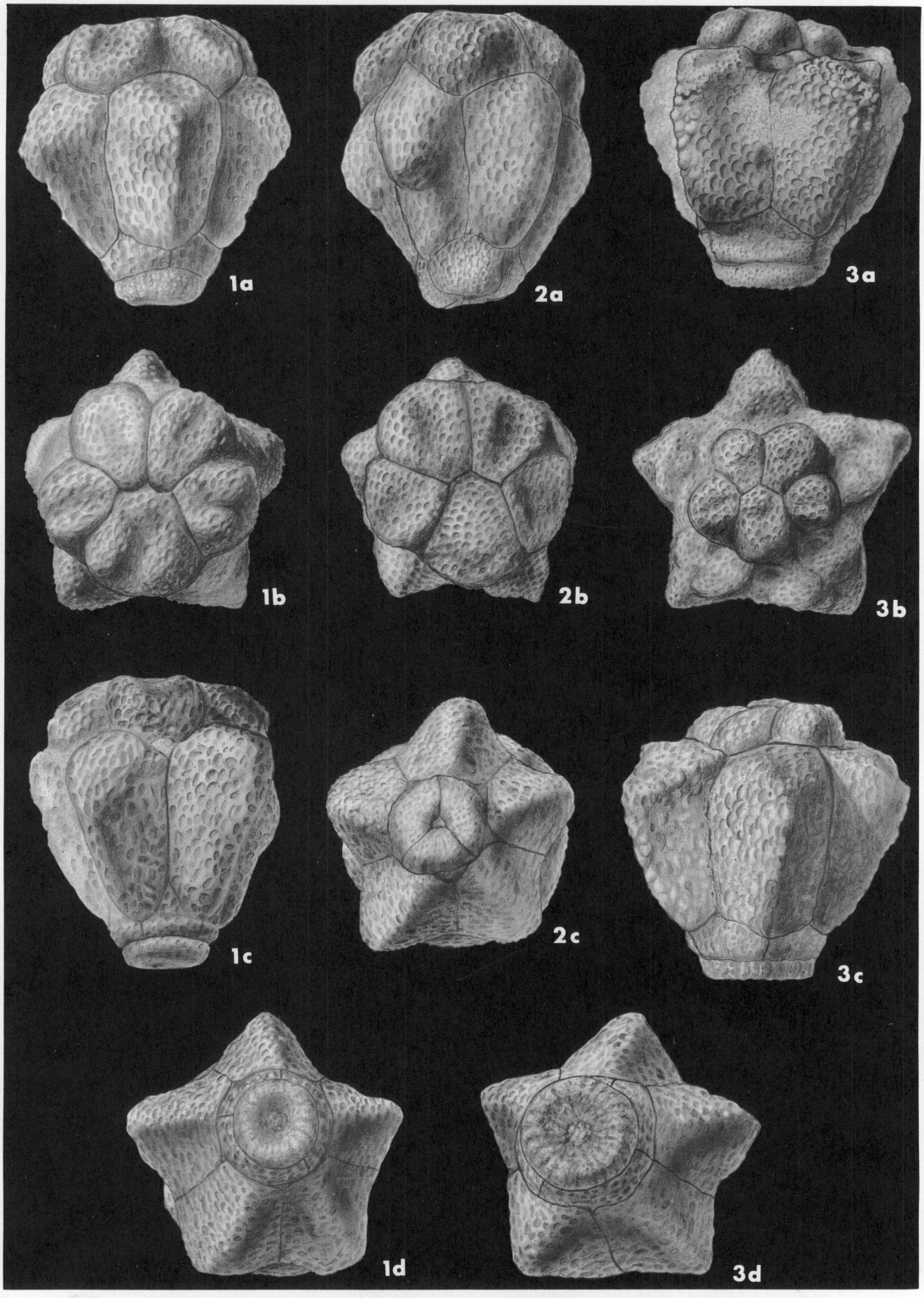
1a
2a
3a
1b
2b
3b
1c
2c
3c
1d
3d

Five radials, half again as wide as high, gently convex transversely and longitudinally. A radial bilaterally symmetrical; B and E radials extended slightly on posterior half; C and D radials obviously extended on posterior half. Interradial articulation faces have denticulate lateral ridge on distal, dorsal, and dorsal half of proximal edges, smooth otherwise. Facet wide, subhorizontal to slight inward slope. Narrow shelf on outer ligament area extending full width of radial; outer ligament ridge faint but present, coalesces with transverse ridge at extremities; ligament pit central, slightly less than one-third width of radial, extends proximally under transverse ridge; ligament pit furrow shallow, terminated at outer extremities by coalescence of outer ligament ridge and transverse ridge; transverse ridge not as wide as radial, crest straight, inner edge convex, outer edge convex notched by ligament pit. Inner ligament area divided into mirror images by moderately deep central pit, short shallow intermuscular furrow, and arched intermuscular notch; oblique ridge continuous from convex inward, extends from lateral edge of facet to center of transverse ridge separating oblique furrow from central pit. Muscular area tear-drop crescent-shaped, pointed on lateral extremities, rounded on inner, containing three obvious furrows on inner ends.

Anal plate pentagonal, erect, slightly convex longitudinally and transversely, little more than half below summit of dorsal cup, in clockwise direction adjoins the following plates: C-ray radial, CD-interray basal, D-ray radial, D-ray primibrach, left anal sac plate, right anal sac plate, and C-ray primibrach.

Ten arms, uniserial, branch isotomously on IBr_2, no further branchng observed. Brachials approximately twice as wide as high, nearly circular in cross section with deep V-shaped food groove.

Ornamentation covering all cup plates and primibrachs consists of fine papillae.

Measurements (mm)—Measurements taken on hypotype 34198. H 20.0; W 29.5 (maximum), 25.5 (minimum), 27.5 (average); H/W 0.73; WIB 15.1; HB 15.1; WB 15.5; HR 9.0; WR 13.5, $HIBr_1$ 4.4; $WIBr_1$ 14.0; HIAx 5.4; WIAx 11.3; $HIIBr_1$ 3.4; $WIIBr_1$ 7.5.

Remarks.—Discovery of unsilicified crowns and disarticulated ossicles of *Paragassizocrinus calyculoides* prompted the emended description above. Lane's original description (1964, p. 682) was based on a silicified cup for *Polusocrinus calyculoides*. His material did not show ornamentation, articulation details, nor information about the arms, all of which are described here. Study of Lane's types of *P. calyculoides* and *P. pachyplax* and comparison with this new material leave no doubt that *P. pachyplax* is a junior subjective synonym of *P. calyculoides*.

Paragassizocrinus calyculoides is a new combination. Table 4 shows that *P. calyculoides* agrees quite well with *Paragassizocrinus* except for the shape of the dorsal cup. Strimple (1960, p. 7) showed that the shape of the infrabasal circlet of *Paragassizocrinus* is variable. Considering the other morphologic features of *P. calyculoides* it is assigned to the genus *Paragassizocrinus*, and the shape of the dorsal cup is considered to be only of specific significance. *Paragassizocrinus calyculoides* probably represents a transitional stage in the development of *Polusocrinus* from *Paragassizocrinus*.

One mature infrabasal circlet was split along the BC and DE sutures through the axial canal. This plate was 8.3 mm thick and showed the column was retained until the plate was 4.7 mm thick. Six proximal columnals were in place within the circlet which continued to grow after the loss of the column covering all external traces of the stem impression.

Because of the distinct appearance of the very

EXPLANATION OF PLATE 58

FIGS. *1,2—Kallimorphocrinus inaquosus* Webster and Lane, n. sp. 1*a-d*, holotype 34194, A-ray, ventral, CD-interray, and basal views, ×37. 2*a-c*, paratype 34195, CD-interray, ventral, and basal views, ×50.

3—Kallimorphocrinus inhumectus Webster and Lane, n. sp. Holotype 34197, CD-interray, ventral, A-ray, and basal views, ×34.

TABLE 4—COMPARISON OF MORPHOLOGIC FEATURES AND RANGES OF *POLUSOCRINUS* AND *PARAGASSIZOCRINUS* WITH INCLUSION OF *PARAGASSIZOCRINUS CALYCULOIDES*

CHARACTER	POLUSOCRINUS	PARAGASSIZOCRINUS	PARAGASSIZOCRINUS CALYCULOIDES
Shape of dorsal cup	Truncated bowl	Truncated cone to bullet-shaped	Globose to truncated bowl
Number of arms	10–14	10	10
Infrabasal circlet	Non-fused	Fused with age	Fused with age
Column	Circular, not lost in mature specimens	Pentabolate, lost in mature specimens	Pentabolate, lost in mature specimens
Dorsal cup plates	Thick	Very thick	Very thick
Geologic range	Desmoines-Missouri	Morrow-Missouri, possibly lower Virgil	Upper Morrow

thick dorsal cup plates, disarticulated ossicles and partial cups of *P. calyculoides* are easily identified in the field and have been found at several localities in southern Nevada. Lane (1964) reported silicified specimens from the lower part of the Callville Formation at Frenchman Mountain, east of Las Vegas, and the Flintkote Quarry at Sloan, Nevada. Silicified partial cups of *P. calyculoides* were collected later from the lower part of the Bird Spring Formation in the southern part of the Bird Spring Range. Unsilicified crowns were found at the Arrowlime Quarry and Las Vegas Range sections; disarticulated ossicles were observed at the Gunnery Range, Arrowlime, Dry Lake, Las Vegas Range, and Arrow Canyon sections. Loose ossicles collected from a thin shale 511 feet above the base of the Bird Spring Formation in Arrow Canyon provided most of the morphological details here described. At all localities the occurrence is a short distance, 5 to 200 feet, below the *Profusulinella* Zone and in the upper extent of the range of *Steptognathodus noduliferus* and *Polygnathodella* sp., thus indicating that the species is restricted to the upper part of the Morrow Series. Washburn (1968) described *Globocrinus bulbus* from the Morrowan part of the Oquirrh Formation. The genus *Globocrinus* is preoccupied (Weller, *et al.*, 1920). *Globocrinus bulbus* is considered by us to be a junior synonym of *P. calyculoides.* From the numerous occurrences it appears that *P. calyculoides* is a good late Morrow index fossil in southern Nevada.

Material.—Two crowns from UCLA locality 5247-37 and numerous disarticulated ossicles from UCLA locality 5245-60.

Types.—Hypotypes, 34198–34199, 39492–39499.

Family POTERIORCRINITIDAE Bassler, 1938.

Genus POTERIOCRINITES Miller, 1821

Type species.—*Poteriocrinites crassus* Miller, 1821

POTERIOCRINITES CAVUS Webster & Lane, n. sp.

Pl. 56, figs. 14,15

Description.—Dorsal cup large, low cone-shaped, base wide; infrabasals five, wide, visible in side view, making up about one-fourth of cup height, tips strongly depressed; basals large, convex, with large, deep, circular depressions between adjacent basals, extending from top of infrabasals to proximal tips of radials, and smaller depressions at distal angles of basals; radials large, convex, strongly depressed at angles with basals; facets one-half to two-thirds width of radials, horseshoe-shaped, directed obliquely upward, with wide, prominent ambulacral notch; anal-X directly above CD basal, quadrangular, distal surface with a conspicuous internal notch that presumably extended distally to anal sac plates; other anal plates missing, but depressions on edges of CD and BC basals, anal-X and C radial indicate radianal and right tube plate were in the cup; C radial has two depressions along its adposterior edge.

Tegmen not preserved; arms broad, strongly rounded, uniserial; brachials low, broad, preserved to height of primibrach *6* in most complete(*E*) ray, without an axillary.

Stem large, wide, lumen large circular, making up over one-half columnal width; columnals thin, with fine crenellae on articular surface.

Measurements.—Dimensions (in mm) of the holotype are: height, cup, *22*; width, cup, 34; width, stem, 12.5; width, lumen, *7*; height and width, IB circlet, 4.5, 19; height and width, DE basal, 13, 14; height, width, E radial, 9, 14; width, B, radial facet, 8; width, brachials, 8.

Remarks.—This species is unlike any previously described Pennsylvanian crinoid and bears closest resemblance to several species of *Poteriocrinites* from the Lower Carboniferous of Great Britain, especially in having deep depressions between cup plates and at least six primibrachs to a ray. British Lower Carboniferous *Poteriocrinites* may have as many as 13 pri-

mibrachs to a ray, typically have facets one-half to two-thirds as wide as the radials, and several species have prominent depressions at the angles of cup plates. American Mississippian *Poteriocrinites,* and the closely related *Springericrinus,* may have similar sculpture on the cup, but the arms typically branch on or below the third primibrach, rather than higher. The few Pennsylvanian species still retained in this genus either have radial facets that almost fill the upper surface of the radial (*P. macoupensis* Worthen; *P. lasallensis* Worthen), or arms that branch on the first primibrach (*P. ramonaensis* Strimple).

Material.—The holotype and only known specimen is no. 47206, from the Bird Spring Formation, at Indian Springs, Nevada, UCLA Loc. 4426 (see Lane, 1964).

FAMILY, GENUS, AND SPECIES UNKNOWN

SPECIES C

Pl. 57, fig. 27

Description.—Crown large, expanded upward with maximum width near lower third of arms. Dorsal cup incomplete, probably low bowl-shaped. Infrabasals and anals not preserved. Distal tips of two basals flaring strongly outward and upward. Radials wider than high, strongly convex longitudinally, facets occupy full width of plates, distal parts subvertical. First primibrachs axillary in all rays, moderately protruded at distal tip. Ten arms, broad, strongly rounded externally in proximal half, flat gently tapering distally; interlocking laterally in proximal third. Brachials short, biserial in proximal half of arm, becoming uniserial distally.

Measurements (mm).—HC 87 (incomplete); H arms 72.5; WB 13.4; HR 11.4; WR 19.7; $HIBrr_1$ 8.2; $WIBrr_1$ 18.1; $HIIBrr_1$ 4.1; $WIIBrr_1$ 10.6; $HIIBrr_2$ 1.5; $WIIBrr_2$ 10.6; $HIIBrr_3$ 1.4; $WIIBrr_3$ 9.7.

Remarks.—The shape of the crown and presence of 10 strongly rounded arms which interlock laterally in the proximal part suggests a relationship to the Cromyocrinidae.

Material.—One partial crown, NAM G2.8693 from the Carrizo Creek locality.

SPECIES D

Pl. 57, fig. 18

Description.—Five upflaring infrabasals?, seven degrees from vertical; slightly wider than high, axial canal pentalobate, proximal part horizontal crenellate. Column round, composed of alternating thick and thin columnals, crenellate; lumen pentalobate.

Measurements (mm).—HIB? 5.5; WIB? 6.1; WS 8.4.

Remarks.—The specimen described above is so fragmentary it is not known if it is an infrabasal or basal circlet. No other loose ossicles were found that could be referred to this form. The round column and steeply inclined infrabasals? are features of some genera of the families Blothrocrinidae and Cercidocrinidae; however, no attempt is made to assign this specimen to either family.

Material.—One partial cup, hypotype 43135, is from the Middle Morrow part of the Bird Spring Formation, Arrow Canyon, Nevada.

LOCALITY REGISTER

Detailed locality information including some stratigraphic sections has been published for numerous species described above. (Webster, 1969). Only data for new localities will be given herein to avoid duplication. Interested readers are referred to the original reference. All locality numbers are from the Paleontology Locality Register, Department of Geology, University of California at Los Angeles.

4426—Middle Pennsylvanian, Bird Spring Formation, Clark County, Nevada, sec. 16, T 16 N, R 56 E; 1.4 miles southwest of Indian Springs, Nevada. Along pole line road 0.2 mile west of Indian Springs Ranch, then 0.5 mile southwest along dirt track to limestone spur. Fossil bed just behind spur about 150 feet above valley floor.

4857–1—Middle Pennsylvanian, Honaker Trail Formation, San Juan County, Utah, sec. 34, T 41 S, R 19 E; along north bank of San Juan River immediately north of the old well-site road; uppermost shale of Desmoines part of formation as illustrated by Wengerd (1963, fig. 5).

5154—Middle Pennsylvanian, Naco Group, Gila County, Arizona. C S½, NW¼, sec. 7, T 6 N, R 20 E; north bank of Carrizo Creek where creek is flowing west. Greenish shale at base of bioclastic cliff-forming limestone.

5243–22 to *5248–16c*—See Webster, 1969.

REFERENCES

BOWSHER, A. L., 1955, New genera of Mississippian camerate crinoids: Univ. Kansas. Paleont. Contr., Echinodermata, Art. 1, 23 p., 6 Pls.

BURKE, J. J., 1967, A new *Endelocrinus* from the Brush Creek Limestone (Pennsylvanian) of Pennsylvania: Carnegie Museum, Ann., v. 39, Art. 4, p. 75–83.

FAY, R. O., 1961, Blastoid studies: Univ. Kansas Paleont. Contr., Echinodermata, Art. 3, 147 p., 54 Pls.

GALLOWAY, J. J., & KASKA, H. V., 1957, Genus *Pentremites* and its species: Geol. Soc. America, Mem. 69, ix + 104 p., 13 Pls.

LANE, B. O., 1962, The fauna of the Ely Group in the Illipah area of Nevada: Jour. Paleontology, v. 36, p. 888–911, Pls. 125–128.

LANE, N. G., 1964, New Pennsylvanian crinoids from Clark County, Nevada: Jour. Paleontology, v. 38, p. 677–684, Pls. 112.

——, & WEBSTER, G. D., 1966, New Permian crinoid fauna from southern Nevada: Univ. California, Pub. Geol. Science, v. 63, v + 87 p., 13 Pls.

LAUDON, L. R., 1941, New crinoid fauna from the Pitkin Limestone of northeastern Oklahoma: Jour. Paleontology, v. 15, p. 384–391, Pls. 56–57.

——, & SEVERSON, J. L., 1953, New crinoid fauna, Mississippian, Lodgepole Formation, Montana: Jour. Paleontology, v. 27, p. 505–536, Pls. 51–55.

MACURDA, D. B., 1964a, The blastoid *Pentremites* Say—a trimerous mutant and some new occurrences: Jour. Paleontology, v. 38, p. 705–710, Pl. 116.

——, 1964b, The Mississippian blastoid genera *Phaenoschisma, Phaenoblastus,* and *Conoschisma:* Jour. Paleontology, v. 38, p. 711–724, Pls. 117–118.

——, 1965, The functional morphology and stratigraphic distribution of the Mississippian blastoid genus *Orophocrinus:* Jour. Paleontology, v. 39, p. 1045–1096, Pls. 121–126.

MEEK, F. B., 1872, Preliminary list of fossils collected by Dr. Hayden's exploring expedition of 1871, in Utah and Wyoming Territories, with descriptions of a few new species: U. S. Geol. Survey of Montana and adjacent territories, Rep. for 1871, p. 373–377.

——, & WORTHEN, A. H., 1865, Note in relation to a genus of crinoids from the Coal Measures of Illinois and Nebraska, proposed on page 174 of the last number of this journal: Am. Jour. Science, v. 39, p. 350.

MILLER, S. A., 1881, Subcarboniferous fossils from the Lake Valley Mining District of New Mexico, with descriptions of new species: Cincinnati Soc. Nat. History, Jour., v. 4, p. 306–315, Pl. 7.

——, & GURLEY, W. F. E., 1897, New species of crinoids, cephalopods, and other Palaeozoic fossils: Illinois State Mus. Nat. History, Bull. 12, 70 p., 5 Pls.

MOORE, R. C. & LAUDON, L. R., 1943, Evolution and classification of Paleozoic crinoids: Geol. Soc. America, Spec. Paper 46, x + 153 p., 14 Pls.

——, & PLUMMER, F. B., 1938, Upper Carboniferous crinoids from the Morrow subseries of Arkansas, Oklahoma, and Texas: Denison Univ. Bull., Jour. Sci. Labs., v. 32 (1937), p. 209–313, Pls. 12–16.

——, & ——, 1940, Crinoids from the Upper Carboniferous and Permian strata in Texas: Univ. Texas Pub. 3945, 468 p., 21 Pls.

PECK, R. E., 1930, Blastoids from the Brazer Limestones of Utah: Pan-American Geologist, v. 54, p. 104–108, Pl. 14.

STRIMPLE, H. L., 1938, A group of crinoids from the Pennsylvanian of northeastern Oklahoma: Bartlesville, Oklahoma (private publication), 14 p., 1 Pl.

——, 1959, Crinoids from the Missourian near Bartlesville, Oklahoma: Oklahoma Geol. Notes, v. 19, p. 115–127, 2 Pls.

——, 1960, Regressive evolution among erisocrinids: Oklahoma Geol. Notes, v. 20, p. 151–155.

——, 1961, Late Desmoinesian crinoids: Oklahoma Geol. Survey, Bull. 93, 189 p., 19 Pls.

——, 1962, Crinoids from the Oologah Formation: Oklahoma Geol. Survey, Circ. 60, 75 p., 9 Pls.

——, 1966, New species of cromyocrinids from Oklahoma and Arkansas: Oklahoma Geol. Notes, v. 26, p. 3–12, 2 Pls.

——, & KOENIG, J. W., 1956, Mississippian microcrinoids from Oklahoma and New Mexico: Jour. Paleontology, v. 30, p. 1225–1247.

TISCHLER, HERBERT, 1963, Fossils, faunal zonation, and depositional environment of the Madera Formation, Huerfano Park, Colorado: Jour. Paleontology, v. 37, p. 1054–1068, Pls. 139–142.

WACHSMUTH, CHARLES, & SPRINGER, FRANK, 1897, The North American Crinoidea Camerata: Harvard College, Mus. Comp. Zoology, Mem., v. 21–22, 897 p., 83 Pls.

WASHBURN, A. T., 1968, Early Pennsylvanian crinoids from the south central Wasatch Mountains of central Utah: Brigham Young Univ. Geol. Studies, v. 15, p. 115–131, 3 Pls.

WEBSTER, G. D., 1969, Chester through Derry conodonts and stratigraphy of northern Clark and southern Lincoln Counties, Nevada: Univ. California, Pub. Geol. Science, v. 79, 121 p., 8 Pls.

——, & LANE, N. G., 1967, Additional Permian crinoids from southern Nevada: Univ. Kansas Paleont. Contr., Paper 27, 32 p., 8 Pls.

WELLER, J. M., 1930, A group of larviform crinoids from Lower Pennsylvanian strata of the eastern interior basin: Illinois Geol. Survey, Rep. Inv. 21, 43 p., 2 Pls.

WELLER, STUART; BUTTS, CHARLES; CURRIER, L. W.; & SALISBURY, R. D., 1920, The geology of Hardin County and the adjoining part of Pope County: Illinois Geol. Survey, Bull. 41, 416 p., 11 Pls.

WENGERD, S. A., 1963, Stratigraphic section at Honaker Trail, San Juan Canyon, San Juan County, Utah, *in* Bass, R. O., editor, Shelf carbonates of the Paradox Basin: Four Corners Geol. Soc., p. 235–243.

WHITE, C. A., 1876, Invertebrate paleontology of the Plateau Province together with notice of a few species from Colorado, *in* Powell, J. W., Report on the geology of the eastern portion of the Uinta Mountains and a region of country adjacent thereto: U. S. Geol., Geog. Survey Territories, p. 74–135.

——, 1877, Report upon the invertebrate fossils collected in portions of Nevada, Utah, Colorado, New Mexico, and Arizona by parties of the expeditions of 1871, 1872, 1873, and 1874: U. S. Geog. Surveys West of the 100th Meridian, Rep., v. 4, pt. 1, 219 p., 21 Pls.

MANUSCRIPT RECEIVED JANUARY 16, 1969