

Plates from Thomasson, J.R., 1979, Late Cenozoic Grasses and Other Angiosperms from Kansas, Nebraska, and Colorado: Biostratigraphy and Relationships to Living Taxa: Kansas Geological Survey, Bull. 218, 68 p.

Available online at  
<http://www.kgs.ku.edu/Publications/Bulletins/218/index.html>

### **Explanation of Plate 1**

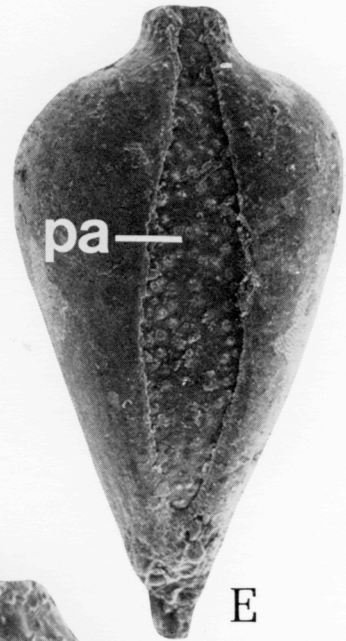
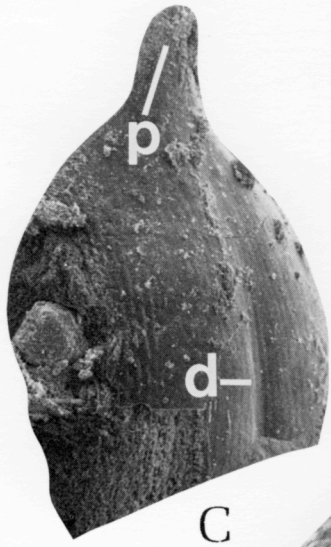
Fossil grasses (Gramineae) from the Ogallala Formation, SEM.

**A, B**, *Berriochloa amphoralis* Elias: **A**, lateral view of anthoecium, x 24, BP128, bed 4 at site 21; **B**, enlargement of crown area of specimen in A showing the labrum, l, and prow, p, x 66.

**C**, *Berriochloa inflata* Elias: palea, showing prow, p, and medial depression, d, x 86, BP66, bed 1 at site 4, locality 4.

**D, E, F**, *Berriochloa minuta* Elias: **D**, lateral view of anthoecium illustrating the heel, h, x 44, BP115, bed 6 at site 42; **E**, frontal view of anthoecium showing palea, pa, exposed between the edges of the lemma, x 44, BP116, bed 6 at site 42; **F**, dorsal view of anthoecium showing medial ridge, r, x 30, BP133, bed 2 at site 8.

**G**, *Berriochloa obrullata* Thomasson, sp. nov., holotype, lateral view of anthoecium, x 30, BP172, bed 2 at locality 3c, site 30.



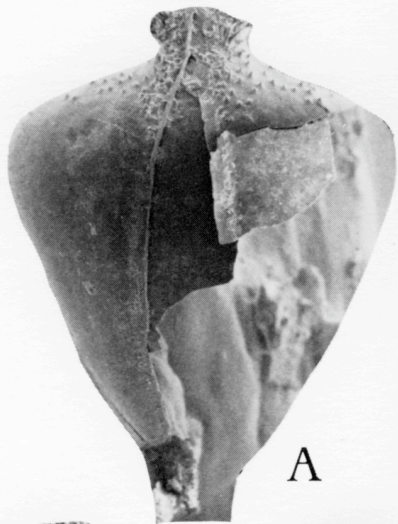
## Explanation of Plate 2

Fossil grasses from the Ogallala Formation, SEM.

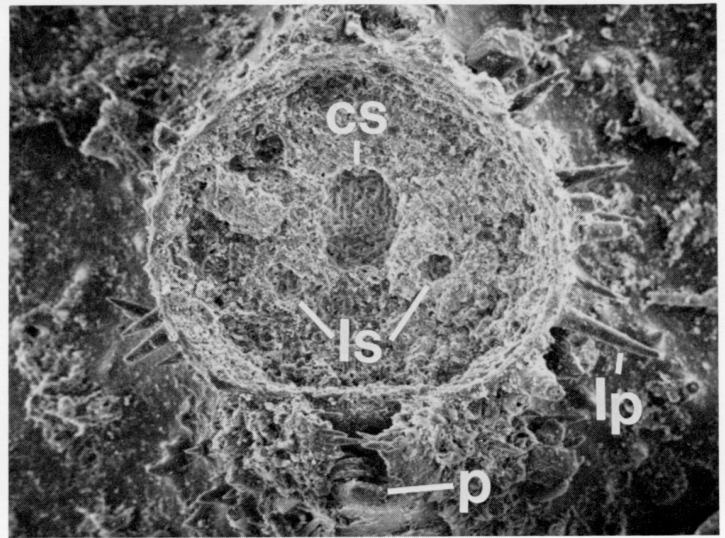
**A, B**, *Berriochloa obrullata* Thomasson, sp. nov.: **A**, isotype, frontal view of anthoecium showing palea exposed between the edges of the lemma, x 26, BP175, bed 2 at locality 3c, site 30; **B**, isotype, detail of scar of attachment of awn showing large central vascular trace scar, cs, small lateral trace scar, ls, large prickles, lp, around the rim of the awn scar and the prow, p, of the palea. x 110, BP173, bed 2 at locality 3c, site 30.

**C, D, E**, *Berriochloa pumila* Thomasson, sp. nov.: **C**, holotype, lateral view of anthoecium showing sharp callus at the base, x 36, BP137, bed 2 at locality 1, site 9a; **D**, dorsal view of anthoecium, x 36, BP144, bed 1 at site 22; **E**, topotype, detail of surface of lemma at the summit of the anthoecium showing hooks, x 320, BP10, bed 2 at locality 1, site 9a.

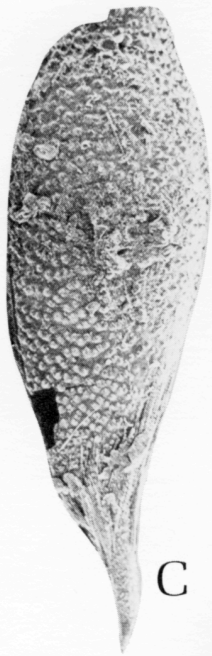
**F, G**, *Berriochloa tuberculata* Elias: **F**, lateral view of anthoecium, x 26, BP113, bed 6 at site 42; **G**, lateral view of anthoecium, x 32, BP117, bed 2 at locality 1, site 5.



A



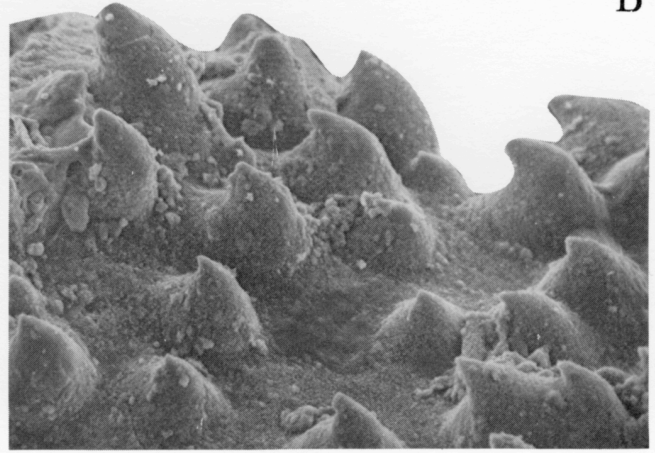
B



C



D



E



F



G

## Explanation of Plate 3

Fossil grasses from the Ogallala Formation, SEM.

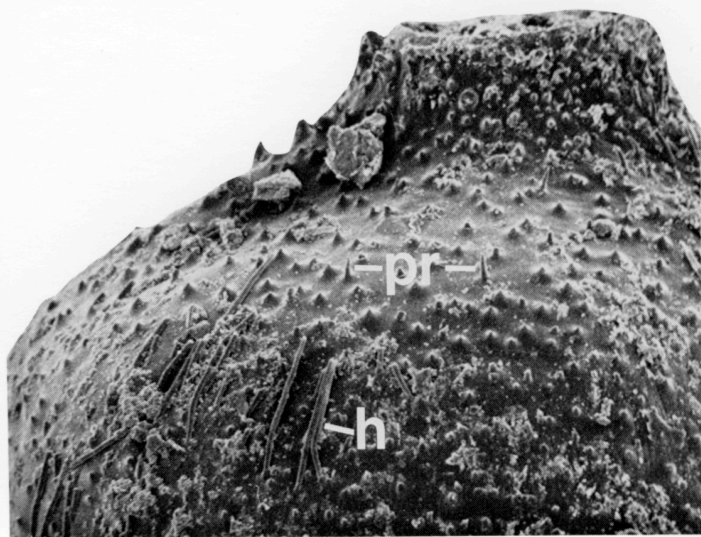
**A**, *Berriochloa tuberculata* Elias: lateral view of the shoulder and crown of an anthoecium showing hairs, h, and prickles, pr, x 78, BP113, bed 6 at site 42.

**B, C, D**, *Berriochloa aspera* Thomasson, sp. nov.: **B**, isotype, dorsal view of anthoecium showing prominent hooks, x 26, BP160, bed 1 at site 22; **C**, holotype, lateral view of anthoecium, x 26, BP162, bed 1 at site 22; **D**, holotype, enlargement of specimen in C showing prominent prow, p, and hooks, x 160.

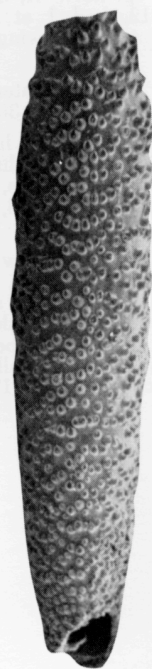
**E**, *Berriochloa brevis* (Elias) Thomasson, comb. nov.: paratype, lateral view of anthoecium, x 32, BP41, UNSM-E73.

**F, G**, *Berriochloa naruhea* Thomasson, sp. nov.: **F**, holotype, lateral view of anthoecium, x 22, BP157, bed 1 at locality 3, site 4; **G**, isotype, upper portion of anthoecium, x 48, BP158, bed 1 at locality 3, site 4.

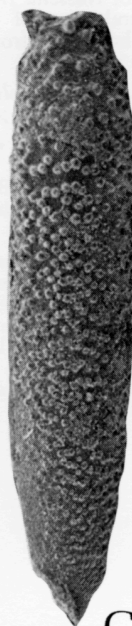
**H**, *Nassella amphora* Elias: paratype, lateral view of anthoecium, x 48, BP93, UNSM-E66.



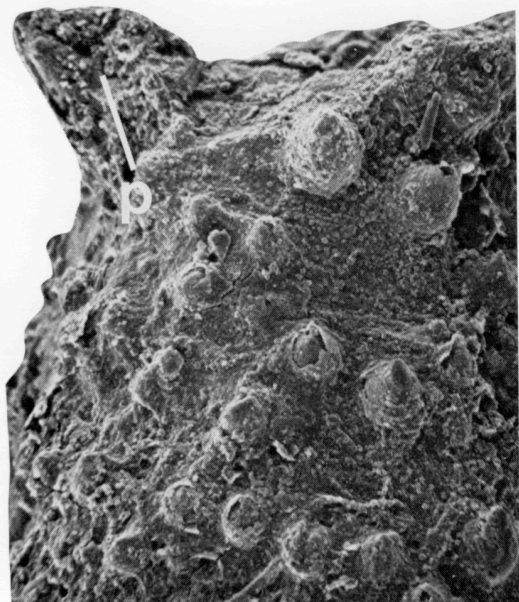
A



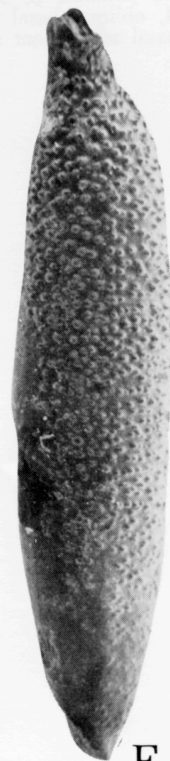
B



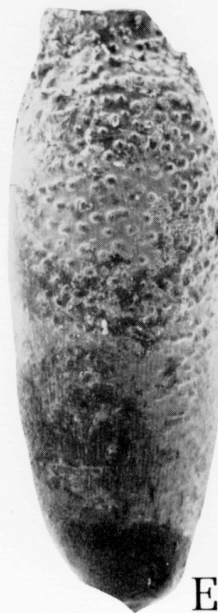
C



D



F



E



G



H

## Explanation of Plate 4

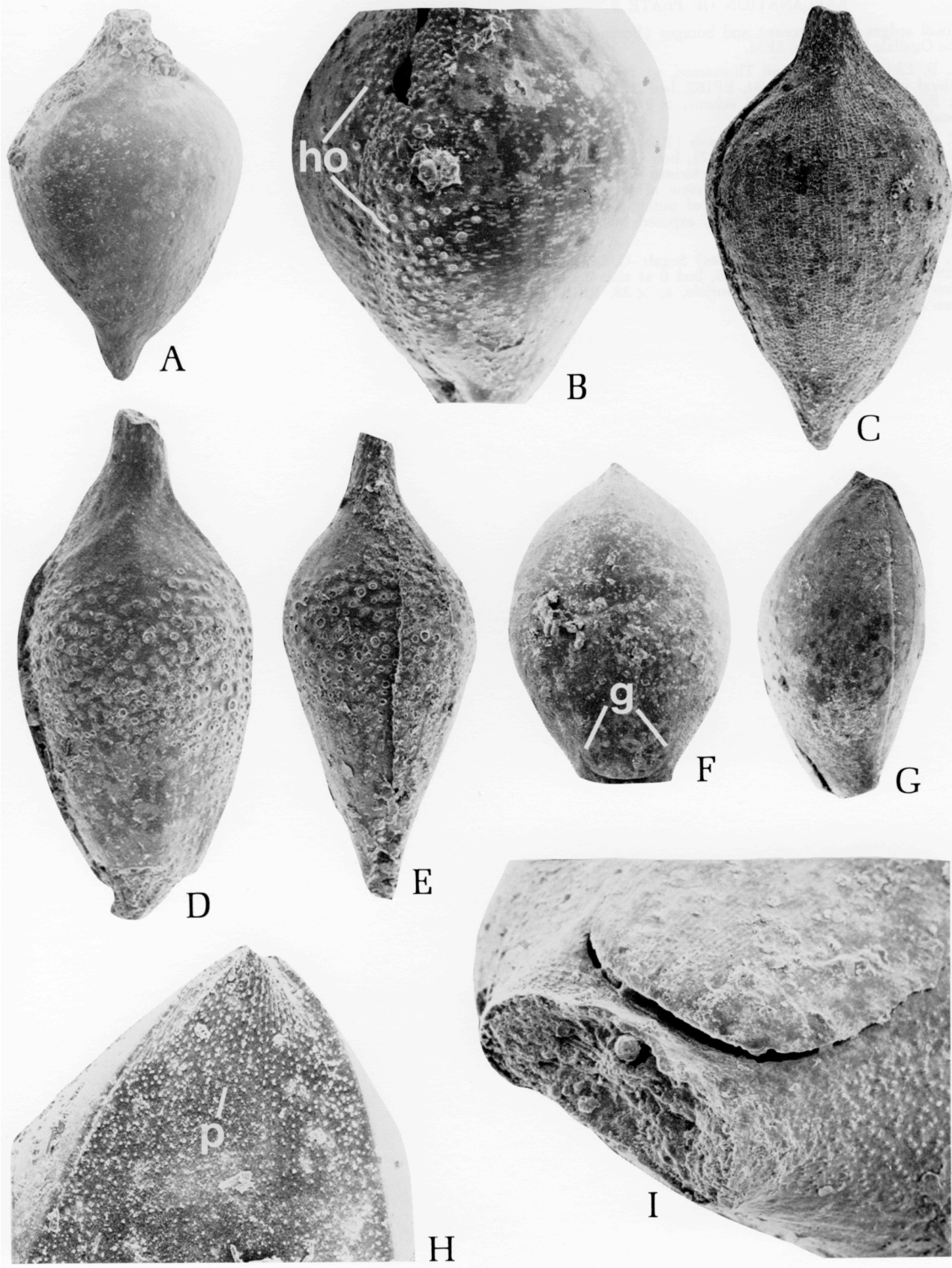
Fossil grasses from the Ogallala Formation, SEM.

**A, B**, *Nassella fryeleonardii* Thomasson, sp. nov.: **A**, holotype, lateral view of anthoecium, x 26, BP12, bed 1 at site 29; **B**, holotype, frontal view of specimen in A showing hooks, ho, x 60.

**C**, *Nassella pohlii* Thomasson, sp. nov.: holotype, lateral view of anthoecium, x 48, BP54, bed 2 at locality 4, site 39.

**D, E**, *Nassella reynoldsii* Thomasson, sp. nov.: **D**, holotype, lateral view of anthoecium showing hooks in medial 1/2 of lemma, x 48, BP104, bed 1 at site 21; **E**, isotype, frontal view of anthoecium showing overlapping lemma, x 48, BP105, bed 1 at site 21.

**F, G, H, I**, *Panicum elegans* Elias: **F**, dorsal view of anthoecium showing square germination lid, g, x 26, BP177, bed 1 at site 33; **G**, lateral view of anthoecium in F showing partially open germination lid, g, x 26; **H**, apex of palea illustrating vertical lines of papillae, p, x 86, BP163, bed 1 at locality 3a, site 30; **I**, oblique basal view of partially open germination lid and basal attachment scar, x 86, BP177, bed 1 at site 33.





## Explanation of Plate 5

Fossil sedges (Cyperaceae) and borages (Boraginaceae) from the Ogallala Formation, SEM.

**A, B**, *Eleoimbris svensonii* Thomasson, sp. nov.: **A**, holotype, lateral view of achene, x 94, BP165, bed 3 at locality 2, site 5; **B**, isotype, dorsal view of achene, x 94, BP164, bed 3 at locality 2, site 5.

**C, D, E, F**, *Cryptantha coroniformis* (Elias) Segal: **C**, dorsal view of smooth nutlet, x 40, BP171, bed 1 at site 1; **D**, ventral view of nutlet showing characteristic scar of attachment, x 40, BP169, site 45; **E**, lateral view of tuberculate nutlet, x 40, BP170, site 45; **F**, surface of nutlet showing rounded tubercules and epidermal cells, e, exposed below cuticle, x 200, BP169, site 45.

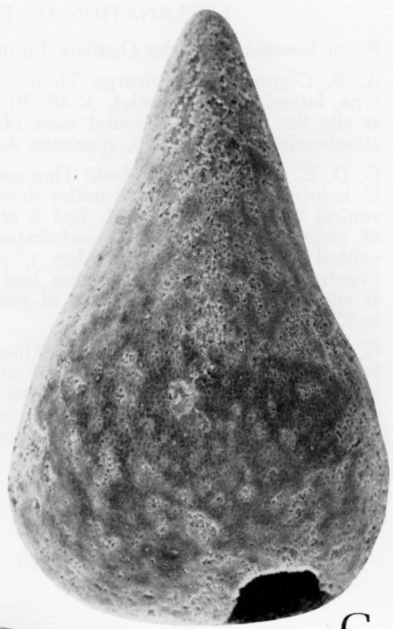
**G, H**, *Cryptantha auriculata* (Elias) Segal: **G**, lateral view of nutlet, x 36, BP180, specimen B, bed 6 at site 42; **H**, dorsal view of nutlet showing small auricle, a, x 32, BP180, specimen A, bed 6 at site 42.



A



B



C



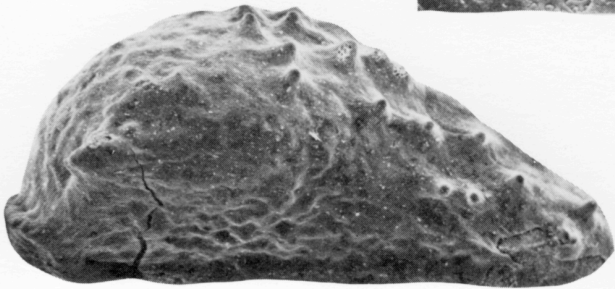
D



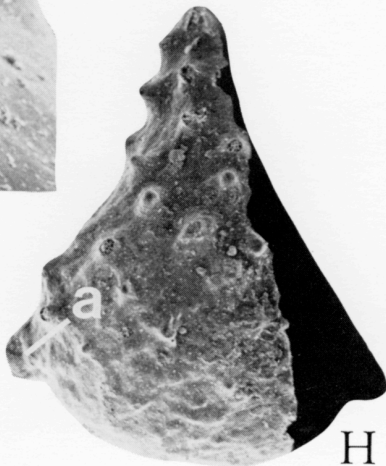
E



F



G



H

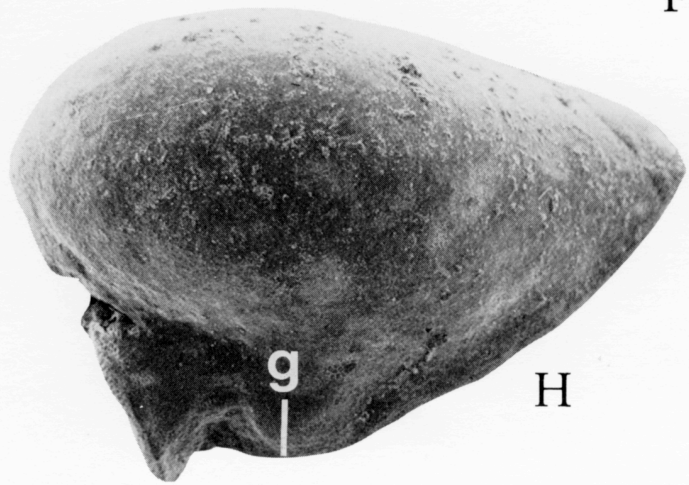
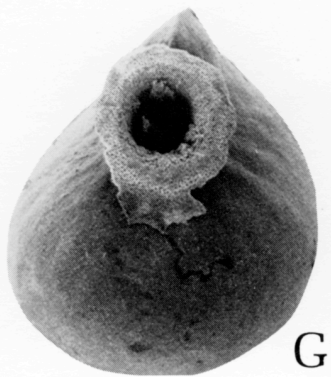
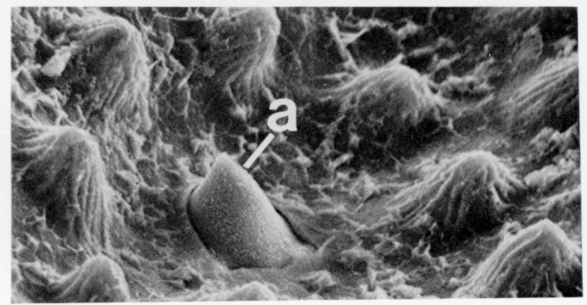
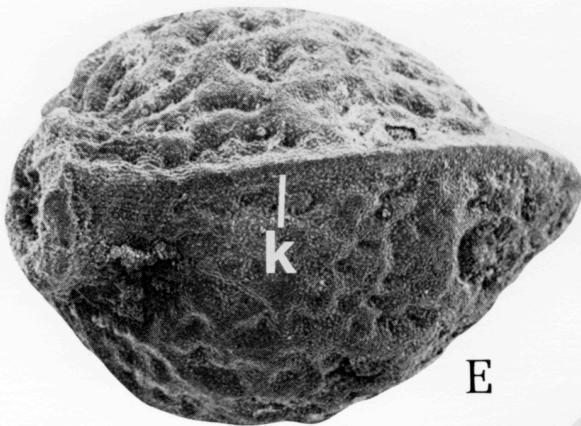
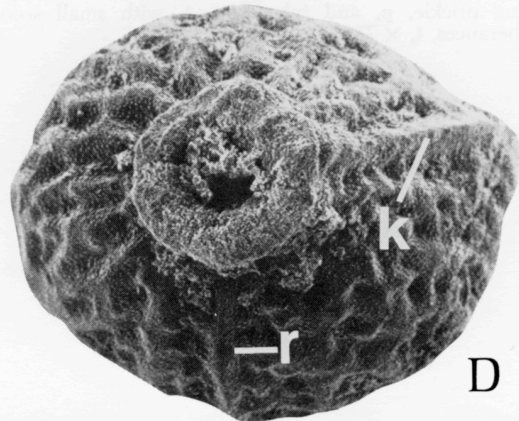
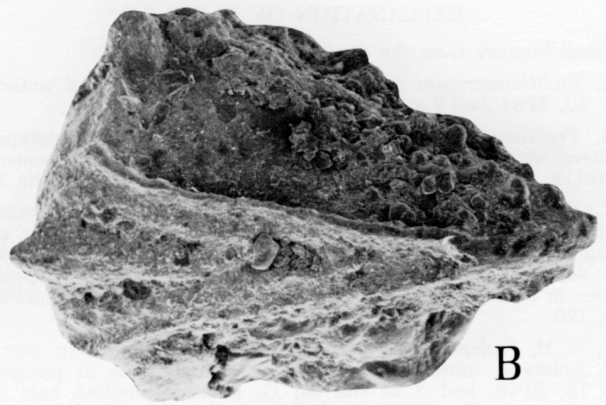
## Explanation of Plate 6

Fossil borages from the Ogallala Formation, SEM.

**A, B**, *Cryptantha parvicarpa* Thomasson, sp. nov.: **A**, holotype, lateral view of nutlet, x 48, BP179, specimen B, bed 2 at site 9c; **B**, isotype, frontal view of nutlet showing scar of attachment, x 48, BP179, specimen A, bed 2 at site 9c.

**C, D, E, F**, *Eliasiana aculeata* Thomasson, gen. nov., sp. nov.: **C**, holotype, lateral view of nutlet showing lateral ridge, r, and ventral keel, k, x 36, BP82, bed 2 at site 47; **D**, basal view of nutlet in E showing funnel-shaped scar with thick rim, ventral keel, k, and lateral ridge, r, x 36; **E**, isotype, frontal (ventral) view of nutlet showing keel, k, x 36, BP83, bed 2 at site 47; **F**, higher resolution of nutlet surface of specimen in C showing aculea, a, x 1000.

**G, H**, *Prolithospermum johnstonii* Elias: **G**, basal view of nutlet showing funnel-shaped scar of attachment, x 20, BP84, bed 9 at locality 3, site 6; **H**, lateral view of nutlet showing characteristic gibbous projection, g, of ventral keel and absence of lateral ridge, x 32, BP85, bed 9 at locality 3, site 6.



## Explanation of Plate 7

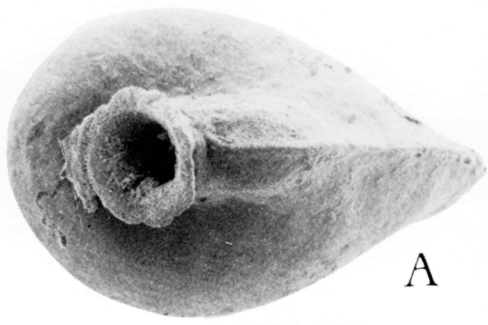
Fossil borages from the Ogallala Formation, SEM.

**A**, *Prolithospermum johnstonii* Elias: ventral view of nutlet, x 20, BP84, bed 9 at locality 3, site 6.

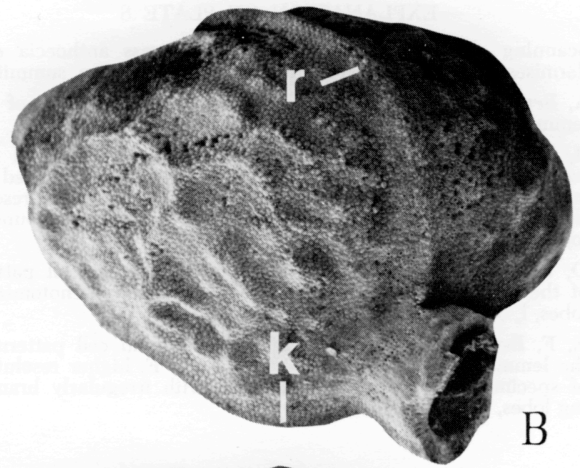
**B**, *Prolithospermum grossii* Thomasson, sp. nov.: holotype, lateral view of nutlet, showing lateral ridge, r, gibbous ventral keel, k, and funnel-shaped scar, x 30, BP178, bed 1 at site 2.

**C, D, E**, *Biorbia fossilia* (Berry) Cockerell: **C**, lateral view of smooth nutlet, x 32, BP89, site 44; **D**, lateral view of rugose nutlet showing lateral ridge, r, and ventral keel, k, x 44, BP98, bed 8 at locality 1, site 46; **E**, enlargement of specimen in D showing characteristic scar of attachment of *Biorbia*, x 120.

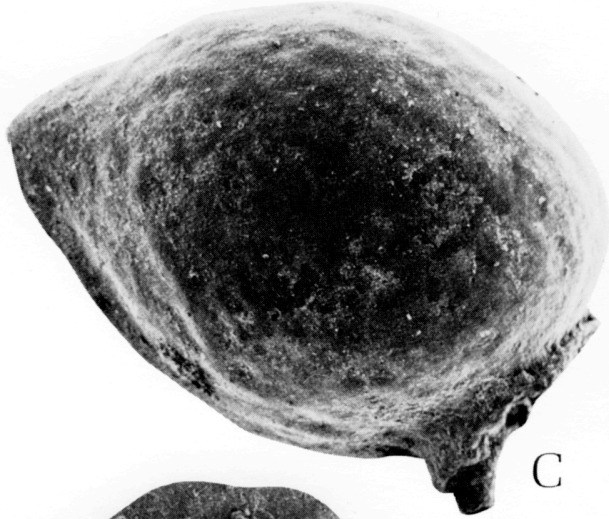
**F, G, H**, *Prolappula verrucosa* Thomasson, gen. nov., sp. nov.: **F**, holotype, nutlet surface showing barbed hairs at margin, x 78, BP18, bed 3 at site 9a; **G**, detail of barbed hair in specimen in F, x 440; **H**, higher resolution of nutlet in F, showing prickle, p, and tubercles, t, with small secondary protuberances, x 780.



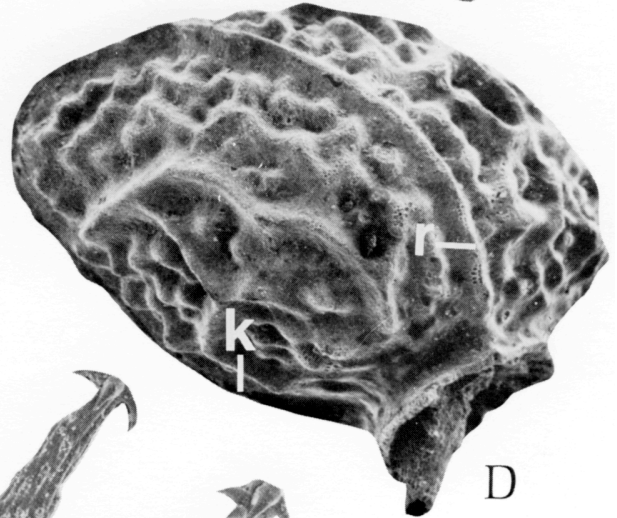
A



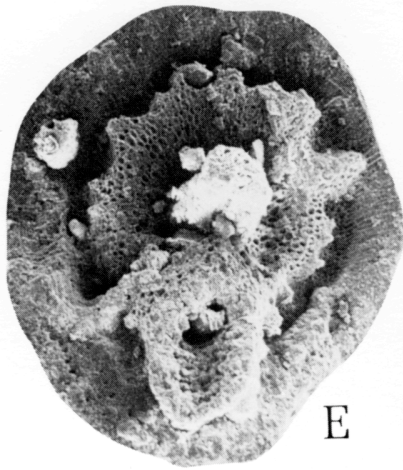
B



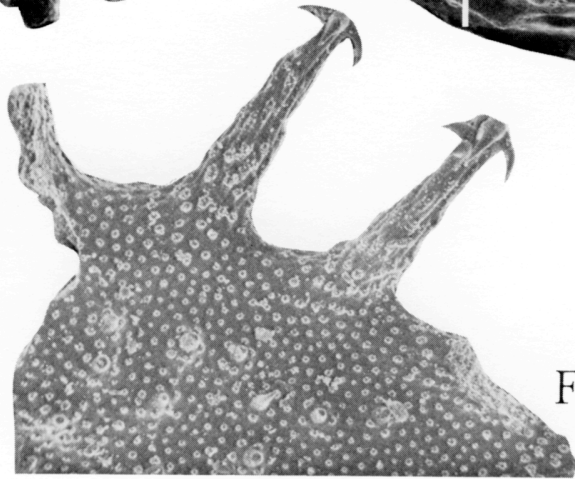
C



D



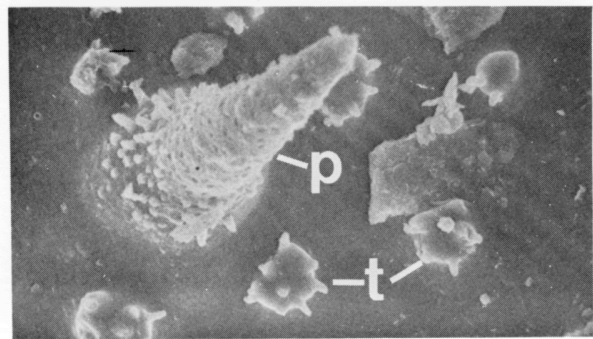
E



F



G



H

## Explanation of Plate 8

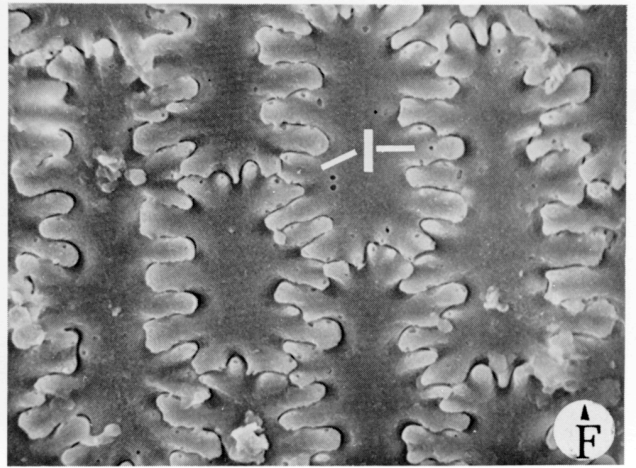
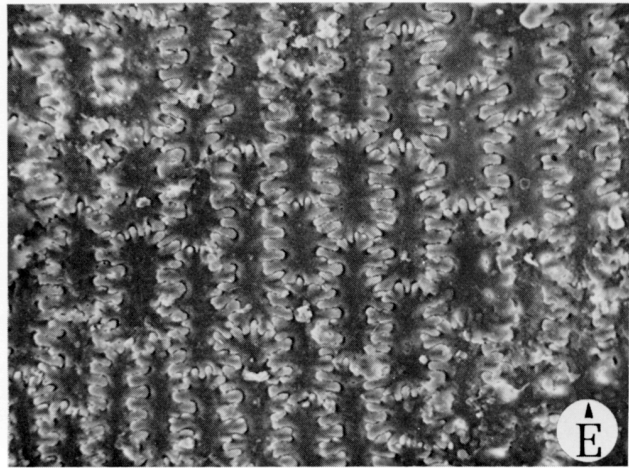
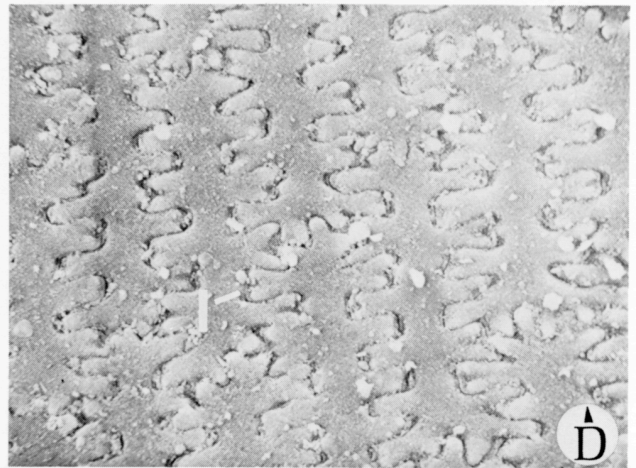
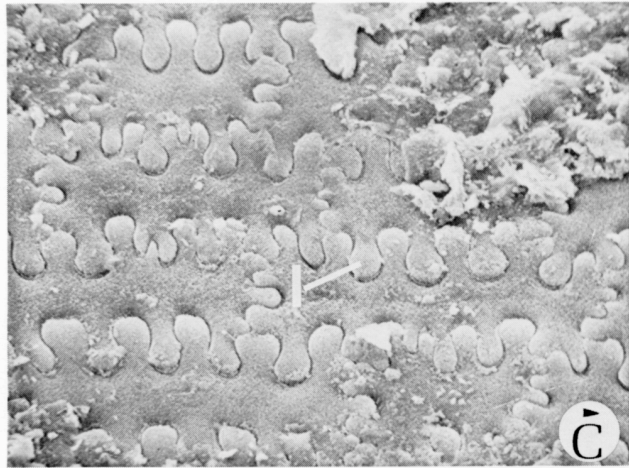
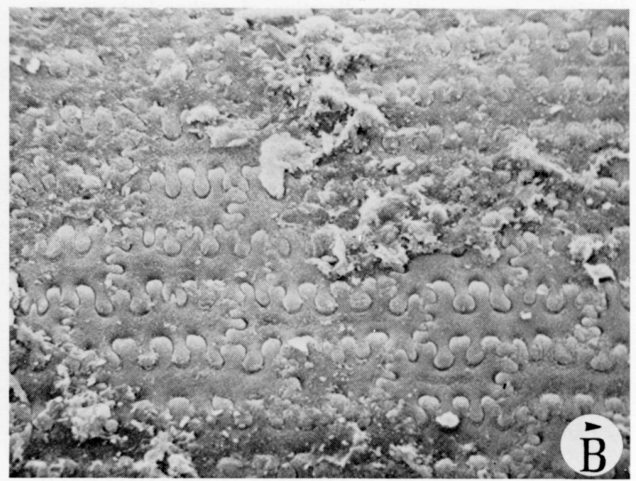
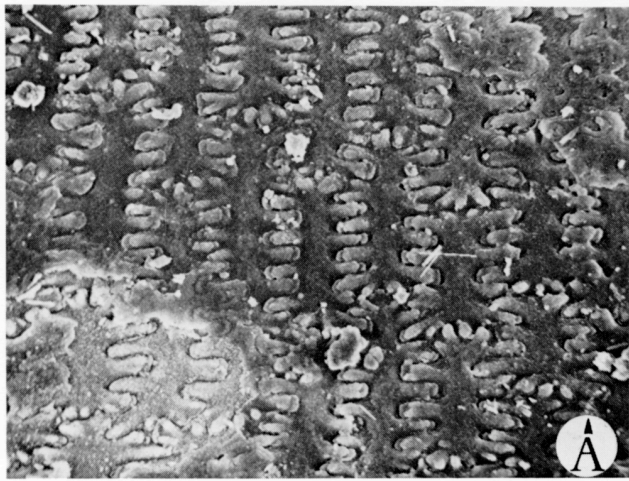
Scanning electron micrographs of fossil grass anthoecia epidermises. Arrows indicate direction of anthoecium summit.

**A**, *Berriochloa amphoralis* Elias: epidermal cell pattern of the lemma, x 440, BP128, bed 4 at site 21.

**B, C**, *Berriochloa conica* Elias: **B**, paratype, epidermal cell pattern of the lemma surface showing long cells obscured by cuticle, x 440, BP52 (from UNSM-E77); **C**, higher resolution of specimen in B showing long cells with simple rounded lobes, 1, x 780.

**D**, *Berriochloa inflata* Elias: paratype, epidermal cell pattern of the lemma showing long cells with regularly dichotomizing lobes, 1, x 780, BP51 (from UNSM-E14).

**E, F**, *Berriochloa maxima* Elias: **E**, epidermal cell pattern of the lemma, x 440, BP3, bed 1 at site 17; **F**, higher resolution of specimen in E showing long cells with irregularly branching lobes, 1, x 780.





## Explanation of Plate 9

Scanning electron micrographs of fossil grass anthoecia epidermises. Arrows indicate direction of anthoecium summit.

**A**, *Berriochloa minuta* Elias: epidermal cell pattern of the lemma showing long cells with simple lobes, x 440, BP116, bed 6 at site 42.

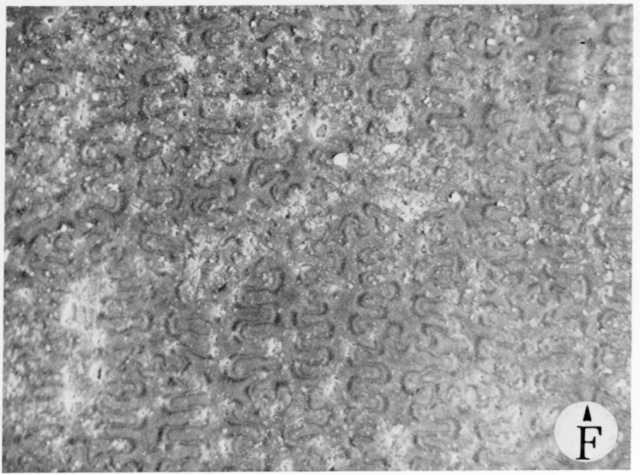
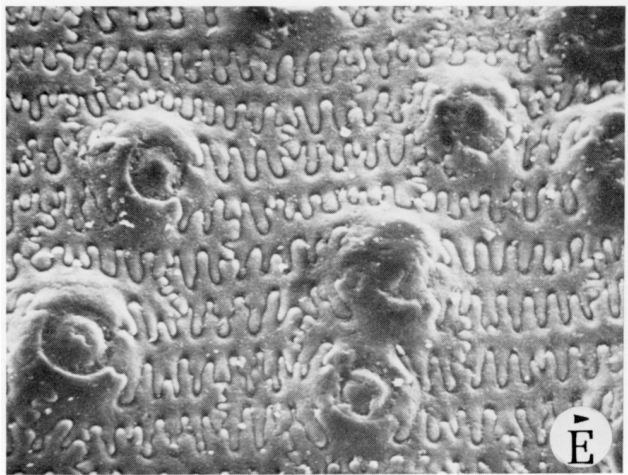
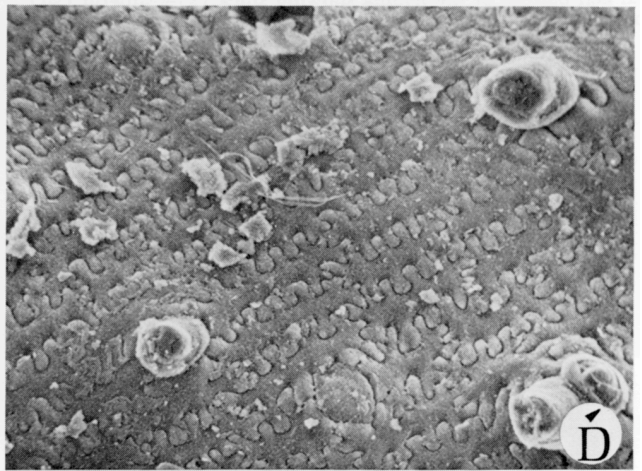
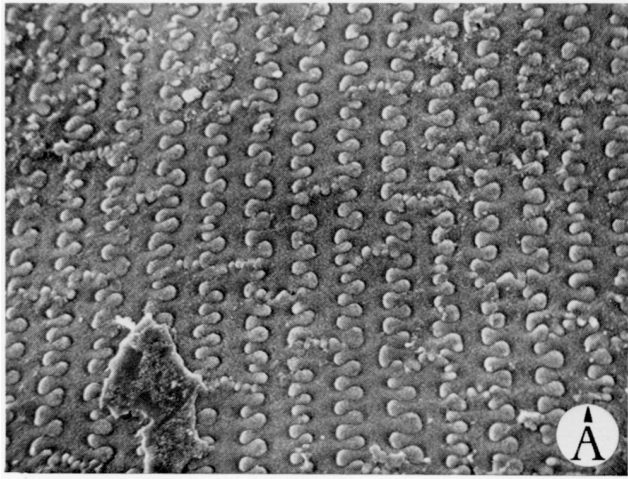
**B**, *Berriochloa primaeva* Elias: paratype, epidermal cell pattern of the lemma showing long cells with simple acute lobes, x 780, BP39 (from UNSM-E9).

**C**, *Berriochloa pumila* Thomasson, sp. nov.: epidermal cell pattern of the lemma showing a hook, h, and long cells partially obscured by a cuticle, x 780, BP145, bed 1 at site 22.

**D**, *Berriochloa tuberculata* Elias: epidermal cell pattern of the lemma showing hair bases and long cells, x 440, BP113, bed 6 at site 42.

**E**, *Berriochloa brevis* (Elias) Thomasson, comb. nov.: paratype, epidermal cell pattern of the lemma showing remnants of hooks and well-developed long cells, x 440, BP41 (from UNSM-E3).

**F**, *Berriochloa grandis* (Elias) Thomasson, comb. nov.: paratype, epidermal cell pattern of the lemma showing long cells obscured by thin cuticle, x 440, BP46 (from UNSM-E10).



## Explanation of Plate 10

Scanning electron micrographs of fossil grass anthoecia epidermises. Arrows indicate direction of anthoecium summit.

**A**, *Berriochloa naruhea* Thomasson, sp. nov.: holotype, epidermal pattern of lemma showing hooks, ho, and long cells, x 440, BP157, bed 1 at locality 3, site 4.

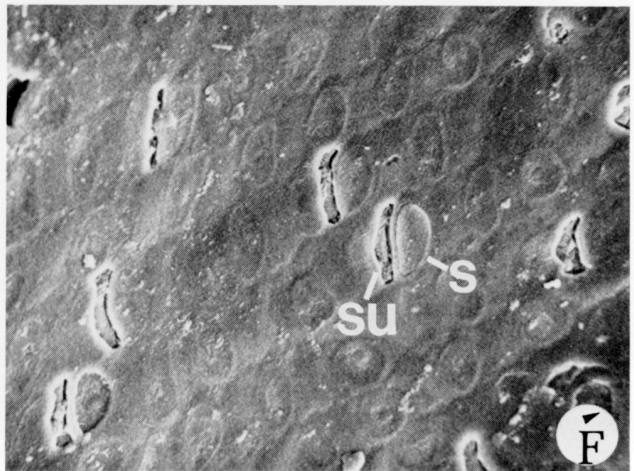
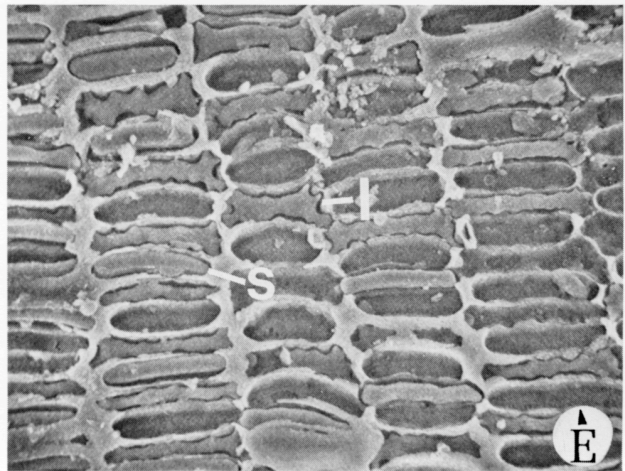
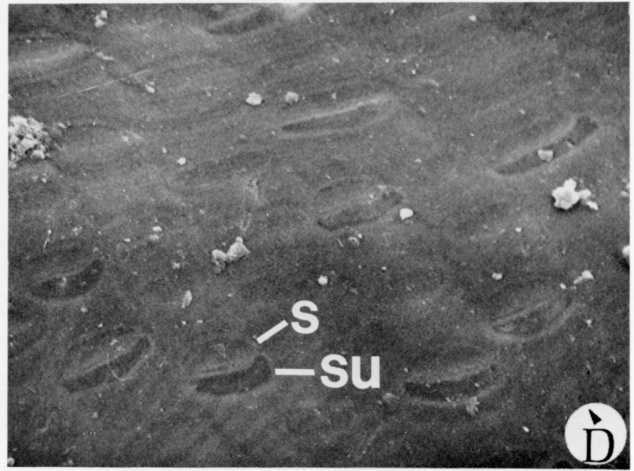
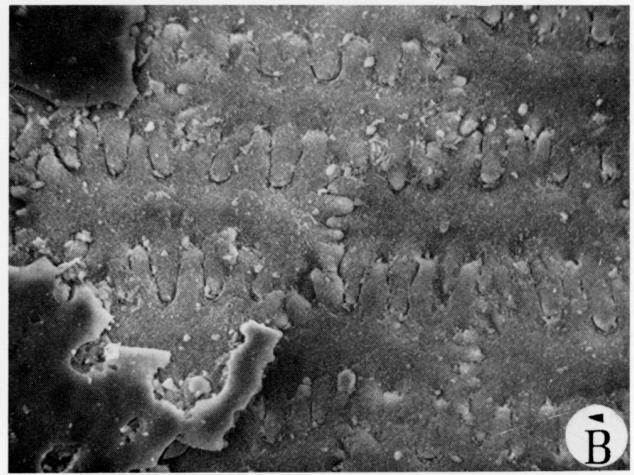
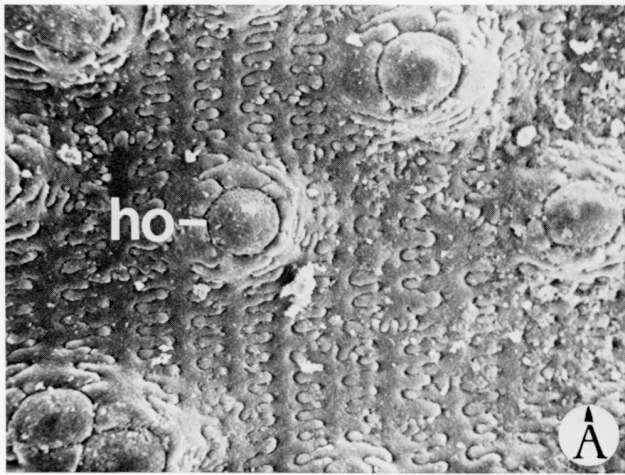
**B**, *Berriochloa tuba* (Elias) Thomasson, comb. nov.: paratype, epidermal pattern of the lemma, x 440, BP55 (from UNSM-E68).

**C**, *Nassella amphora* Elias: paratype, epidermal cell pattern of the lemma with features only slightly observable through the cuticle. Note the remnants of tubercles, t, and the crescent to oval shaped long cells outlined in black. Note other similar cells nearby, x 440, BP93 (from UNSM-E66).

**D**, *Nassella fryeleonardii* Thomasson, sp. nov.: holotype, epidermal cell pattern of the lemma showing silica (s)-suberin (su) couples, x 660, BP12, bed 1 at site 29.

**E**, *Nassella pohlii* Thomasson, sp. nov.: holotype, epidermal cell pattern of the lemma showing long cells with ripple walls, l, and crescent to oval shaped short cells (? silica) with smooth walls, s, x 780, BP54, bed 2 at locality 4, site 39.

**F**, *Nassella reynoldsii* Thomasson, sp. nov.: holotype, epidermal cell pattern of the lemma showing silica (s)-suberin (su) couples, x 780, BP104, bed 1 at site 21.



## Explanation of Plate 11

Scanning electron and light micrographs of the epidermises of fossil grass anthoecia or leaves, sedge achenes, and sedge nutlets. Arrows indicate direction of the anthoecium, achene, or nutlet summits.

**A**, *Panicum elegans* Elias: epidermal cell patterns of the over-lapping lemma (left) and palea (right), x 780, BP177, bed 1 at site 33, SEM.

**B**, *Graminophyllum kansasensis* Thomasson, sp. nov.: holotype, epidermal cell pattern of a leaf fragment showing silica cell, si, suberin cell, su, long cell, l, and stoma with guard cells, g, and dome-shaped subsidiary cells, d, x 3176, bed 2 at site 2, LM.

**C**, *Eleofimbris svensonii* Thomasson, gen. nov., sp. nov.: holotype, epidermal cell pattern of the achene surface, x 780, BP165, bed 3 at locality 2, site 5, SEM.

**D**, *Prolithospermum johnstonii* Elias: epidermal cell pattern of the nutlet surface, x 780, BP84, bed 9 at locality 3, site 6.

**E**, *Cryptantha coroniformis* (Elias) Segal: epidermal cell pattern of the nutlet surface, x 780, BP169, site 45.

**F**, *Biorbia fossilia* (Berry) Cockerell: epidermal cell pattern of the nutlet surface, x 780, BP98, bed 8 at locality 1, site 46.

