

## USE OF THE GLEN DEAN LIMESTONE AS A STRUCTURAL KEY HORIZON IN THE ILLINOIS BASIN<sup>1</sup>

GEORGE V. COHEE<sup>2</sup>

*Illinois State Geological Survey, Urbana, Illinois*

The Glen Dean formation is one of the best known formations of the Chester series in Illinois. Since 1937 the basal limestone has been used widely as a structural key horizon and as a subsurface "marker" in drilling. The producing formations in most of the new oil fields in Illinois lie below the Glen Dean limestone, so the formation is penetrated by a great majority of the oil tests drilled within its boundary.

The formation was first described by Butts<sup>3</sup> in 1917 as follows: "The Glen Dean limestone is named from Glen Dean in the southern part of Breckinridge County, Kentucky. This name is adopted because of the excellent exposure of the limestone along the railroad on both sides of Glen Dean. It is composed of varying proportions of limestone and shale and includes locally, at least, a little sandstone. The bottom segment of the formation, at several widely separated points in Breckinridge County, is about 10 feet of green and red shale lying upon the flaggy Hardinsburg sandstone."

Figure 1 shows the subsurface and outcrop boundaries of the Chester series and the Glen Dean formation in Illinois and the thickness of the Glen Dean throughout its areal extent. Considerable variation in thickness is noted from north to south. Around the north end of the Illinois basin it is from 0 to 25 feet thick, and in Jackson County in southwestern Illinois it is more than 100 feet thick. A short distance to the east in Union County there is a pronounced thinning of the formation along the outcrop, but it thickens again to almost 100 feet in Johnson County. In the deep basin area in White, Hamilton, and Wayne counties, it is generally from 50-75 feet thick. Thinning of the formation occurs in areas of major structural features in the State, in-

dicating some structural movement during late or post-Glen Dean time.

The Glen Dean formation in the Illinois basin is predominantly limestone with various amounts of shale. In many areas it consists of two limestone members, separated by calcareous shale, which are designated as upper and lower or "massive" Glen Dean. The upper limestone is very erratic in its distribution but the lower member is persistent and maintains a fairly uniform structural relationship with the underlying beds although there may be some local variation in its thickness. Both the top and base of this lower member are used as key horizons on which structure contour maps are based. The limestone is characteristically coarse-grained, crinoidal, oolitic, and brownish-gray. It contains a variable amount of chert and some dolomite. In most areas it is the highest limestone of the Chester series that contains well developed oolites. (Occasionally oolites occur in the higher Menard and Vienna formations.) In subsurface studies the top of the formation is placed at the top of the calcareous shale overlying the uppermost limestone and the bottom of the formation is placed at the base of the calcareous shale below the basal limestone member.

The Glen Dean is usually overlain by the Tar Springs formation, generally a massive sandstone which varies from 30 to 135 feet in thickness but in some areas it is principally shale or sandy shale. The Glen Dean formation is underlain by the Hardinsburg formation, which generally consists of shale and sandy shale or siltstone and is usually from 20 to 60 feet thick. Locally a well developed sandstone may occur within the Hardinsburg.

<sup>1</sup> Published with the permission of the Chief, Illinois State Geological Survey.

<sup>2</sup> Now Assistant State Geologist, Dept. of Geology, Indianapolis, Ind.

<sup>3</sup> Butts, Charles, Description and Correlation of the Mississippian Formations of Western Kentucky: Kentucky Geol. Survey, 1917, p. 97.

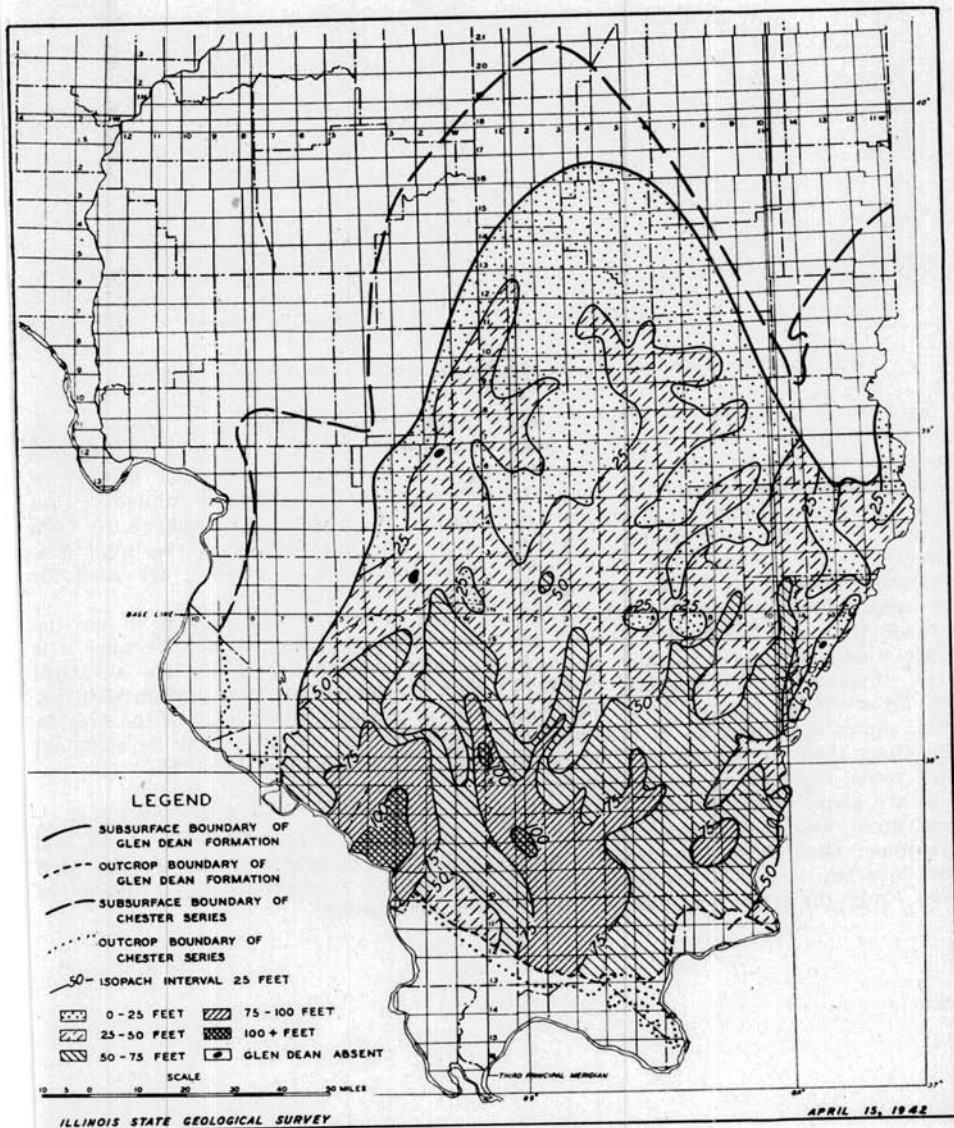


Fig. 1.—Thickness map of Glen Dean formation.

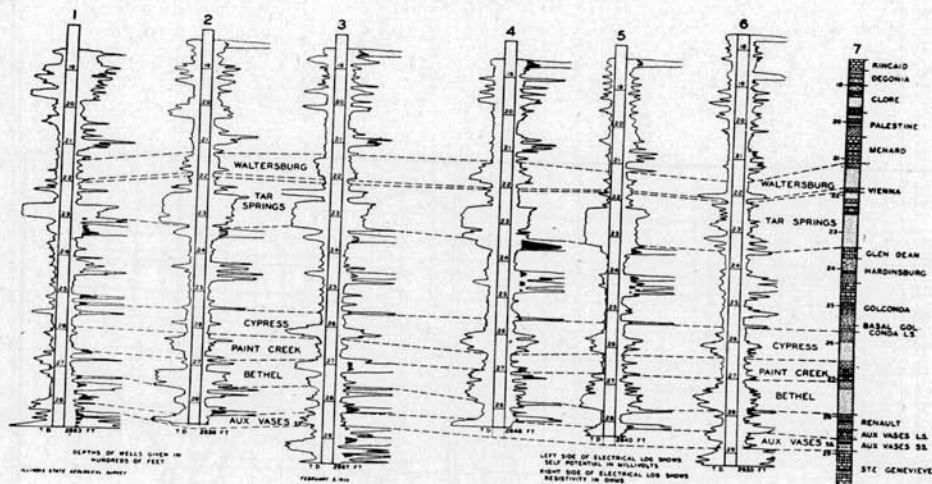


Fig. 2.—New Harmony Field. North-south electrical log cross-section

In various areas in the Illinois basin certain thin persistent limestone beds, such as the basal Golconda limestone, have proved more satisfactory than the Glen Dean for detailed structural information. In the New Harmony field of eastern White County the thin basal Golconda limestone is present throughout the area and is a better structural key horizon than the basal Glen Dean limestone which is slightly variable in thickness. Figure 2, a north-south electrical log cross-section in the New Harmony field, shows the variation in thickness of the Glen Dean formation in that area. The wells represented in the cross-section are about one mile apart. In wells one, three, and five of the cross-section, the upper Glen Dean limestone is present; however, it is best developed in well one. Only the lower or "massive" lime-

stone occurs in the other wells of the cross-section. The "massive" limestone is poorly developed in well six. In the few areas where production is limited to that part of the Chester series above the Glen Dean, the basal Menard or the lower Kincaid limestone, if present, are used for structural key horizons.

The Glen Dean formation is an important subsurface "marker" because it is usually recognized easily in electrical logs, in sample studies, and in drilling, and it is present over most of the area in southern Illinois where oil development and exploration is most active.

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