Data Load into PETREL

Task Fronterra Geoscience developed a workflow to facilitate the direct access of Borehole Image (BHI) log analysis results in PETREL, the widely used reservoir modeling software. This enables quick accessibility of well log data and provides a useful suite of analysis and modeling tools to customize interpretations and/or fully integrate BHI data into the reservoir modeling process.

Data Reorganization

The digital listings provided in a standard data pack will be reorganized in a PETREL friendly ASCII format. The different outputs like dip vectors (e.g. fractures, faults and beddings), point data (e.g. breakouts and centerline fractures), and facies are grouped to the customer's specific needs and flagged with discrete attributes accordingly.

```
# Petrel Point Well Data format
VERSION 1
BEGIN HEADER
Well
MD
Dip azimuth
Dip angle
STRING,CATEGORY
STRING,COVERAGE
FLOAT,INCL_WELLBORE
FLOAT,AZIM_WELLBORE
FLOAT,RB_IMAGELOGGER
FLOAT,PAD1_AZIM_IMAGELOGGER
FLOAT,R1_WELLBORE
FLOAT,R2_WELLBORE
INT,BEDDING_INDEX
END HEADER
ABC  13662.05  208.1   3.4  Sandstone Bedding  full  14.6  177.1  288.5  105.1  4.5   4.55  6
ABC  13662.82  232.7   7.6  Sandstone Bedding  full  14.6  177.1  286    102.6  4.38  4.43  6
ABC  13665.16  164.2  15.7  Sandstone Bedding  full  14.7  177.1  283.1  99.7   4.28  4.37  6
ABC  13668.06  308.2   5.1  Sandstone Bedding  full  14.7  176.9  276.9  93.6   4.23  4.36  6
ABC  13668.42  292.5  19.6  Crossbedding       full  14.7  176.9  276.5  93.2   4.25  4.38  2
ABC  13668.69  294.4  21.3  Crossbedding       full  14.7  176.9  276.2  92.9   4.24  4.38  2
ABC  13668.80  313.8   6.8  Truncation Surface full  14.7  176.9  276    92.7   4.27  4.39  8
ABC  13669.10  328.3   6.2  Sandstone Bedding  full  14.7  176.9  275.4  92.1   4.37  4.44  6
```

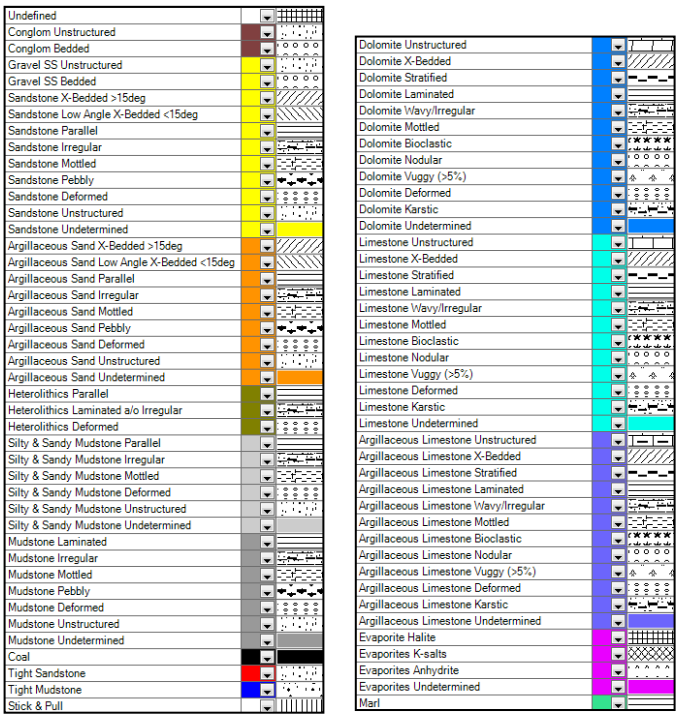
PETREL point well data ASCII file for data import

The data import is not only limited to "depth MD", "dip angle" and "dip azimuth" of the recognized features, but provides a full set of information about length/width, wellbore shape/deviation, together with descriptions. These additional parameters facilitate the further data use in various geosciences disciplines.

Task Fronterra designed templates for dip vectors and facies logs with the same color scheme as used in the reports and borehole image composite logs. The patterns and symbols deviate slightly from Task Fronterra's standards, as neither customized patterns nor symbols can be directly loaded into PETREL. Nevertheless, great effort has been made to be as similar as possible.

The templates presented in the illustrations below are suggestions and may be fully customized if requested by the customer.

Task Fronterra's suggested dip vector symbol and color scheme for bedding and fractures in PETREL



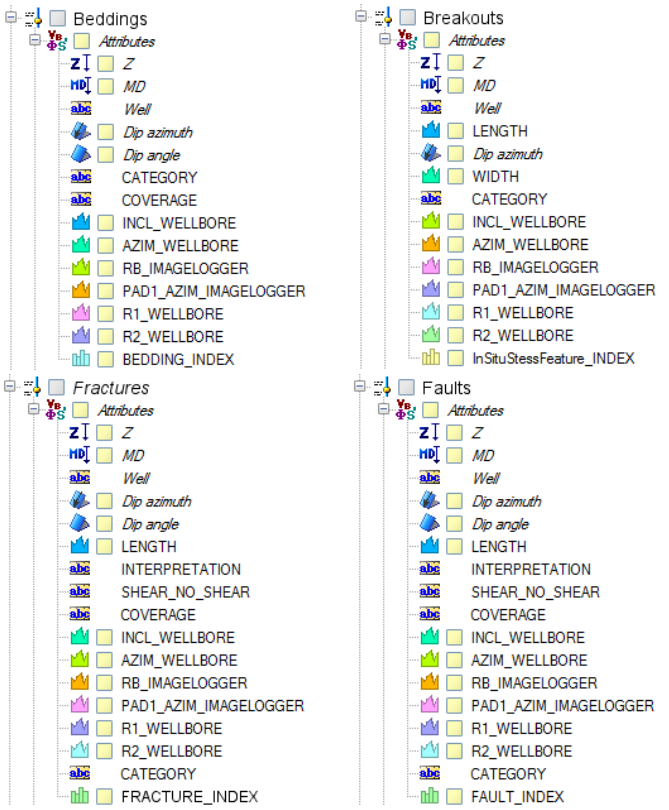
Task Fronterra's suggested image facies texture and color scheme for clastic and carbonate strata in PETREL

BHI Data Load into PETREL

Depending upon the customer's requests, the dip vectors can be imported on a well by well basis (e.g. ABC-1 Beddings, ABC-2 Beddings and ABC-3 Beddings), and/or lumped together in one file for an entire project (e.g. ABC Beddings). Single well

data sets provide maximum flexibility in data analysis and visualization whereas lumped data sets facilitate standardized visualization and field statistics.

The imported "Point Well Data" sets of the different dip vector groups (e.g. fractures, faults) are finally listed under "Global well logs" in PETREL's "Input" panel (see figure below). The image based lithofacies logs are stored for each well separately, but linked to the "Global well logs" folder, too.

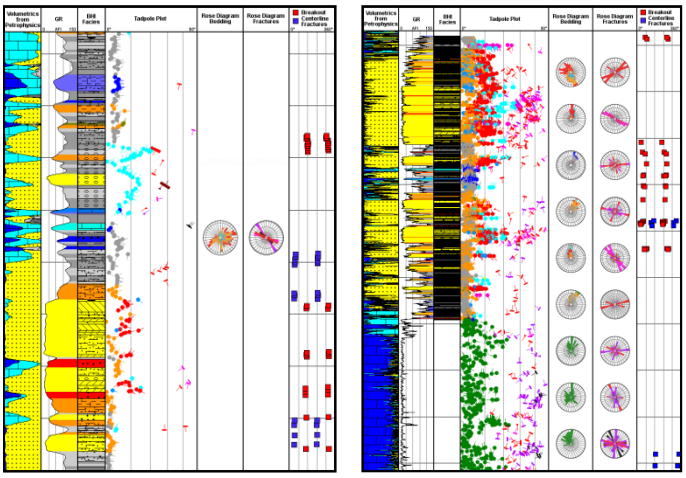


BHI data attributes for bedding, in-situ stress features, fractures and faults imported into PETREL's well folder

It is possible to visualize the processed image data directly in the well correlation panel, however only in a pixel-based file format (e.g. .BMP). To recognize structural and stratigraphic features properly, a borehole image scale of less than 1:40 is necessary, but this implies cutting the image into smaller intervals. As this image log only serves for illustration purposes and cannot be used interactively in PETREL, Fronterra does not recommend importing these graphic representations of the BHI.

Summary

With the BHI log analysis import into PETREL, dip vectors and image lithofacies can be directly accessed by geoscientists and engineers in the same reservoir modeling solution. The easy integration of BHI data into the daily analysis and/or modeling workflows of exploration and production data add valuable information to improve reservoir management decision making.



PETREL well section window with dip vectors, image facies and in-situ stress features visualized

Benefits

- Time and cost effective way of transferring Task Fronterra's BHI analyses into a modeling software/digital data base;
- No loss of information during data transfer due to a comprehensive data QC procedure;
- Easy access and comprehensive integration with other available E&P data possible in the same software environment;
- Customized visualization, analyses and modeling possible with the delivered data set;
- Quick update during field development possible.

Task Fronterra Geoscience is a global independent provider of industry leading, integrated geoscience solutions, from single well analysis to complete reservoir studies.

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