Compilations

This chapter summarizes the methodology followed in creating the oil and gas field outlines shown in each relevant Atlas chapter. Also included in a summary of oil and gas reserves and production distribution, again in accordance with Atlas stratigraphic intervals.

The original assignment for this project was to provide up-to-date and reliable oil and gas field outlines, reserves and production summaries for the 13 producing stratigraphic intervals embraced by this Atlas. This target was achieved using Digitech’s Production Data System and Geological Survey of Canada’s PETRIMES reserves database.

Sources of Data

The producing oil and gas wells were identified and located using PDS (Production Data System), marketed by Digitech Information Services Limited of Calgary. Retrieval of these data for producing wells was obtained using Alberta data that had been updated to January 31, 1991, British Columbia data updated to October 31, 1990, and Saskatchewan data updated to August 31, 1990. Further clarification of producing zone and production figures for specific horizons in each province was obtained from provincial reports listed in the references at the end of this chapter.

Reserves, cumulative production and size distribution data were provided by P. J. Lee of the Institute of Sedimentary and Petroleum Geology in Calgary, using the PETRIMES reserves database (Lee and Tzung, 1988), updated to 1991.

Methodology

The first step in identification of producing wells was to request a printout from Digitech listing all producing oil or gas wells for each of 17 major stratigraphic zones. The wells were listed in order of location (i.e., U.W.I.) and current status: field, zone and pool were given. The 17 major stratigraphic zones included several, such as Ekto1, Shunda and Banto, etc. Later they were lumped together to provide the production data for the 13 producing zones discussed in this Atlas. Included in the retrieval were all abandoned and suspended oil and gas wells, which were identified as such under the current status column. Digitech also provided maps, at a scale of 1:50 000, showing the location of all producing oil or gas wells for each horizon.

The second step was to outline and name all the pools and fields on these maps, using the printouts as a reference. All wells in the same pool were outlined in red by tracing a smooth line around the perimeter wells at a distance of approximately one legal subdivision. This has been described as the “rubber band” method, although indentations were carefully included. All of the pool outlines belonging to the same field were then outlined in blue, following the same “rubber band” method.

In addition to outlining all field boundaries and assigning the proper field names, major fields were identified by a special symbol, so that only the names of those major fields would be printed on the final maps provided for the Atlas. There are many small oil or gas fields that need not be identified by name on the Atlas maps, and this method thus allowed deletion of the names of these smaller fields. Major fields were arbitrarily selected on the basis of large size and number of wells, as likely being among the top 20 fields for that particular horizon. Careful review of reservior data commonly resulted in change of apparently minor fields to the major field designation.

The third step was to plot these maps with red pool outlines and blue field outlines to Digitech for digitization, so that these could be retrieved on any scale. Throughout verification of these digitized oil and gas pool and field outlines was carried out before the final 1:2 500 000 scale maps for each of the Atlas’ major 13 stratigraphic intervals were ordered.

The fourth step was to request these digitized pool and field outlines from Digitech, in maps at a scale of 1:2 500 000, showing all field outlines for each stratigraphic interval, but names of only the major fields. The individual producing wells and pool outlines were deleted to reduce overprinting. This step completed the retrieval of producing well locations and digitized pool and field outlines and names from Digitech.

The fifth step was to plot the retrieval of reserves and production data for every oil and gas field within each of the 17 stratigraphic horizons. These data were obtained from the Institute of Sedimentary and Petroleum Geology, using the PETRIMES package. Retrieval was made of all producing pools and of all producing fields within each interval. Close correlation was found between the wells, pools and fields on Digitech’s PDS system and PETRIMES.

The sixth step involved compilation from PETRIMES of the reserves and production statistics for the top ten fields in each interval. Some zones, such as the Permian and Duvernay, showed small individual field reserves, so that a lower limit of 100 000 × 10⁶ m³ (i.e., 35 Bbls) of initial established marketable reserves or 1 × 10⁷ m³ (i.e., 6 MMbbls) initial established recoverable reserves was set. The size distribution of individual pools within each horizon was also retrieved through PETRIMES and is included in the statistical summaries.

Retrieval Specifications

Stratigraphy

Minor problems were encountered in assigning production from some stratigraphic intervals because of the broad stratigraphic range of the producing formation. For example, production from the Mississippian Rundle Group is assigned to the Devonian-Ekto1 interval, even though the Rundle extends into the Shunda-Pekisko interval. This arbitrary designation of Rundle to the Devonian-Ekto1 has proven satisfactory, however, the occurrence of a few Rundle fields beyond the Devonian-Ekto1 wedge edge indicates that in these cases Rundle production is derived from the Shunda-Pekisko.

The Niskuannisk is generally regarded as Late Jurassic to earliest Cretaceous in age, and another arbitrary decision was made to assign all Niskuannisk production to the Jurassic stratigraphic interval.

Similarly, the Granite Wash is arbitrarily assigned to the Elk Point, and not extended down into the Cambrian. The Wapella is assigned to the Lower Mannville rather than the Jurassic, Cretaceous to Lower rather than Upper Mannville and Upper to Lower Mannville rather than Viking.

Production from the Camrose member in the Wainwright formation is assigned to the Woodbend rather than the Winterbarn.

In southern Albert, five major oil fields are listed as producing from the Blairmore, without clarification as to Upper or Lower Blairmore (i.e., Mannville). In its case, the field retrievals assigned such production to the uppermost zone. However, these five fields, namely Bellshill Lake, Bantry, Cessford, Taber and Taber South, produce primarily from the Lower Mannville.

Solution Gas

In a few major gas fields, production is primarily derived from solution gas associated with major oil production. For example, Beaverhill Lake gas production from the Swan Hills and Jenny Creek fields is reflected in only two gas wells, even though these two fields are among the largest Beaverhill Lake gas fields. Because oil and gas fields are shown together for each interval, this anomaly is not apparent on the maps.

Summary of Reserves and Production Data

Cumulative production totals for oil and gas, by stratigraphic interval, are shown as tables accompanying the field outline maps in each of the 13 relevant stratigraphic zones. These data are reproduced below (Tables 31.1 and 31.2) to allow comparison of reserves and production capability for each interval. Also represented are the reserves and production percentages of each interval compared to total reserves and production. Note that the tabulated data refer to established reserves and cumulative production to date, and do not include potential or unproven reserves.

The Devonian (last four intervals) contains 90.7 percent of Western Canada’s initial established recoverable oil reserves, and accounts for 58.3 percent of Western Canada’s cumulative production oil to date. The five Cretaceous intervals contain 26.6 percent of recoverable oil reserves and have produced 23.7 percent of Western Canada’s oil to date. The Carboniferous contains 13.0 percent of the reserves and has produced 13.1 percent of the oil. The remaining 9.8 percent of reserves and 9.3 percent of production is divided between Jurassic and Triassic, with the minor remainder assigned to the Permian.
Table 32.3 lists the distribution of oil and gas pools in each interval according to pool size, as measured by the initial in-place volume. Also shown in the average pool size. Note that individual pools rather than fields are listed in these tables.

Table 32.3 lists the distribution of oil and gas pools (units of 10^9 m³).

<table>
<thead>
<tr>
<th>Stratigraphic interval</th>
<th>Number of pools</th>
<th>Pool-size class (units of 10^9 m³) for in-place vol.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average pool size</td>
<td>Less than 0.1</td>
</tr>
<tr>
<td>Bell River</td>
<td>0.15</td>
<td>28</td>
</tr>
<tr>
<td>Cardium</td>
<td>1.03</td>
<td>76</td>
</tr>
<tr>
<td>Devonian</td>
<td>0.21</td>
<td>5</td>
</tr>
<tr>
<td>Viking</td>
<td>0.34</td>
<td>116</td>
</tr>
<tr>
<td>Mannville</td>
<td>0.13</td>
<td>655</td>
</tr>
<tr>
<td>Jurassic</td>
<td>0.30</td>
<td>48</td>
</tr>
<tr>
<td>Triassic</td>
<td>0.38</td>
<td>84</td>
</tr>
<tr>
<td>Pennsylvanian</td>
<td>0.67</td>
<td>8</td>
</tr>
<tr>
<td>Carboniferous</td>
<td>0.62</td>
<td>76</td>
</tr>
<tr>
<td>Woodsmere</td>
<td>0.00</td>
<td>27</td>
</tr>
<tr>
<td>Watah River</td>
<td>0.01</td>
<td>46</td>
</tr>
<tr>
<td>Beaverhill Lake</td>
<td>2.48</td>
<td>29</td>
</tr>
<tr>
<td>Elk Point</td>
<td>0.28</td>
<td>182</td>
</tr>
</tbody>
</table>

Table 32.4 provides an indication of the oil pool sizes to be expected in new discoveries from specific horizons. Note that in every horizon, the pool volume class of 0.1 to 1 x 10^9 m³ contains the largest number of pools. However, it is also instructive to note that 11 of the 14 largest pools occur in the Paleozoic.

Table 32.4 shows that the average pool size generally increases with the increasing age of the interval, with the Beaverhill Lake oil pools averaging ten times larger than the Cretaceous oil pools. There are, however, some exceptions. For example, the Watah River is characterized by very small average oil pool sizes (0.06 x 10^9 m³) as well as a small number of pools. This low relative productivity of the Watah River may be related to the disappearance of stratigraphic units at the beginning of the Watah River deposition, thus curtailing the development of reefs that could act as reservoirs. The Elk Point also has an anomalously low average pool size, but a large number of pools, both characteristics related to numerous small pinnacle reefs and reservoirs in the Rainbow and Zama fields. Lower average oil pool sizes in the Cretaceous relative to the Devonian is to be expected because Cretaceous oil reservoirs occur mainly in porous sands, which are much smaller and more discontinuous than Devonian dolomite oil reservoirs. An exception occurs in the Cardium, where the extensive sheet sands in the Pembina field account for increased average oil pool size, to over 1 x 10^9 m³ in-pool volume.

Reference:


Acknowledgements:

A major contribution of data and resources was provided by Digital Information Services Ltd. of Calgary and by staff members Brian Hall and Sandie Bogger. P.J. Lee of the Geological Survey of Canada aided greatly by providing numerous printouts of reserves and production data. Ken Drennon reviewed this chapter and his suggested improvements are much appreciated.