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PENNSYLVANIAN ROCKS OF THE SAN JUAN BASIN

By B. B. Bradish and N. K. Mills
Skelly Oil Company

Introduction

This paper is a brief summary of the general features of the Pennsylvanian rocks fringing the eastern and northern sides of the San Juan Basin in New Mexico and Colorado. An attempt is made to describe the essential lithology, paleogeography, age, and correlation.

Rocks of Pennsylvanian age are exposed in the mountain ranges of the region, and are known to be present in a number of deep bore holes in the interior of the basin. These rocks are composed of a complex sequence of continental and marine strata which constitute a major sedimentary cycle of marine transgression and deposition followed by regression of the seas and continental sedimentation.

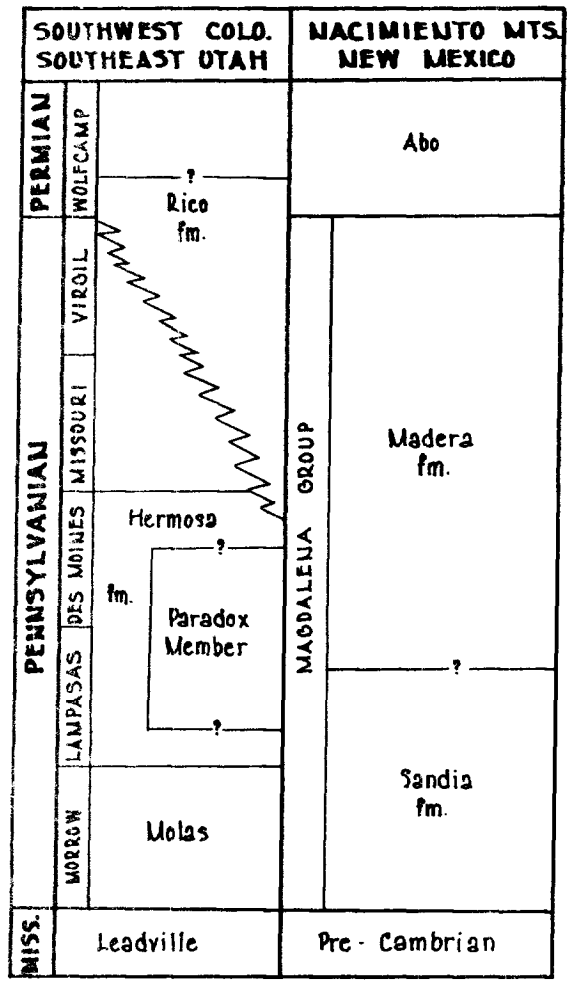
Changes in the sedimentary composition and thickness of Pennsylvanian strata indicate the existence of positive masses paralleled by geosynclinal depressions and localized basins. This positive mass of Pennsylvanian time is referred to as the Uncompahgre Uplift. In general this ancient land mass followed a northwestward trend and is included as part of the Ancestral Rocky Mountains. Other positive elements are also thought to have been existent during this time along the west and southwest border of the basin. These land masses are referred to as the Zuni and Defiance Uplifts.

Pennsylvanian beds of the San Juan Basin are characterized by lateral changes of facies and thickness. Time-rock units of the section are generally thinner in areas which are predominately composed of pure limestone, and thicker in those areas composed predominately of clastic beds. Therefore, it may be anticipated that lithologic boundaries will be found to cut across faunal and chronologic horizons. Regression of the Pennsylvanian seas appears to have resulted from rapid accumulation of continental clastic sediments, which exceeded the rate of subsidence in the foreland and basin areas.

Subdivisions

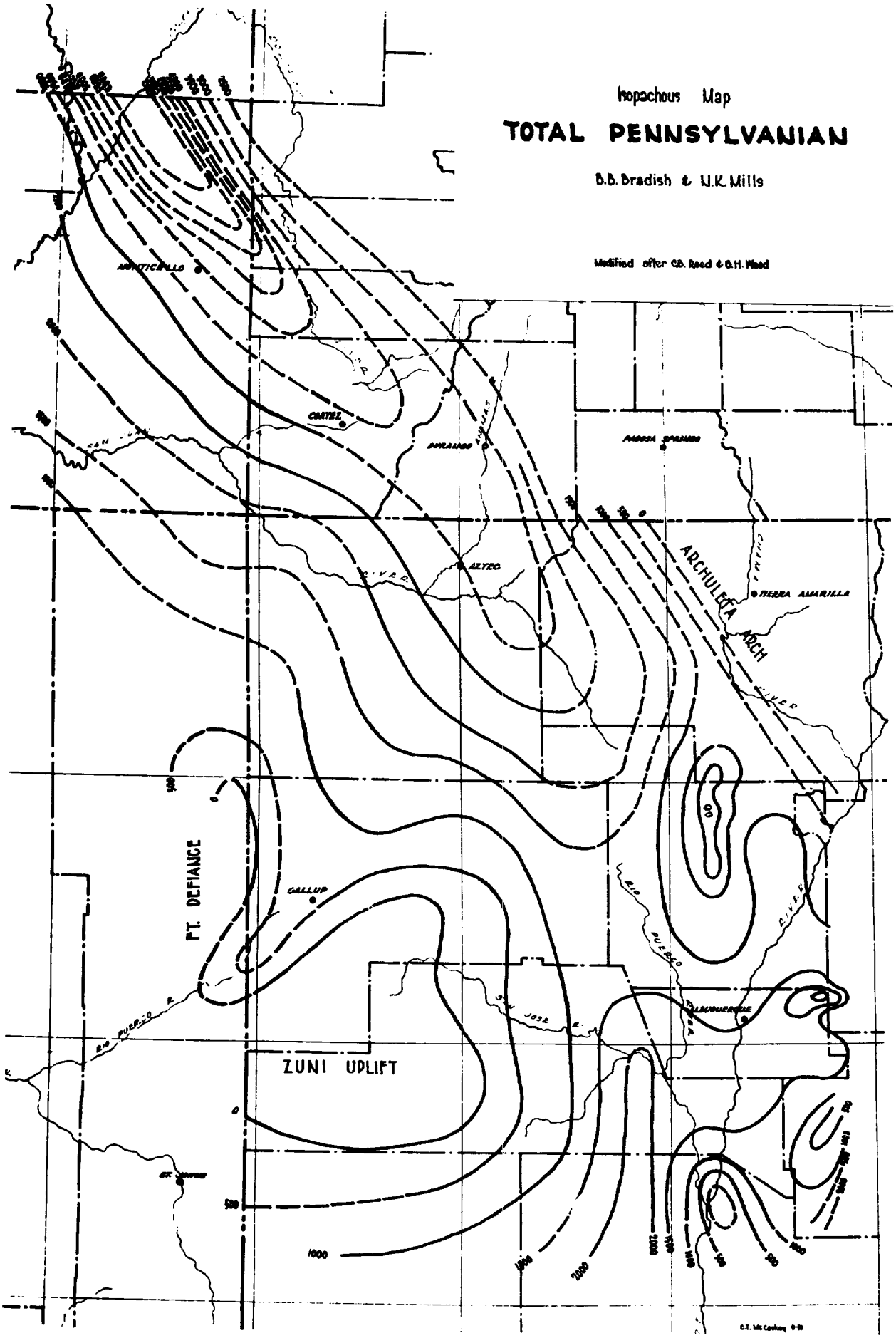
Pennsylvanian sediments are exposed in Sandoval and Rio Arriba Counties, New Mexico, along the Sierra Nacimiento and San Pedro Uplifts. The land mass from which these sediments are thought to have been derived is in the area of the northwest edge of the present Archuleta Arch and San Luis Highland.

The term "Magdalena group" has been applied in naming these rocks along the eastern border of the San Juan Basin in New Mexico.



CORRELATION DIAGRAM

The basal unit of the Magdalena group is the Sandia formation. This name was given to the limestone and sandstone that constitute the lower part of the Magdalena group. The Sandia formation shows much variation in detail according to locality. Usually, it is divided into a lower limestone member and upper clastic member. The lower member is a dark-gray, slightly siliceous limestone. The upper clastic member of the Sandia formation consists of dark-brown, brownish-green, and brownish-gray sandstone, and impure arenaceous limestone. The lower units of the Sandia formation have been dated locally through fossil evidence as upper Morrow in age. However, it is thought by some, on the basis of lithologic evidence, that the basal limestone unit may be Leadville in age (Mississippian). The upper limits of the formation appear to be within the Fusulinid zone and therefore fall within the Lampasas series.


Isopachous Map
TOTAL PENNSYLVANIAN
B.B. Bradish & W.K. Mills
Modified after C.B. Read & G.H. Wood
MONTICELLO
CORTEZ
AZTEC
FARMINGTON
TIERRA AMARILLA
ARCHULETA ARCH
FT. DEFIANCE
GALLUP
ZUNI UPLIFT
ALBUQUERQUE
SAN JOSE R.
RIO PUERCO R.
RIO PUEBLO
RIVER
0
500
1000
1500
2000
90

The Madera formation is the upper unit of the Magdalena group. As normally defined, this formation is dominantly calcareous; however, the type of sediment suggests a gradual transition from marine to continental deposition. The formation is divided into a lower gray limestone member and an upper arkosic member. The lower unit lies conformably upon the Sandia in the southern part of the Sierra Nacimiento Mountains and consists of dark-gray limestone with interbedded gray shale and some sandstone beds. The upper arkosic member consists of limestone, arkosic limestone, red and gray shale, and arkose. Paleontological evidence indicates that the lower member is Lampasas to early Des Moines in age, and the upper arkosic member ranges from early Des Moines to Virgil in age.

Molas Formation

The term Molas is used for the formation unconformably overlying the Leadville formation of Mississippian age. The name is usually applied to the basal Pennsylvanian of Colorado and in the gas fields lying in the northwestern part of New Mexico by the Colorado border. This formation ranges considerably in thickness and character due to the irregularity of the depositional surface and to sedimentational factors. The bulk of the formation, however, consists mainly of dull, dark, purplish-red calcareous shale and sandstone. It also contains many chert pebbles and some limestone, with several lenses of conglomerate composed mainly of black chert and red shale. The Molas is probably the equivalent of the lower Sandia formation in New Mexico. As the Molas appears to indicate slow accumulation and therefore, a considerable period of time, it is likely that the lower and upper horizons differ substantially in age.

Hermosa Formation

The Hermosa formation consists of gray limestone with thin-bedded limestone and interbedded gray, black, and lavender shale and gray-brown or yellow calcareous fine-grained sandstone. The limestone contains nodules of flint, jasper, and variegated chert and emits a petroliferous odor on fresh fractures. At least one zone contains beds of gypsum. The Paradox unit has been designated a member of the Hermosa formation. It is a horizon of shale, salt, anhydrite, and gypsum, occurring in the deepest part of the Pennsylvanian basin as shown on the accompanying isopachous map. Fusulinids obtained from well cuttings have been identified as Lampasas and Des Moines in age.

The deposition of the Hermosa was accompanied by many fluctuations of an unstable shoreline of the Pennsylvanian seas. The contact between the Hermosa and overlying Rico formation is hard to identify because of the gradational characteristic of the rocks between the formations. Fossils are of little assistance in determining the boundary between these formations as the change in fauna does not coincide with the change in lithology.

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