

**Gamma-ray logging of water wells in
southeastern Alberta and southwestern Saskatchewan**

by J. Bushell

(Project 690021)

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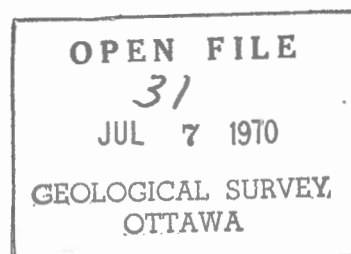


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Diary of Uranium Project No. 690021

According to Dr. Irish, Institute of Sedimentary and Petroleum Geology, Calgary, our best chance of finding uranium in Alberta was to probe formations numbered 56, 61, 62, 48 and 49 on the geological map of Alberta.

Formations 56, 61 and 62 were found in Alberta in the Cypress Hills area. In two books entitled, "Water-well records in Southern Alberta", which contain 95% of all available water well information, I could find very few wells with the proper lithological logging. According to the above two books deep wells could be found in the area, but the vast majority of my first 69 wells logged in this area were very shallow. I suspect that most of these deeper wells, with large casings, have been filled in long ago, since most of them were drilled approximately 25 to 45 years ago. Also the large majority of farmers I talked to, had been on their farms less than ten years, so that they would have limited knowledge of such old wells. According to a depth of bedrock map of the Cypress Hills area, 75% of these first 69 wells were in bedrock. However we got no positive results in these formations.

I next decided to investigate wells in formations 49 and 48. Again, very few wells could be chosen on a lithological basis, as the logs were incomplete or just don't look favourable. No positive results were obtained by logging wells, what few I could find, in these formations.

However as I noted various outcrops of coal and was told of others by farmers, I spent about one week in the Cypress Hills area, digging horizontal holes into these seams, and getting spot checks of the amount of radiation in a

certain area. Two promising areas, one of 180 cps and another of 1050 cps were noted and have been plotted on the topographical map 72E of Alberta. After having scaled as many accessible wells as possible in the Cypress Hills area of Alberta, I decided to try the area around Eastend and Shaunavon Saskatchewan.

According to Dr. Irish our best chance of success was to observe geological formations numbered 28, 29a, 29 and 31 on the geological map of Saskatchewan. By superimposing these formations onto the topographical map of the area, as was previously done in Alberta, one obtained a general idea of the boundaries to which he should be subjected in looking for promising wells.

Moving eastward from Eastend, I encountered many deeper wells. Many of these wells were old wells, with a twenty four inch diameter wood casing, thus allowing easy access in some cases. I also met some drillers who gave me the location of newly drilled wells. My first promising results were obtained some fifteen miles east of Eastend. As well, other wells in the area had smaller anomalous results. By talking to several men who had lived in the area for a long time, I soon received the location of all wells which they knew would allow easy access for probings. This was perhaps the best source of water well information, as in some cases these fellows could even tell you if the well had been put down through coal seams. By talking to such people, one could save a lot of time that would otherwise be spent visiting farms with no wells. Moving southward from Eastend, deep accessible wells were still to be found,

but no positive results were to be found. Westward from Eastend, the wells generally decreased in depth as one encountered range land.

Leaving Eastend I moved to Estevan. Here results were hard to find, and wells that could be probed were even harder to find. All of the wells that were of any significant depth had two inch casings, and as the probe itself was almost two inches around, the probe instrument could barely fit into the casing, and hence could easily become stuck there. After spending four days working around Estevan to determine if the casings were all of two inch diameter, which they were, I returned to Shaunavon.

While at Shaunavon I worked generally in a northward direction and encountered wells worth logging. Again I met many other folks who were a big help in the locating of accessible wells. Good results turned up about eight miles north of Shaunavon. At this time money was running short so Dr. Little advised me to return home.

Results from logging of water wells for uranium in Southern Prairies

Project number 690021 was originally designed to select water wells on a lithological basis and probe them for uranium. Lithology logs could be obtained from the well drillers' reports sent to either the Alberta or Saskatchewan Research Council. By studying these logs and noting especially those wells which contained lignitic coal, it was hoped that these wells could be logged for uranium. However two important facts were not realized. First of all, it would be impossible to probe these wells, selected on a lithological basis, because of the time and effort required to remove the pump and pipes so that the probe could be lowered into the well. Secondly, for any wells that could be logged, a lithology log could not be obtained because of the fact that any wells which were open, were usually so old that the information had not been kept. Thus one course of action seemed to be left open; that being, to try to find wells which had the pumps pulled, wells with large diameter casings, or new wells being drilled, all in areas where there was a known occurrence of coal.

Initially around the Cypress Hills area of Alberta, we logged shallow wells as they were all that were available in this region. We received no positive results by probing these water wells. By probing as many coal outcrops as I came across, we got our first positive results of 1050 and 180 counts per second, southeast of Thelma, Alberta (see map 72E). We had covered all of the Cypress Hills area which corresponds to formations 56, 61 and 62 on the geological map of Alberta. Further work was done in formations 48 and 49 but no more positive results were obtained.

Working around Eastend and Shaunavon Saskatchewan our results showed much improvement. We tried to log wells in formations 28, 29a, 29 and 31 found on the geological map of Saskatchewan. The size of the anomalies from 60 to 140 counts per second, and the wells number and locations were plotted on the topographical map 72F. It is important to note that the size of the anomalous results recorded on the logs were never as large as the results that could be obtained by dropping the probe to that level and simply observing the rate meter. This was mainly caused by the fact that the recorder lagged the rate meter by a fraction of a second with the result that before the pens on the recorder could reach the maximum peak observed by the rate meter the probe was through the ^{anomalous} ~~analanous~~ level and the pens fell off to the background level with the rate meter. Of course with any anomalous results noted, I left the probe at this level to take an accurate reading from the rate meter, which I then wrote on all pertinent logs.

Our efforts around Estevan Saskatchewan, proved futile mainly because of the fact that the majority of casings were two inches in diameter and as the instrument was nearly two inches around, the probe could easily get stuck in the casing.

The location and number of all wells logged during the summer project of 1969, have been plotted on the appropriate topographical maps.

Problems encountered during uranium project No. 690021

Undoubtedly the largest problem of the whole project was the locating of wells which could be probed. It was not a simple matter of driving to a farm, finding an open well, and probing it.

The original idea of the project was to log those water wells that looked promising on a lithological basis, by removing the pump and pipes from the casing. However we soon discovered that to do so, required a large amount of time and effort. Therefore the only alternative procedure was to search for wells which were newly drilled and were open, wells which had the pumps and pipes removed from the casing, or wells which have a large diameter casing and would allow easy probing. The majority of wells which I logged satisfied the latter two stipulations. However no lithology report could be obtained for such wells. The large diameter wood cased wells were drilled 25 to 45 years ago with an auger tool drawn by two horses, and no such reports were ever kept. As well the small diameter steel cased wells which had pipes and pumps removed were also drilled a long time ago. The pipes and pumps were generally pulled because the wells were never drilled deep enough and hence the supply and quality of water left much to be desired. Therefore the only course of action was to work in areas of known coal deposits, hoping to find open wells that could be probed. The best information about such open wells could best be obtained from older men who had lived in their respective areas for a long time. Also they often knew of outcropping coal seams which I probed.

Artesian wells could not be probed because of the fact that they had connecting pipes which screwed on to the top of the casing and led the water away. Even if these were removed one could not lower the probe into a well, while water was gushing out of it.

The farmers were almost all helpful in my attempts to probe wells. I visited perhaps 1100 farms during the summer and encountered only two adverse farmers. It was only because of the large amount of work required to remove pipe and pumps from the well that inhibited them from letting me log their wells.

Several open steel casings which I encountered were blocked off close to the surface with debris. There was nothing that could be done to open the pipes as the debris was tightly lodged in the casing.

When I moved to Estevan, the steel cased wells which I found were all two inches in diameter. Although the instrument was less than two inches in diameter and could have been further reduced in size by the removal of an outside protective coating; the fact that the casing diameter shrunk to one and three quarter inches where the 20 foot sections of casing joined together, made it a risky business to lower the \$2000 probe into such wells. Thus seeing that the trend would continue I spent little time at Estevan.

While at Eastend it rained off and on for almost three weeks so that the roads were often covered with six inches of gumbo. Needless to say I was struck more often than I could remember. Although the vehicle I had, a Chev. Panel Truck, had lots of room, it was far from a good field vehicle. I felt it

should have been a four-wheel drive vehicle with perhaps the addition of a winch and a much larger engine.

Of course a major difficulty with the project was the fact that the wells to be logged had to be taken where they were. If promising results showed in one area, a more intensive investigation of this location could be carried out only if more wells could be found in the surrounding area.

The scintillation probe itself gave us some difficulty. Initially when the probe was being lowered into the hole the background counts were of the order of three to four times greater than what they should have been ie. 25-30 cps. However by allowing the instrument to sit over a period of time, say ten minutes, with the current running through it, the background counts fell off to what they should have been. Once this happened, the hole could be logged. But whether or not all the background counts, seen on the logs presented with this report, are as low as they should be, cannot accurately be determined because I may not have waited long enough in all cases for these backgrounds to drop to the proper level. Nevertheless, any anomalous results noted were readily detected whether I had waited for the background counts to decrease or not. Let me give an example. If upon lowering the probe into the hole, I initially observed a background of say 90 cps and say at 25 feet an ^{anomalous} ~~analanous~~ reading of 140 cps; once the background had fallen off to 25 cps I would then observe a reading of 75 cps at the 25 foot level say ten minutes later. Thus the increase over the background counts was constant. I told Dr. J. Wyder, Institute

of Sedimentary and Petroleum Geology, Calgary about this behaviour, and after a few days of testing the instrument, we attributed this occurrence to initial internal heating. The fact that the recorder often moved in sudden jumps instead of recording evenly, can be attributed to the fact that the speedometer cable running from the winch to the recorder was too long, and thus often had kinks in it, which inhibited the inner cable from turning freely. However the recorder still gave the proper number of counts even though it jumped on certain logs.

Suggestions for improvement of future projects

Undoubtedly this project was seen the way it was because of the lack of extra financial assistance. However if more money could have been made available, this project could be vastly improved.

By the formation of a two man crew and the addition of a portable drill many holes could have been sampled in areas where the depth to bedrock is less than 75 feet. Maps showing depth to bedrock are available for Cypress Hills and Wood Mountain areas, so that in locations where the bedrock is close to the surface and coal is in evidence a small portable drill could drill shallow holes worth logging.

By further investigation into the exact nature of the pumps placed in these wells, perhaps a smaller probe could be designed to fit in some of these wells. For example, in many wells, especially the newer ones, submersible pumps have been installed. These pumps are at the bottom of the well, and the pump and central pipe, up which the water travels, are all supported in place by a flat piece of steel which lies over the top of the casing. Often I noted a small cap on these pieces of steel which when removed provides an opening down to the pump, to which a probe could be lowered. However, the diameter of the opening is perhaps one and a quarter inches, but if a smaller instrument were available, such wells could be probed. As for the jet pumps which have two plastic hoses running down the casing, and wells with pressure systems, I can see no way to log these.

Another idea that occurred to me, was to contact maybe ten drillers who would be drilling new wells in say southern Alberta or Saskatchewan. These men could contact a student or vice versa so that he could drive to the site of a new well before the pump was placed in it. The drillers might have to be given some remittance for their trouble, but with some organization perhaps a lot of wells could be logged this way. The drillers I talked to seemed to be very interested in formations as well as the general geology of the area, so that I feel many would be happy to lend a hand in such a project.