O&G Analysis Public

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1 Exploration of Oil & Gas Well Data

See article on taanktech.com for more context on this analysis.

```
In [1]: from datetime import date

        import pandas as pd
        import matplotlib.pyplot as plt
        import geopandas as gp
        from shapely.geometry import Point, Polygon
```

1.1 Get the data

Wells data is available from https://ndr.ogauthority.co.uk

```
In [2]: df = pd.read_csv('MyWellsExtendedDenNo compatible-utf8.csv')

In [3]: df.columns

Out[3]: Index(['WELLBORE_NAME', 'WELL_ORIGIN', 'SPUD_DATE', 'COMPLETION_DATE',
               'WELL_INTENT', 'CURRENT_STATUS', 'CURRENT_OWNER', 'LICENCE',
               'FIELD_NAME', 'WELLBORE_SEQUENCE_NUMBER', 'WELL_ORIGIN_STATUS',
               'SUBAREA_OPERATOR', 'ORIGINAL_OPERATOR', 'RELEASE_DATE',
               'RELEASE_ROUND', 'ELEVATION_REF', 'ELEVATION', 'WATER_DEPTH',
               'DRILLER_TD_MD', 'TVD', 'TD_DATE', 'COUNTRY_CODE', 'BH_AGE', 'CORED',
               'HYDROCARBONS_FLOW_CLASS', 'FALLOW', 'KICKOFF_DEPTH',
               'ORIG_SURF_X_LONG', 'ORIG_SURF_Y_LAT', 'ORIG_SURF_CRS_NAME',
               'ORIG_SURF_CRS_CODE', 'SURF_LOCATION_STATUS', 'ORIG_BH_X_LONG',
               'ORIG_BH_Y_LAT', 'ORIG_BH_CRS_NAME', 'ORIG_BH_CRS_CODE', 'PLATFORM',
               'PLATFORM_SLOT', 'PRIMARY_TARGET', 'WELL_PRODUCT', 'WELL_DEVIATION',
               'WELL_DRILLTYPE', 'WELL_TYPE', 'QUALITY_NOTE', 'DEN_NUMBER', 'ID',
               'WELL_ALIAS', 'WELL_ORIGIN_EXCEL_SAFE'],
              dtype='object')

In [4]: df.head()
```

Out[4]:

	WELLBORE_NAME	WELL_ORIGIN	SPUD_DATE	COMPLETION_DATE	WELL_INTENT
0	1/04- 1	1/04- 1	14-Oct-1982	25-Nov-1982	EXPLORATION
1	1/04- 2	1/04- 2	09-May-1983	18-May-1983	EXPLORATION
2	10/01- 1	10/01- 1	31-Dec-1971	08-Feb-1972	EXPLORATION
3	10/01- 1A	10/01- 1A	27-Feb-1972	07-May-1972	EXPLORATION
4	10/01- 2	10/01- 2	09-May-1972	23-Jun-1972	EXPLORATION

	CURRENT_STATUS	CURRENT_OWNER	LICENCE	FIELD_NAME
0	AB3	BP EXPLORATION	P367	NaN
1	AB3	BP EXPLORATION	P367	NaN
2	AB3	TOTAL UPSTREAM UK LIMITED	P118	NaN
3	AB3	TOTAL UPSTREAM UK LIMITED	P118	FRIGG
4	AB3	TOTAL UPSTREAM UK LIMITED	P118	NaN

	WELLBORE_SEQUENCE_NUMBER	...	PRIMARY_TARGET	WELL_PRODUCT	WELL_DEVIATION
0	WB1	...	A	NaN	VERTICAL
1	WB1	...	B	NaN	VERTICAL
2	WB1	...	NaN	NaN	NaN
3	WB1	...	NaN	GAS	VERTICAL
4	WB1	...	NaN	NaN	VERTICAL

	WELL_DRILLTYPE	WELL_TYPE
0	NaN	NaN
1	NaN	NaN
2	NaN	NaN
3	NaN	NaN
4	NaN	NaN

	QUALITY_NOTE	DEN_NUMBER	ID
0	Cored value updated by RSALWAY at CDA on 29th ...	6748.0	798357
1	NaN	2134.0	798363
2	NaN	380.0	766606
3	NaN	380.0	764966
4	Cored value updated by RSALWAY at CDA on 29th ...	405.0	764974

	WELL_ALIAS	WELL_ORIGIN_EXCEL_SAFE
0	1:001/04 - 01:1/04-1:6748:WB1:1/4-1	1/04- 1
1	001/04 - 02:1/04-2:1/4-2:2134:WB1:2	1/04- 2
2	380:WB1:10/1-1:16316:010/01 - 01	10/01- 1
3	10/01-1A:010/01 - 01A:380:WB1:10/1-1:1064:10/1-1A	10/01- 1A
4	010/01 - 02:10/01-2:WB1:1065:10/1-2:405	10/01- 2

[5 rows x 48 columns]

In [5]:
```
len(df)
```

Out[5]: 12157

2 The Age of Abondoned Wells

```
In [6]: possible_statuses = set(df.CURRENT_STATUS.unique().tolist())
        possible_statuses
```

```
Out[6]: {'AB1',
         'AB2',
         'AB3',
         'COMPLETED_OPERATING',
         'COMPLETED_SHUT_IN',
         'DRILLING',
         'PLUGGED'}
```

```
In [7]: abandoned = {'AB3'}
        active = possible_statuses - abandoned
```

```
In [8]: # number of spud_dates
        df.SPUD_DATE.notnull().sum()
```

```
Out[8]: 12157
```

```
In [9]: # earliest spud date
        pd.to_datetime(df.SPUD_DATE).min()
```

```
Out[9]: Timestamp('1964-12-26 00:00:00')
```

```
In [10]: df['today'] = pd.to_datetime(date.today())
         df['age'] = df['today'] - pd.to_datetime(df.SPUD_DATE)
```

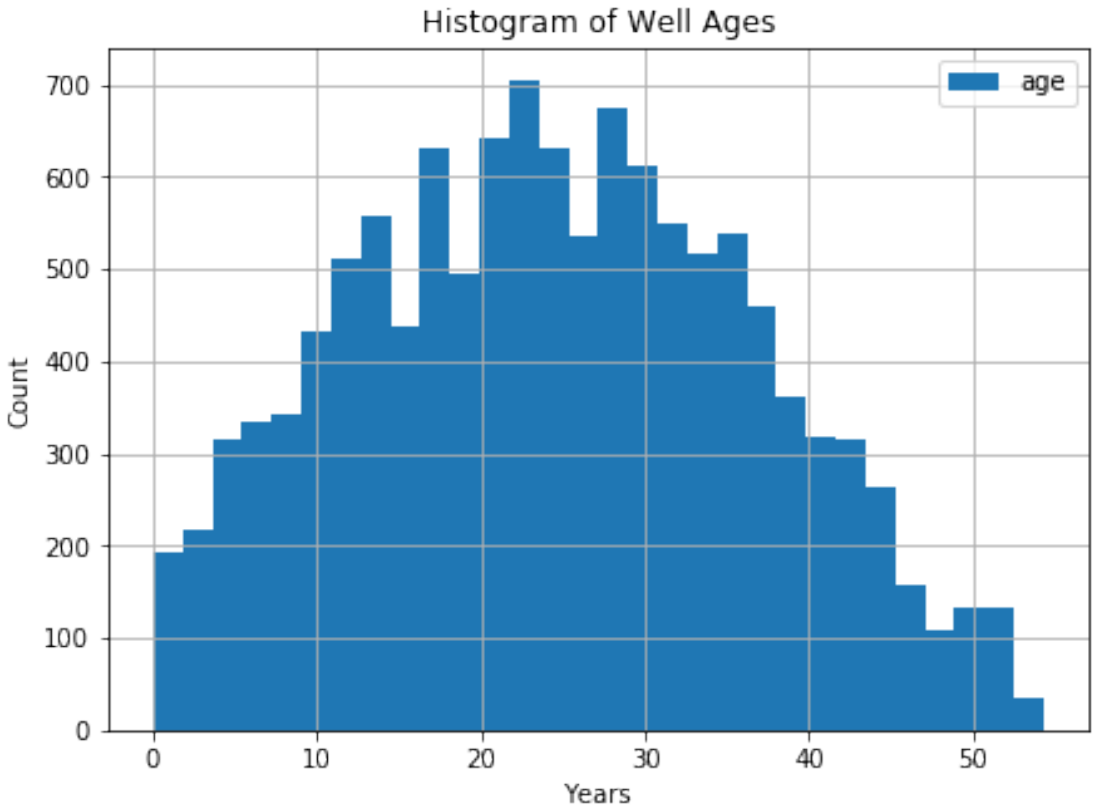
```
In [11]: # date info
         df['SPUD_DATE RELEASE_DATE COMPLETION_DATE age'.split()].head()
```

```
Out[11]:      SPUD_DATE RELEASE_DATE COMPLETION_DATE        age
         0  14-Oct-1982  07-Jul-1988     25-Nov-1982 13315 days
         1  09-May-1983  03-Jan-1989     18-May-1983 13108 days
         2  31-Dec-1971  22-Jan-1979     08-Feb-1972 17255 days
         3  27-Feb-1972  22-Jan-1979     07-May-1972 17197 days
         4  09-May-1972  01-Dec-1980     23-Jun-1972 17125 days
```

2.1 Histogram of Well Ages

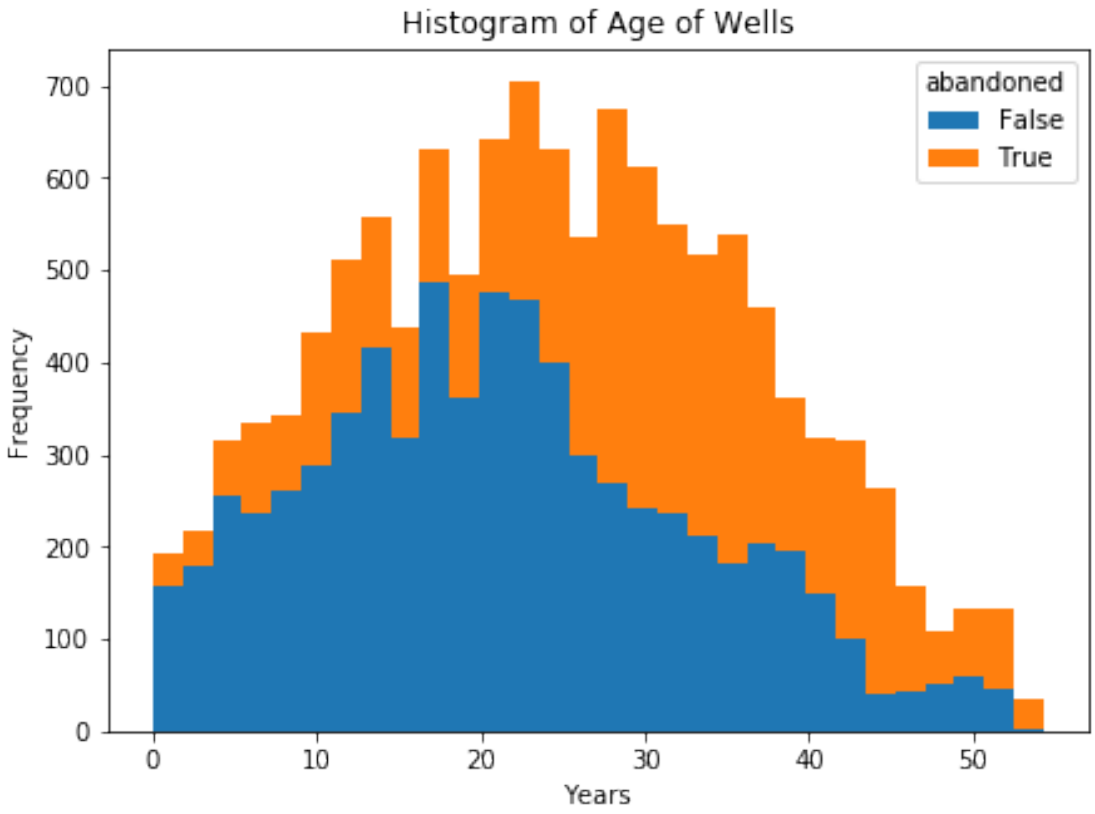
```
In [12]: df['age_yrs'] = df.age.dt.days / 365
         df['abandoned'] = df.CURRENT_STATUS == 'AB3'

         fig, ax = plt.subplots(figsize=(7,5))
         ax.set_xlabel('Years')
         ax.set_ylabel('Count')
         ax.set_title('Histogram of Well Ages')

         df['age_yrs'].hist(bins=30, label='age', ax=ax)
         plt.legend()
```

Out[12]: <matplotlib.legend.Legend at 0x11be382e8>



In [13]:
```
fig, ax = plt.subplots(figsize=(7,5))
df.pivot(columns='abandoned').age_yrs.plot(bins=30, kind='hist', stacked=True, ax=ax)
ax.set_title('Histogram of Age of Wells')
ax.set_xlabel('Years')
```

Out[13]: Text(0.5, 0, 'Years')



3 Locations of Abandoned and Active Wells

```
In [14]: geometry = [Point(x, y) for _, (x, y) in df['ORIG_SURF_X_LONG ORIG_SURF_Y_LAT'.split()
```

```
In [15]: geo_df = gp.GeoDataFrame(df, geometry=geometry)
```

```
In [16]: df_abandoned = geo_df[df.CURRENT_STATUS.isin(abandoned)]
         df_active = geo_df[df.CURRENT_STATUS.isin(active)]
         print(f'number of abandoned wells: {len(df_abandoned)}\nnumber of active wells: {len(
```

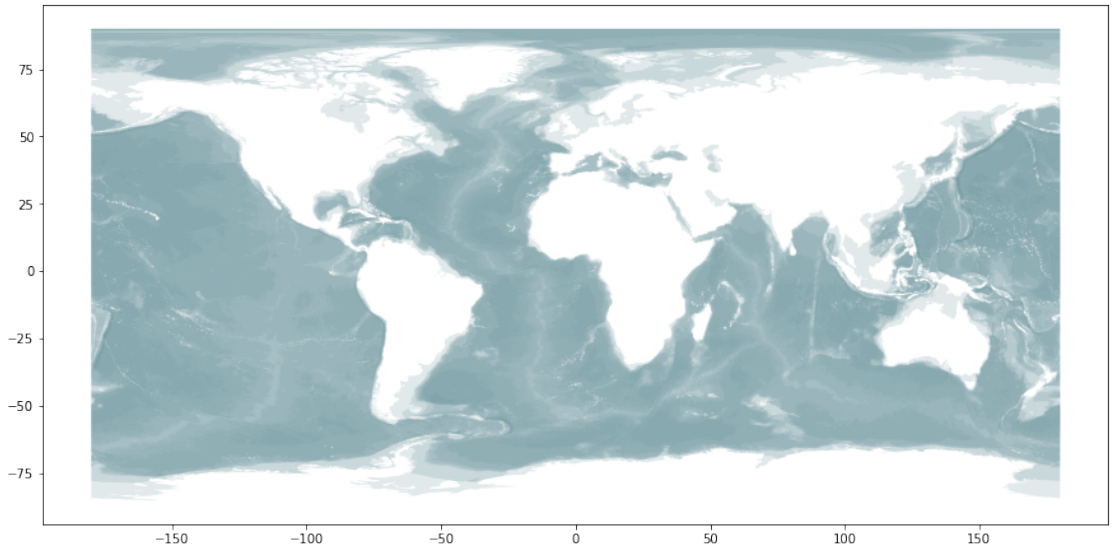
```
number of abandoned wells: 5173
number of active wells: 6984
```

Bathymetry files are available here: https://www.naturalearthdata.com/downloads/10m-physical-vectors/10m-bathymetry/

```
In [17]: bathymetry_fnames = 'L_0 K_200 J_1000 I_2000 H_3000 G_4000 F_5000 E_6000 D_7000 C_800
         bathymetry_files = [gp.read_file(f'ne_10m_bathymetry_all/ne_10m_bathymetry_{fn}.shp')
```

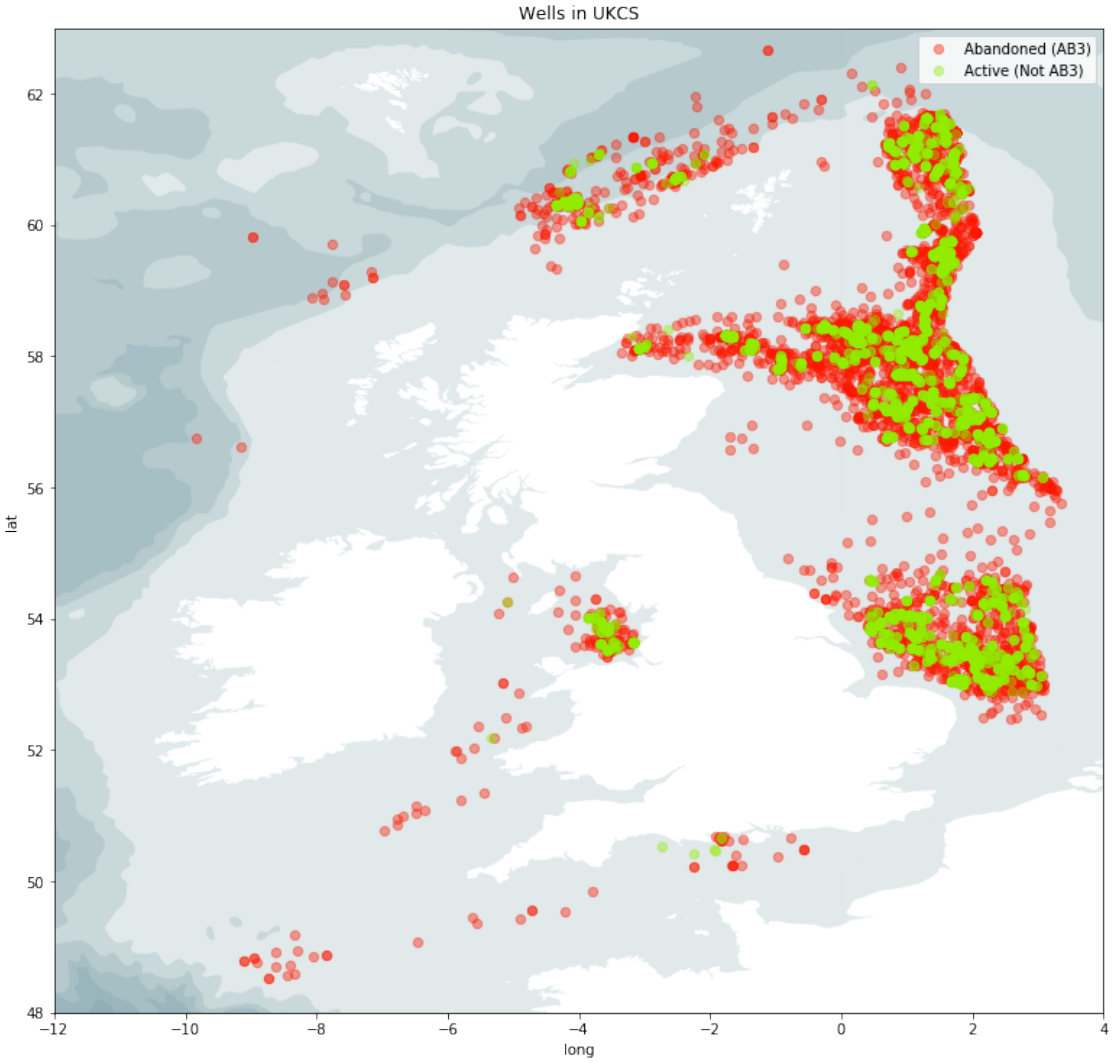
3.1 Global Bathymetry

```
In [18]: fig, ax = plt.subplots(figsize=(15, 15))

         for bf in bathymetry_files:
             bf.plot(ax=ax, color='#6A959D', alpha=0.2)
```



3.2 Wells in UKCS (UK Continental Shelf)

```
In [19]: fig, ax = plt.subplots(figsize=(13, 13))

         for bf in bathymetry_files:
             bf.plot(ax=ax, color='#6A959D', alpha=0.2)

         ms = 40
         df_abandoned.plot(ax=ax, color='#FF1800', marker='o', markersize=ms, alpha=0.4, label=
         df_active.plot(ax=ax, color='#92ED00', marker='o', markersize=ms, alpha=0.4, label='A

         plt.legend()
         ax.set_xlim(left=-12, right=4)
         ax.set_ylim(top=63, bottom=48)
         ax.set_xlabel('long')
         ax.set_ylabel('lat')
         ax.set_title('Wells in UKCS')

Out[19]: Text(0.5, 1.0, 'Wells in UKCS')
```


Wells in UKCS
Abandoned (AB3)
Active (Not AB3)
lat
long
62
60
58
56
54
52
50
48
−12
−10
−8
−6
−4
−2
0
2
4