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Geological and Natural History Survey

Freeman Ward, State Geologist

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Field Conditions  
in  
Southern Haakon County

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## EXPLANATION

The Survey issues two series of publications as follows:

**BULLETINS.**—Some subjects have been investigated a longer time, full data have been gathered, such preparatory or experimental work as was necessary has been entirely or nearly finished. In other words, the study of the subject is actually completed or so nearly so that the results can be relied on and published with a degree of confidence as to their value; and the treatment is full and thorough. In such a case the matter is published as a bulletin.

**CIRCULARS.**—But often during the progress of the work enough information is at hand to be of value to those interested, yet not enough for a complete treatise. A part of a county or a part of a certain subject may be finished, perhaps, and publication waiting for the complete investigation of the whole county or the whole subject. There may be a demand for statistical matter, or lists of references, or current information, etc., which would hardly do for a formal bulletin. Such partial reports, summary reports, reports of progress, lists, or unit fragments of larger subjects, etc., are handled in circulars.

It is planned to publish the circulars frequently and the bulletins at longer intervals. With this arrangement much information will reach the public with a minimum of delay.

Inquiries may be addressed to the State Geologist, Vermillion, S. D.

## FIELD CONDITIONS IN SOUTHERN HAAKON COUNTY

**Introduction.**—Last summer, at the request of W. A. Noerenberg and D. D. Collins, the State Geological and Natural History Survey spent about a month in the vicinity of Powell, investigating the oil possibilities. The above mentioned gentlemen furnished a car, gasoline, etc., to hasten the progress of the work. The Survey takes pleasure in acknowledging their help and courtesies.

In all about five townships were examined, viz., T. 1 and 2 N., R. 21, 22, 23 E. The index map (Fig. 1) shows the location of the area.

The results attained were inconclusive as far as the oil problem is concerned. A negative decision is no particular contribution to the subject of geology. But since the area covered is typical of many parts of western South Dakota and since the field conditions are so difficult to work in, it has been thought advisable to outline briefly the situation, partly to impress workers that the geologic evidence is extremely scanty in such areas, and partly to stimulate thought concerning possible new field methods to be applied where such conditions exist.

Although there are several bigger things in the oil problem of South Dakota than that of locating "structures," yet drilling is necessary to get much of the evidence bearing on the larger phases of the subject; and drilling should not be a haphazard affair. For the present, then, the locating of suitable structures is an important part of the oil investigation, especially if companies are to be induced to drill. This was the chief concern of the field work in the area.

**Surface Conditions.**—The only formation in the field (except Pleistocene and Recent) is the Pierre shale (Cretaceous): Probably not more than a total of 125 feet is exposed throughout the area. This is the upper portion of this formation; the exact horizon was not determinable.

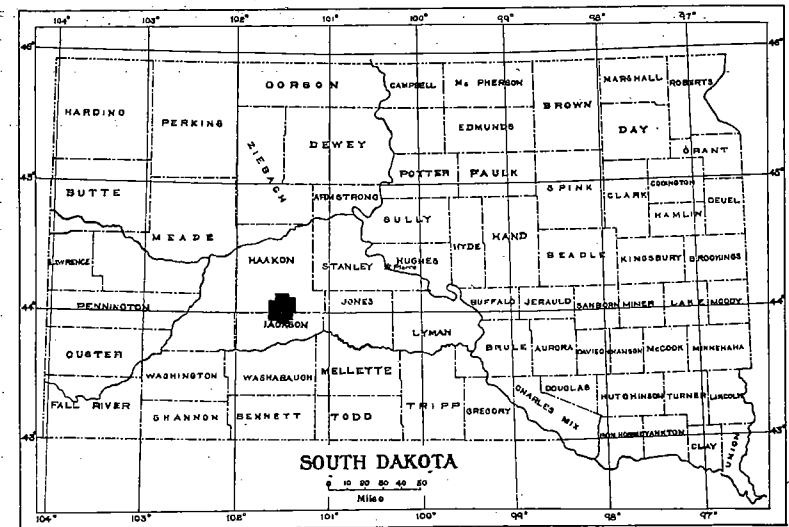


Fig. 1. Index Map

Black portion shows area covered by this report.

The Pierre shale is an extremely uniform dark gray to almost black shale. It has impure carbonate concretions occurring at many horizons. Rarely there is a thin (1-3 inch) bed of bentonite.

The strikingly uniform character of the formation makes the finding of an index bed a well nigh hopeless task. At first great hopes were entertained that the concretion layers might serve in the capacity. Literally hundreds of these nodules were cracked open and examined. Many of them were found to be fossil-bearing, but no species was restricted in range. In one high cut bank fourteen different concretion horizons were found and not one with any distinctive earmarks on it.

One of the bentonite beds proved to be a poor sort of index bed but was found only in three outcrops in the whole area.

The great uniformity of the shale also prevented the development of any erosional forms that were distinctive. Nor did any part of the formation exert any control on the growth of vegetation.

An additional disturbing factor was the scarcity of outcrops. They occur only on the cut banks along Bad River and some of the tributary creeks. Soil, sod and vegetation form a cover which is continuous, section after section; indeed, a whole township may show scarcely an outcrop. In other words the geologic evidence, poor as it is, is largely covered up and inaccessible.

Dip readings were resorted to with no better results. Many were taken but few could be used. The Pierre is a formation especially susceptible to slumping. When it is recalled that the outcrops almost without exception occurred in banks bordering the streams it can readily be seen that opportunities for slumping were very favorable. The slumping ranged from fresh, clean cut cases which an amateur could not miss to more obscure, weathered and

eroded slump blocks which were less convincing. A plotting of the dips showed no order or system among them. It is believed that the larger proportion of dips taken were undoubtedly slump dips; the others were doubtful.

It was because of these adverse conditions that no definite conclusions could be reached.

**Deeper Conditions.**—Deep wells are extremely scarce in western South Dakota. The few that are to be found were put down some years ago for the purpose of obtaining artesian water. The logs are for the most part very general, indicating only the major formations and none of them reaching below the Dakota. Such wells contribute little to the solution of some of the outstanding oil problems of the State and are altogether too few in number to work out local structures. In regard to this particular area, the nearest deep well is at Nowlin, two miles beyond the eastern edge of the area; the next is at Capa, fifteen miles east of Nowlin.

**Future Development.**—A very large proportion of western South Dakota has nothing but Pierre shale as the surface formation. The field conditions, then, will be similar to those just described. It is rather certain that the dip readings will be unreliable. It is equally sure that index beds are rare. In those areas where outcrops are common there is a chance, albeit a slim one, of finding a usable index bed. In short, the conditions will be so unfavorable that it will be extremely difficult to get positive results.

It seems that the most satisfactory, though also more expensive, way to get structural data is by putting down well holes. If the drilling is by means of the diamond drill, a careful examination of the core may reveal a widespread index bed in the Pierre not recognized by other means. In some parts of the State, such as along the Cheyenne River, thin beds of oil shale have been noted. These should be relatively easy to recognize and may prove to be widespread. If, by such exploratory method, an index bed can be established in the upper two or three hundred feet of the Pierre, the expense of the holes will not be prohibitive, at least after South Dakota has been proven to be a productive oil field. At any rate holes could be put down to the Niobrara, which is known to be a widespread formation. This would necessitate drilling to depths of from 800 to 1,500 feet, depending on the location.

Another line of investigation may be carried along by the study of the physiography. At least three cycles of erosion were noted in the Powell area and are known to be present well over the State. A study of the stages of development of the various kinds of topography, a study of terraces and stream patterns will undoubtedly throw light on the diastrophic history of the western part of the State. This will necessitate studies over large areas in order to get all the data and make the proper correlations. It is of course possible that the date of such diastrophism as the physiography indicates may be too recent to have a bearing on oil accumulation. Yet even these later diastrophic movements may be indications of trends of deformation started in earlier times.

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