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Fossil Shark Teeth from the Coastal Plain Of Georgia[1]

by

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Shark teeth, next to dinosaurs and possibly trilobites, are probably the most sought-after fossil for the amateur or beginning paleontologist. They have also been the subject of important scientific research both in this country and in Europe. Numerous attempts have been made to use shark teeth for the correlation of formations both in nearby areas and over wide areas. These attempts have not always been successful.

It only takes a casual observation of a modern shark jaw to recognize the fact that numerious and quite different teeth are present in a single individual. If the teeth had been found separately, they might well have been described as belonging to different species or even different genera. This fact has, undoubtedly, accounted for much confusion in the nomenclature of shark teeth.

The fact that shark teeth are common in certain localities (for example the Miocene Calvert Cliffs of Maryland and certain Eocene deposits in North and South Carolina) does not necessarily mean that sharks were exceedingly abundant in those areas. Sharks shed their teeth periodically during their life and thus a single individual may yield a large number of fossils.

Only a few fossil shark teeth have been reported from Georgia. The species mentioned in this report were studied from the collections of the Academy of Natural Sciences of Philadelphia and the United States National Museum.

As stated above, the identification of shark teeth is a difficult task. Indeed, even in naming modern sharks where complete dentitions are available, it is not always possible to distinguish some species. For fossils, this situation is further complicated by an inevitably fragmentary record of isolated teeth and inadequate or incorrect labelling of specimens.

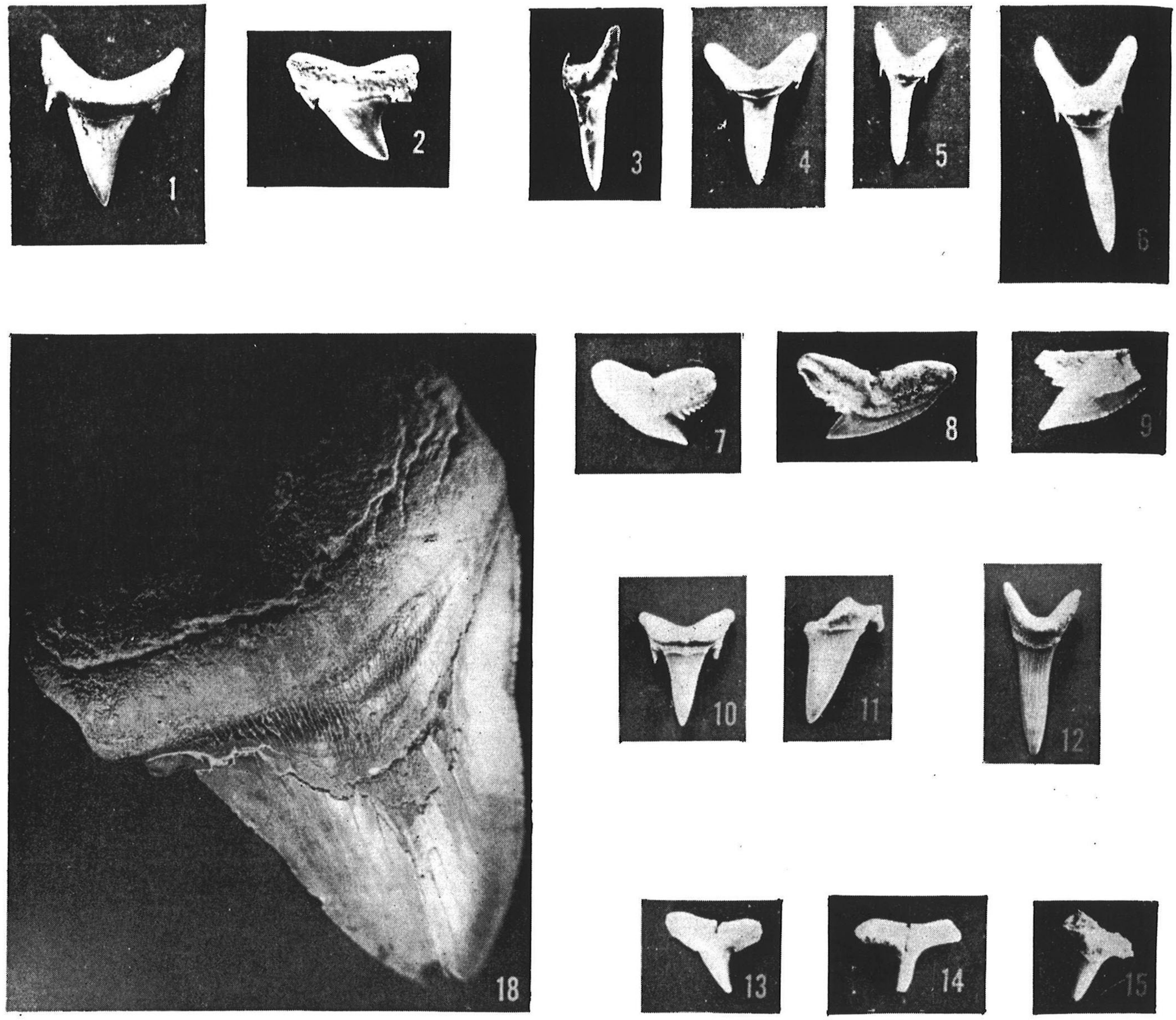
In general, most of the shark teeth from the Atlantic Coastal Plain can be assigned to living genera. Their identification must, of course, be based upon comparison with the teeth of recent specimens. Nomenclature in the present report is based upon that used in the collections of the American Museum of Natural History. Nevertheless, the authors agree with a personal communication of Dr. Bob Schaeffer that identification beyond genus of shark teeth of the Coastal Plain is questionable and perhaps completely meaningless. As background for discussion of the various localities and ages, the following table is given, adapted from the series of articles on the Coastal Plain of Georgia by the senior author.[2]

Stratigraphic Table of Formations of Coastal Plain of Georgia.

PLEISTOCENE	Pamlico
	Older Pleistocene mostly non-marine
PLIOCENE	Non-marine gravels
	Charlton
MIOCENE	Duplin
	Hawthorn
	Tampa
OLIGOCENE	Flint River Suwannee
	Cooper Marl
EOCENE	Ocala; Barnwell Santee limestone
	McBean
	Wilcox
PALEOCENE	Clayton
UPPER CRETACEOUS	Providence Ripley Cusseta Blufftown Eutaw Tuscaloosa
LOWER CRETACEOUS	Subsurface

[1]This report covers part of a project undertaken by Mr. Hand under the direction of Dr. Richards. This was part of a cooperative program between Antioch College and the Academy of Natural Sciences.

[2]Georgia Mineral Newsletter, Vol. VII, No. 3, to Vol. IX, No. 2, 1955-56.



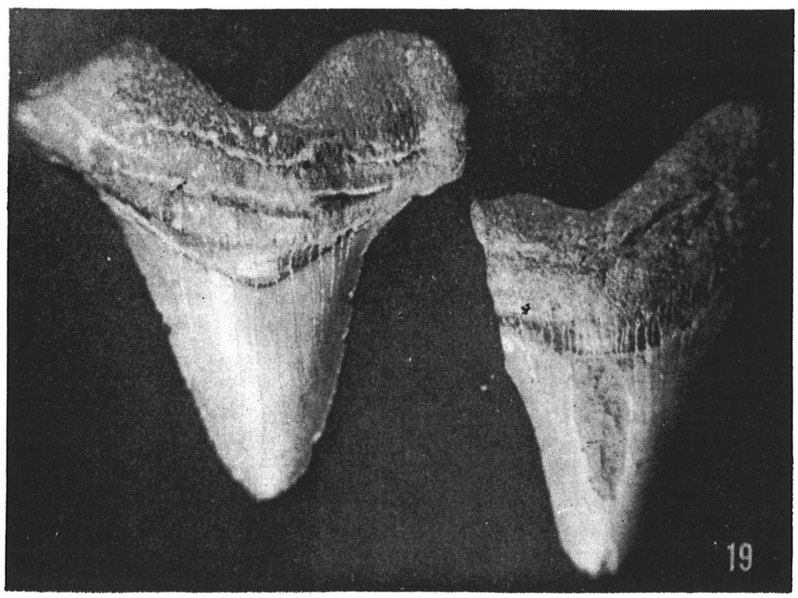
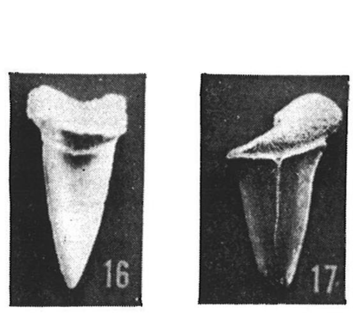
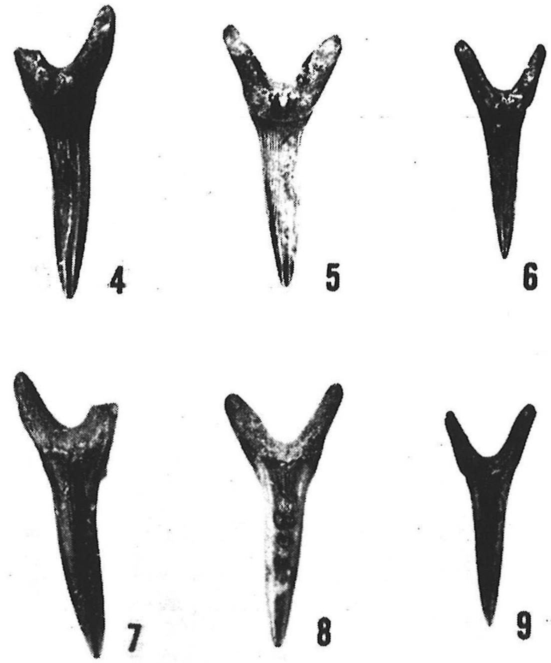
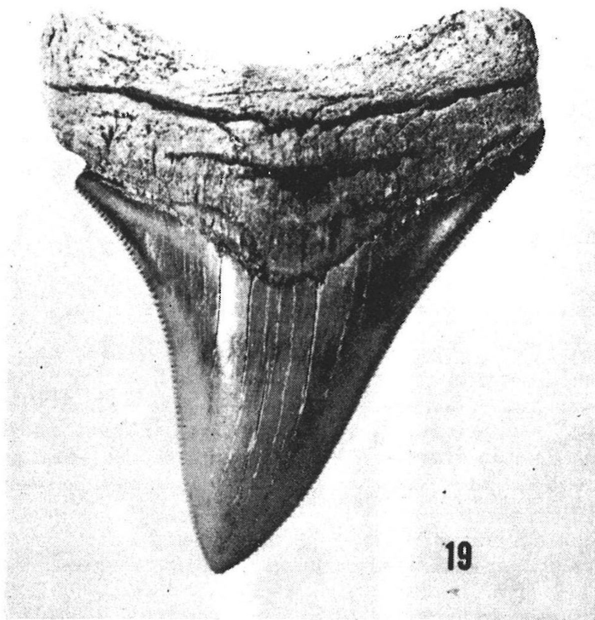


Plate 1

Cretaceous and Tertiary Shark Teeth from the Coastal Plain of Georgia.







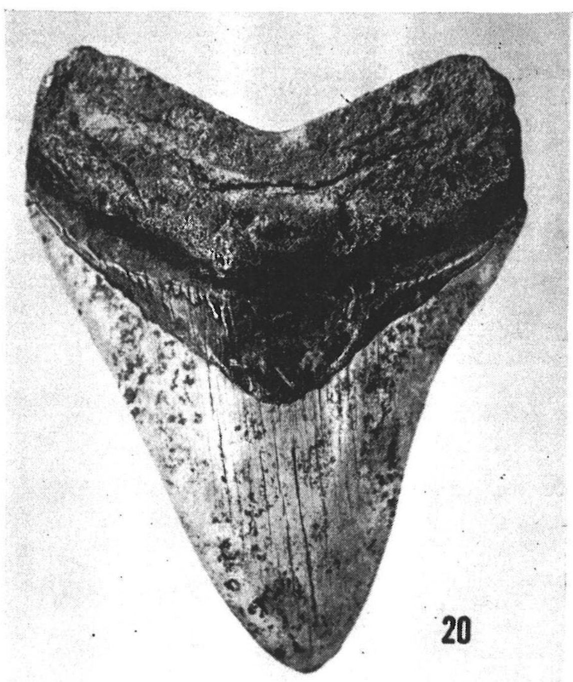
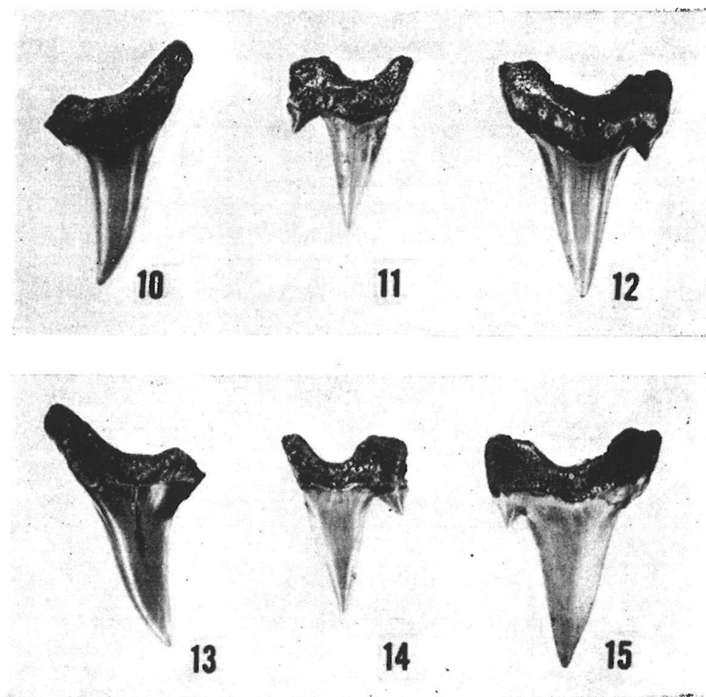


Plate 2

Cretaceous and Tertiary Shark Teeth from the Coastal Plain of New Jersey.



LIST OF LOCALITIES

Under *Systematic Paleontology* are given the localities from which the specimens have been reported. More complete notes on these localities are given below:

Douglas, Coffee County, Georgia. These specimens were labeled "Pliocene or Pleistocene," but they probably are of Miocene age.

Dry Branch, Bibb County, Georgia. Barnwell formation; Late Eocene.

Three miles south of Avera, Jefferson County, Georgia. Barnwell; Late Eocene.

One mile south of Gordon, Wilkinson County, Georgia. Label reads "G. I. Mine, Martin's Gordon Clay Pit." Here the Barnwell overlies the Tuscaloosa, although the specimens are probably from the Barnwell.

Cuthbert, Randolph County, Georgia. Wilcox formation.

Near Albany, Dougherty County, Georgia. From Sealy Well No. 1; depth uncertain, probably Eocene.

Florence, Stewart County, Georgia. Cretaceous, probably Bluffton formation.

Pataula Creek, Clay County, Georgia. Cretaceous; Providence sand.

SYSTEMATIC PALEONTOLOGY

Class Pisces

Subclass Elasmobranchii

Order Selachii

Suborder Galeodidae

Family Carchariidae

Genus *Carcharias* Rafinesque 1810

The living representative of this group (*C. taurus Rafinesque*), is the sand shark commonly found along the Atlantic Coast of North America. Teeth number about 46 in each jaw. In front they are awl-shaped with or without a basal cusp on each side, and with a double root. Toward the sides of the mouth they become shorter for their basal width, the two branches of the root that form a sharp V in the front of the mouth become less pronounced and more widely spread, and the basal cusps become larger and generally duller in relation to the main cusp.

Carcharias cuspidata (Agassiz) Plate 1, figs. 3-6. Distinguished by the presence of basal cusps and the smooth inner (more convex) surface of the teeth. One specimen found at Dry Branch; six near Avera; and nine at Gordon.

Carcharias texana Roemer Plate 1, fig. 12; Plate 2, figs. 4-9.

Distinguished from *C. cuspidata* by the presence of striations on the inner surface of the tooth, extending most of the way from the root to the tip, and by the absence of basil cusps. Two teeth from near Florence and one from Pataula Creek.

Family Isuridae

Genus *Lamna* Cuvier 1817

This genus is represented in modern seas by the mackerel shark or porbeagle, *L. nasus* (Bonnaterre.) The teeth of this shark are sharp, narrowly triangular, erect, with a single sharp basal cusp on each side. Except in the case of the front teeth, the double root is not very pronounced. Twenty-four to thirty-two teeth are found in the upper jaw, fourteen to twenty in the lower. All the teeth are quite similar except those near the corners of the mouth. Among living forms, teeth of *Lamna* are generally less sinuous in form than those of *Isurus*.

Lamna appendiculata (Agassiz) Plate 1, figs. 1, 2, 10, 11; Plate 2, figs. 10-15. Four teeth from Dry Branch and three from the Gordon Clay Pit.

Lamna (?) sp. A single incomplete specimen found at Cuthbert and one from the Sealy well are probably of this genus.

Genus *Isurus* Rafinesque 1810

Sharks of this genus are very closely related to those of the genus *Lamna*, and are most easily distinguished on the basis of body features. The teeth of *Isurus* have no lateral denticles and are somewhat more flexuous than those of *Lamna*. The North Atlantic form is the Mako Shark, *I. oxyrinchus* Rafinesque 1810.

Isurus (?) sp. Plate 1, figs. 16, 17. Two teeth from the vicinity of Florence, Ga. See Plate 2, figs. 1-3, for New Jersey specimens.

Genus *Carcharodon* Agassiz 1838

Carcharodon carcharias (Linnaeus), the White Shark, or Man Eater, is probably the only living species of this genus. The teeth are large and triangular, with slightly concave margins and coarsely serrate edges, but without lateral denticles. The lower teeth are somewhat smaller and not so broad-based as the uppers.

Carcharodon megalodon Agassiz Plate 1, figs. 18, 19; Plate 2, figs. 19, 20. Three teeth from Douglas. All differ slightly from the "typical" *C. megalodon* of the Maryland and New Jersey Miocene by having a somewhat larger and heavier root.

Family Carcharhinidae

Genus *Galeocerdo* Muller and Henle 1837

All modern specimens of this genus are believed to belong to a single species, *G. cuvier* (Leseuer), the Tiger Shark. The teeth are serrate, with a complex anterior margin and a strongly notched posterior margin. Some of the serrations become so coarse as to bear secondary serrations themselves. The root is moderately small, hardly wider than the base of the crown, and not very high.

Galeocerdo latidens Agassiz Plate 1, figs. 7-9. Three specimens, one of which is a median tooth found at Dry Branch. Distinguished from others of its genus by small size, blade-like character, and convex margins.

Family Sphyrnidae

Genus *Sphyrna* Rafinesque 1810

Teeth narrowly triangular, but widening considerably at base. Upper teeth deflected toward the corners of the mouth. The lower teeth are more erect and narrower. Teeth may be serrate or smooth-edged. The root is broad, nearly flat, and very low.

Sphyrna (?) sp. Plate 1, figs. 13-15. Nine specimens found at Gordon probably belong to this genus, but may represent *Carcharhinus*. Dr. Leonard Schultz believes that these two genera are indistinguishable on the basis of teeth alone. (See *Sphyrna prisca*, Plate 2, figs, 16-18.)

ILLUSTRATIONS

Plate 1

Figures

1, 2	*Lamna appendiculata* (Agassiz)
3-6	*Carcharias cuspidata* (Agassiz)
7-9	*Galeocerdo latidens* (Agassiz)
10, 11	*Lamna appendiculata* (Agassiz)
12	*Carcharias texana* (Roemer)
13-15	*Sphyrna* sp. (?)

16, 17	*Isurus* sp. (?)
18, 19	*Carcharodon megalodon* (Agassiz)

Plate 2

1-3	*Isurus hastalis* (Agassiz)
4-9	*Carcharias texana* (Roemer)
10-15	*Lamna appendiculata* (Agassiz)
16-18	*Sphyrna prisca* (Agassiz)
19, 20	*Carcharodon megalodon* (Agassiz)

(All approximately natural size.)

Zirconium Goes Commercial *

Triumphant Technology—Like silicon and a host of other chemical elements, elemental zirconium was first isolated by the Swedish chemist, J. J. Berzelius. This was 134 years ago. It took more than 120 years to evolve uses that added up to a commercial demand, and chief of them was initially in the atomic reactor field.

Commercialization posed several problems. Zirconium is not a rare element. It is actually more plentiful than any of the base metals, but it is far more difficult to separate from its ores. What proved even more baffling, it is invariably associated with the element hafnium, which has a high neutron absorption rate, whereas zirconium's low rate makes it eminently suitable for permanent parts of nuclear reactors. Use of zirconium makes it possible to effect substantial savings, for it reduces requirements either for the critical mass of uranium or for the percentage of enrichment needed to generate power. . . .

William J. Kroll, a native of Luxembourg and one of the world's foremost metallurgists, not only carried on the research but pioneered the development that led to the economical production of metallic zirconium. Further work has yielded a 'reactor grade' containing 1% or less of hafnium. So-called commercial grades contain 2%. The Kroll process now has competition, but it was Kroll who, as consultant to the Bureau of Mines, put zirconium on the market.

Growing Demand—Initially, the Atomic Energy Commission took the entire output of the metal and encouraged private industry to undertake production by offering long-term contracts. To the single, government-owned plant at Albany, Oreg., have been added Wah Chang's privately owner facility, also at Albany; Carborundum Metals' at Parkersburg, W. Va., and Akron, N. Y.; U. S. Industrial Chemical's at Ashtabula, Ohio; and Columbia National's at Pensacola, Fla. Gross capacity totals only 3400 tons—which sounds more impressive if translated into 6.8 million pounds.

Three of these facilities came into production late in 1957 and early in 1958, with an output of 4.7 million pounds. Of this amount, only 2.2 million pounds is on contract for AEC. For the first time, therefore, there is a substantial quantity of zirconium on the free market available for general use.

The market is not ready to absorb the amount at its disposal. The use of shredded zirconium in flash bulbs as a substitute for aluminum foil will require little of the metal. Zirconium's high resistance to corrosion makes its use in chemical plant equipment, pipes, joints, and accessories desirable where corrosion is an acute problem. But its price is too high for large installations. Product development is now this new industry's big challenge.

Raw Materials—Zircon is the principal ore of zirconium. It is a minor constituent of granites and related igneous rocks, but its concentration is too low for mining. Economic recovery is limited to sands derived from zircon-bearing rocks. Although zircon has been reported from twenty different states—from Alaska to Florida and from Maine to California—Florida accounts for all domestic production. Last year there was also some by-product zircon recovered in the Crane Co.'s monazite operation on the Savannah River near Bath, S. C. Although the market was by no means strong, the price paid for 66% zircon, delivered, has remained steady at \$50-\$55 per short ton. Imports from Australia, the world's largest producer, supplement the domestic output. Additional domestic production must successfully compete with Australian ore, and the investigation and development of new potential sources of supply must be governed almost wholly by competitive factors. But it is a raw material field with promise.

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Interior Department Establishes Office of Mineral Exploration

Secretary of the Interior Fred A. Seaton announced today the establishment of the Office of Minerals Exploration to carry out the provisions of Public Law 701 (85th Congress) for Federal assistance in financing exploration for new or additional mineral reserves. The authorizing legislation had been submitted to the Congress as a part of the Administration's minerals program.

Proposed regulations governing the granting of Federal assistance will be published in the *Federal Register*. A 30-day period for comments, suggestions, or objections is provided.

The OME succeeds the Defense Minerals Exploration Administration. The exploration assistance program authorized by the new law is a continuation of the DMEA-type program which started in 1951 under the Defense Production Act of 1950. The DMEA program expired on June 30. The OME will also assume responsibility for the DMEA contracts still in force and for each project certified by the DMEA as a discovery or development. The Congress, in the 1959 Supplemental Appropriation Bill, approved funds in an amount of \$4,000,000 for OME operations.

As a result of congressional action on the enabling legislation, the OME program will differ from the previous DMEA program in three important respects: (1) Applicants must provide evidence that funds cannot be obtained from commercial sources on reasonable terms; (2) interest will be charged from the dates Federal funds are disbursed to operators; and (3) Government participation in any one contract may not exceed \$250,000.

The Secretary stated that the new program is not intended to provide Federal funds for exploration projects that would ordinarily be undertaken by the applicant, at his sole expense, under current conditions or circumstances. The primary purpose of the program is to share with private industry the risks involved in carrying out those exploration projects which have good potential but which normally would not be undertaken with private capital.

Section 8 of the proposed regulations lists the minerals or mineral products which are eligible for financial assistance at this time. The list is substantially the same as that used by the DMEA during the last year of its operations. The former 75 percent category has been eliminated and all commodities are now eligible for 50 percent Government participation, as a result of a recommendation by the House Appropriations Committee.

Section 12 (a) provides that interest shall accrue on all Federal funds from the dates they are made available. The Secretary made it clear that such accrued interest would not