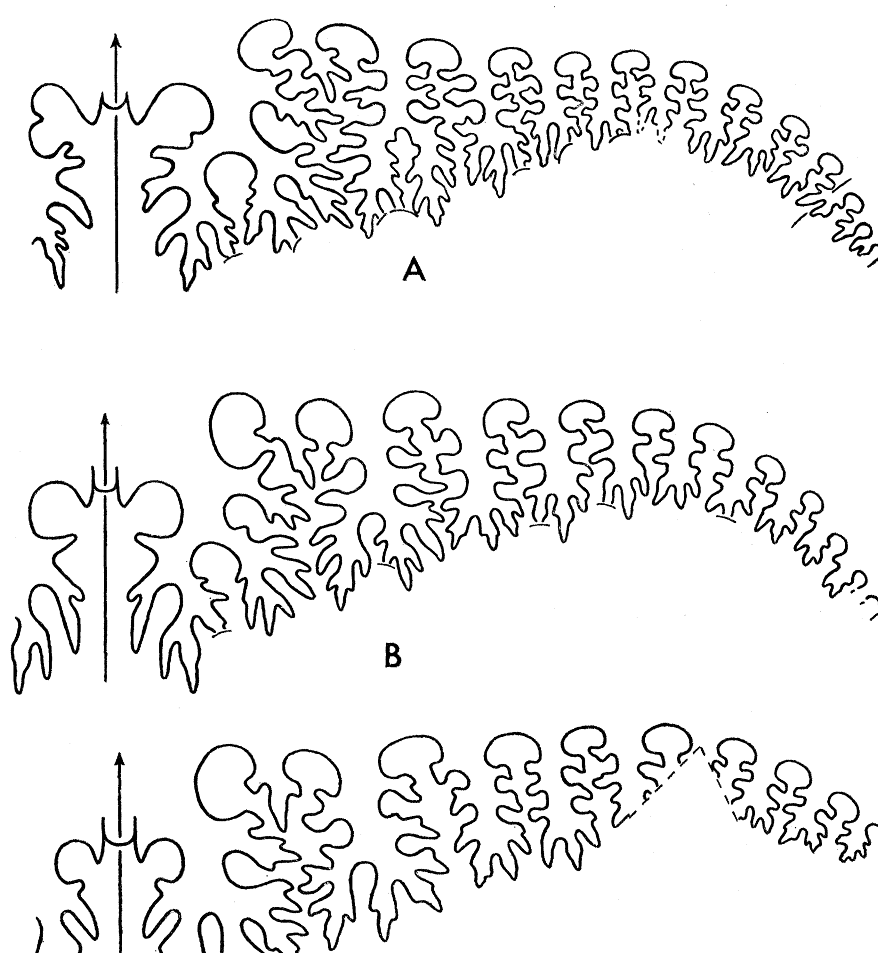

Fig. 1. Diagrammatic illustrations of single sutures in three representatives of *Cyclolobus walkeri* Diener from the Himalayas; C represents the holotype from southwestern Tibet; B is the holotype of *C. kraffti*, regarded as conspecific, from Spiti, central Himalayas; and A is based on the newly discovered specimen from Guryul Ravine, near Srinagar. All three sutures are from specimens of approximately the same size, 60-mm conch diameter. Sutural details change progressively throughout growth of the ammonoid shell. Differences comparable to those illustrated commonly occur on opposite sides of the same whorl, whereas successive sutures of the same individual tend to show precisely the same pattern.

Cyclolobus is confined to the upper Chhidru. All the Salt Range representatives of *Cyclolobus* for which accurate occurrence data are available came from 10 to 23 m below the top of the Chhidru (*5*, p. 73). There is no conclusive ammonoid evidence for the precise age of the Kalabagh.

Four additional ammonoids have been reported from the Zewan Formation in the vicinity of Srinagar. "*Xenaspis* cf. *carbonaria* Waagen" was recorded by Diener (*17*) as being represented by three specimens (India Geological Survey, Nos. 11117 to 11119) from the "Spur 2 miles N. of Barus," a well-known locality (*12*) approximately 11 km south-southeast of Guryul Ravine. The parent horizon is "Unit 3½" of Middlemiss and probably corresponds to the basal few meters of the Triassic black shales at Guryul Ravine rather than the underlying Zewan Formation. Our recent study of these three specimens reveals that they are at least specifically distinct from the widespread Late Permian *Xenodiscus carbonarius*, and are best regarded as indeterminate Triassic ophiceratins, possibly *Glyptophiceras*. An associated bivalve [plate 6, figure 1, in (*17*)] is *Claraia stachei* (Bittner). The fourth ammonoid reported from the Zewan Formation (India Geological Survey, No. 11120) was collected near Pahlgam (Pailgam) approximately 95 km east of Srinagar. Stratigraphic occurrence of the specimen is uncertain (*12*) and Diener's assignment (*17*) to the Permian genus *Popanoceras* is certainly incorrect. Our examination leads us to regard the specimen as generically indeterminate, but Triassic in age. Unquestionably Permian ammonoids, including *Xenodiscus* and *Stacheoceras*, have been collected recently from Pahlgam and adjacent areas, but the details of occurrence are not yet available.

The discovery of *Cyclolobus walkeri* near the top of the Zewan Formation of Kashmir strengthens the correlation of the parent beds with the upper Kuling Shale of the central Himalayas, the upper Chhidru Formation of the Salt Range, and the Ankitohazo beds of Madagascar. All occurrences are interpreted as representing the Chhidruan Stage of the middle Dzhulfian Series (*18*). It follows that if no major hiatus occurs in the upper Zewan, the latest Dzhulfian Changhsingian Stage is represented in the top few meters of the Zewan Formation at Guryul Ravine. Detailed collecting and comparison of the fauna from this interval with that from the type Changhsingian of South China and the correlative *Paratirolites* beds of Armenia and possibly Madagascar are proceeding (*19*).

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1α-Hydroxy Derivative of Vitamin D_3: A Highly Potent Analog of 1α,25-Dihydroxyvitamin D_3

Abstract. *The 1α-hydroxy derivative of vitamin D_3 has been chemically synthesized and tested for its biological activity. This analog has comparable biological activity on a weight basis to 1,25-dihydroxyvitamin D_3 in the stimulation of intestinal calcium transport and bone calcium mobilization in normal and anephric rats. Because the 1α-hydroxy derivative is synthesized from cholesterol, it is easier and less expensive to prepare than 1α,25-dihydroxy derivative, making it attractive as a drug in the treatment of renal osteodystrophy and hypoparathyroidism.*

For vitamin D to carry out its biological functions in stimulating intestinal calcium transport and mobilizing bone calcium, it must be hydroxylated on C-25 in the liver (*1*) and subsequently on C-1 by the kidney (*2*). The resulting metabolite, 1α,25-dihydroxyvitamin D_3 [1α,25-$(OH)_2D_3$] (Fig. 1) was isolated in pure form, identified (*3*), and recently synthesized (*4*). This metabolite is the most potent form of vitamin D known (*5*, *6*), and it is the only known

Table 1. Intestinal calcium transport and bone calcium mobilization response of rats to 1α-OH-D_3. Results are means of six rats; S.E., standard error.

1α-OH-D_3 (pmole)	^{45}Ca serosal/ ^{45}Ca mucosal (mean ± S.E.)	Serum Ca (mg/ml) (mean ± S.E.)
	Normal	
None*	1.5 ± 0.2	4.3 ± 0.1
6.2	1.8 ± 0.2	4.8 ± 0.1
62.5	2.8 ± 0.3	5.8 ± 0.1
625	2.9 ± 0.2	6.7 ± 0.1
1250	2.9 ± 0.2	6.9 ± 0.1
	Anephric	
None*	1.5 ± 0.2	4.1 ± 0.1
312	2.3 ± 0.2	5.2 ± 0.1

* The control dose consisted of 50 μl of 95 percent ethanol alone.