Crystalline dolomite and grainstone are the only rock types that have high enough porosities and permeabilities to provide significant yields of water. Medium and finely crystalline dolomites show best values of porosity and permeability because they have high percentages of intercrystal and moldic pores that are well connected. Filling of pores by anhydrite or gypsum can significantly reduce porosity and permeability.

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Metallic Sulfide Deposits in Winnfield Salt Dome, Louisiana: Evidence for Episodic Introduction of Metalliferous Brines During Cap Rock Formation

Winnfield dome is a shallow piercement salt structure that penetrates Late Jurassic through early Tertiary siliciclastic and carbonate strata of the North Louisiana basin. Quarrying operations in the calcite and anhydrite portions of the cap rock have exposed zones of metallic sulfides and barite. Within the anhydrite portion of the cap rock, sulfides form laminar zones parallel to the tightly intergrown layered anhydrite; sulfides occur either as cement between anhydrite grains or as coarse euhedral crystals in open space. The sulfide layers are up to several centimeters thick and extend for tens of meters. These layers locally thicken into laminated, flat-bottomed, concave-downward, massive sulfide mounds. Monoclinic pyrrhotite is the dominant sulfide; sphalerite, galena, or barite may also be present. In weathered samples hydrating to gypsum, marcasite is common and appears to be an alteration product of pyrrhotite.

A roughly laminated massive sulfide lens is exposed at the calcite to anhydrite transition zone. This sulfide body has a maximum thickness of about 5 m (16 ft) and extends for about 45 m (150 ft). The edges of the lens taper to a layer about 30 cm (1 ft) thick that separates the overlying calcite from the anhydrite. The massive sulfide lens is comprised of marcasite and pyrite complexly intergrown with calcite, gypsum, and anhydrite. Colloform sphalerite, galena, marcasite, pyrite, and barite line the vugs and fractures; pyrrhotite is found locally within the sulfide lens. Examination of rotary drill samples suggests that massive sulfide concentrations, similar to the exposed example, are common along the calcite to anhydrite transition zone.

These sulfide concentrations are believed to have originated from the interaction of metalliferous basinal brines with reduced sulfur trapped within the cap rock. Textural relationships and variations in chemical compositions between the sulfide layers in the anhydrite portion of the cap rock suggest that distinct pulses of metalliferous brines were responsible for the sulfide concentrations. Anhydrite grains that are completely surrounded by sulfides are euhedral and undeformed, similar to the anhydrite disseminated throughout the salt mass. Anhydrite grains outside the mineralized areas are deformed and tightly intergrown. These textures suggest that mineralizing fluids were introduced episodically along the salt and anhydrite interface at the zone of salt dissolution before that portion of the anhydrite zone was compressed and accreted to overlying anhydrite cap rock. Therefore, the earliest formed sulfides originating by this mechanism occur at the top of the anhydrite cap rock zone, whereas the last sulfides to form are found at the base. Extensive sulfide concentrations along the anhydrite-calcite contact suggest that this contact also acted as a permeable zone allowing metalliferous brines into the cap rock. Textural and compositional relationships suggest that sulfides that formed along the anhydrite-calcite contact are locally superimposed on sulfides that formed at the salt-anhydrite contact.

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Early Opening of Initially Closed Gulf of Mexico and Central North Atlantic Ocean

Regional structures beneath the northern Gulf of Mexico coastal plain clearly reveal the fit of the American continents following the late Paleozoic Appalachian-Ouachita orogeny. Most diagnostic is a wrench fault zone within the former Gondwana megacontinent, recognizable from the Florida Panhandle to western Mississippi, along which future South America moved northwest against the southern edge of North America to form the Ouachita foldbelt, while future Africa was already subducting that continent along the Appalachian belt. Extending west from this fault zone is the Wiggins arch, underlain by "granite" and phyllite of Late Pennsylvanian to Early Permian age, apparently part of a volcanic arc. Along its north side and that of its counterparts farther west are shallow marine strata of similar age. These strata appear to occupy the area of a remnant ocean on North American oceanic crust that was uncoupled by the close approach of future South America and subducted briefly beneath North America, while the sediments on it were peeled off and thrust onto the continent. The inferred volcanic arc and remnant ocean, and a Late Triassic rift system that separates them from the Ouachita foldbelt, terminate abruptly in east Texas against a wrench fault that transferred this rifting south-southwest to the Rio Grande Embayment area.

If the Pickens-Quitman-Gilbertown-Pollard and the Mexia-Talco fault zones, which mark the approximate updip limit of appreciable Louann Salt, represent the northward-converging wrench faults, then northern continental South America (i.e., the Guyana shield) fits precisely against them, with some overlap onto the Wiggins and Sabine uplifts. With Africa conventionally joined to South America, this continental fit also places west Africa's two prominent capes opposite the pronounced salients of the southern and central Appalachian foldbelt, while Capes Cod and Hatteras face the principal west African basins, which occupy salients in the equivalent African foldbelt. Also, pre-Mesozoic Florida lies in the reentrant between the southern continents, seemingly separated from each by an arm of a triple rift system whose third arm passes between them.

From this tightly closed condition, the Gulf of Mexico opened by right-lateral translation of eastern North America (south of Newfoundland) against the bulge of northwestern Africa—actually a rotation about a pole near the central southern edge of the Sahara. The Interior rift system formed by the sialic block that includes the Wiggins and Sabine uplifts, remaining briefly with South America as North America moved north-northeast along the east Texas transform and a parallel one at the east end of the Wiggins arch. The rifting jumped south of these uplifts after extension of perhaps 50 mi (80 km) to open the present Gulf basin. Almost 200 mi (322 km) of such translation brought Cape Hatteras solidly against Africa's Cap Blanc, ending this movement in earliest Jurassic time.

Magnetic anomaly lineaments off the southeastern states, used as crude isochrons, show that opening of the central North Atlantic Ocean (CNAO) began by southern North America swinging westward to disengage the obstructing capes. The Blake Plateau basin and Carolina trough opened first, then the spreading jumped east of the latter and propagated northward along the entire CNAO, followed by a second jump marked by development of the Blake Spur magnetic anomaly lineament. Changes in North America's movement direction throughout this period were recorded by the Great Abaco fracture zone (as reinterpreted), a leaky transform along which the early CNAO terminated against the Florida-Bahama platform. Right-lateral offsets of this fracture zone, totaling about 65 mi (100 km), are associated with the two spreading-center jumps.

The Late Triassic intercontinental transform continued across northwestern Morocco into the Tethyan sea, which then extended west into what is now the northern CNAO. As the CNAO opened to its full length, it appropriated this tip of Tethys and left the intervening Moroccan Meseta with Africa. Tethys' venture into the future CNAO followed the earliest Mesozoic rifting in eastern North America, which may also have formed an inferred series of grabens responsible for the Brunswick magnetic anomaly lineament in the southeastern states and offshore.

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Sedimentology of Upper Cretaceous Coffee Sands in North-Central Mississippi

The Upper Cretaceous Coffee Group within the Desha basin of Mississippi is composed of two major lithologies, a light to dark marlstone and a series of white, fine to medium-grained siltstones and sandstones. The two source areas for the sands are the Sharkey platform to the south and the southern Appalachians. The presence of hydrocarbons has been described at the outcrop and in subsurface cuttings and cores. Depositional environments in the shallow shelf consist of lagoons, barrier island bars, offshore bars, and surge channel deposits. Southwest regional dip of approximately 40 ft/mi (8 m/km) is reflected on all Upper Cretaceous horizons.