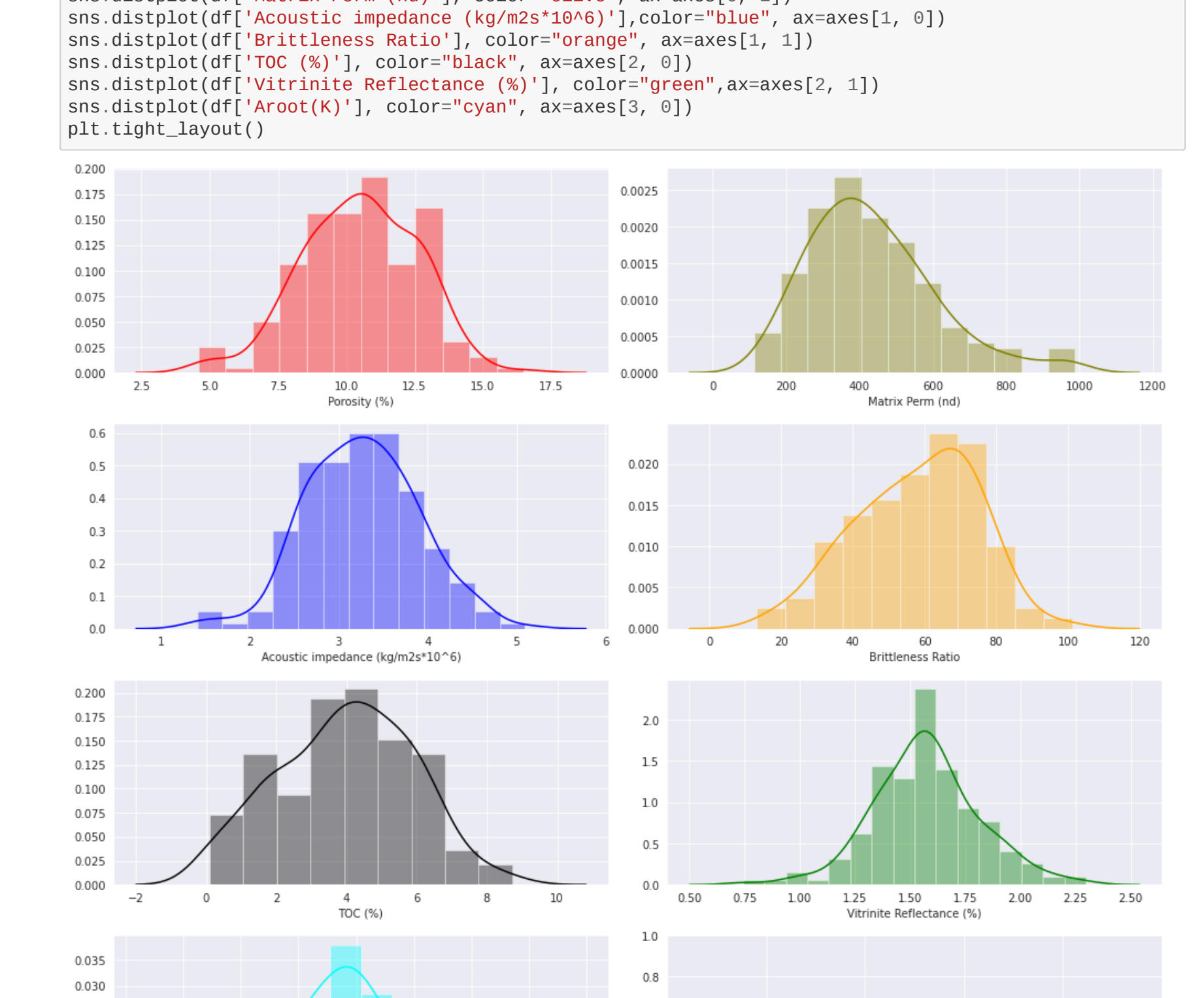
In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns
sns.set_style("darkgrid")
df=pd.read_csv('/home/abdou/Desktop/DataSet.csv')
df.describe().transpose()
```

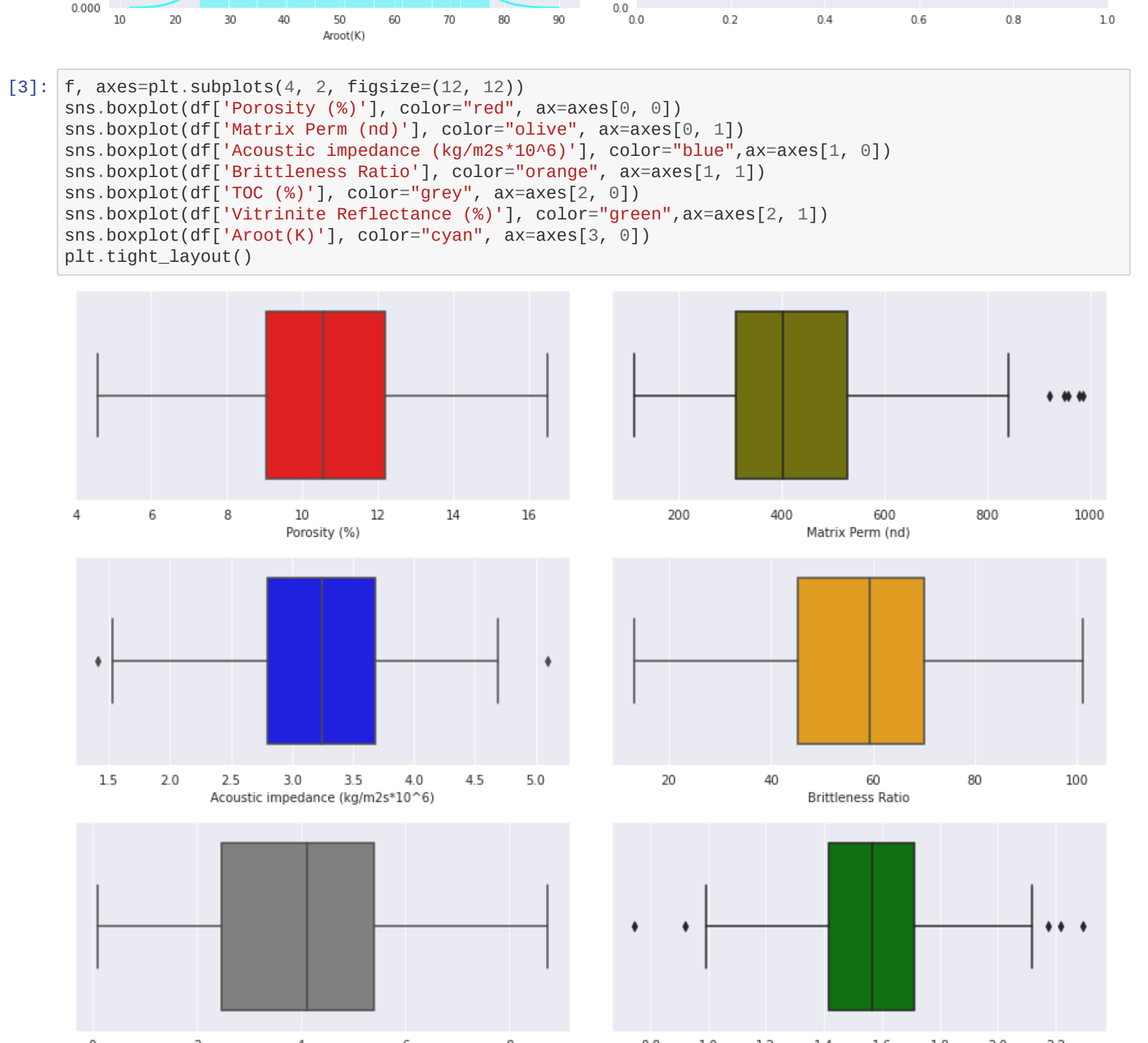
Out[1]:

	count	mean	std	min	25%	50%	75%	max
Porosity (%)	200.0	10.493805	2.079824	4.585000	9.03875	10.549000	12.181750	16.485000
Matrix Perm (nd)	200.0	433.075000	173.101415	113.000000	312.250000	403.500000	528.750000	987.000000
Acoustic impedance (kg/m2s*10^6)	200.0	3.265735	0.623574	1.408000	2.80225	3.250500	3.679500	5.093000
Brittleness Ratio	200.0	57.794340	16.955346	13.128000	45.30600	59.412000	69.915000	101.196000
TOC (%)	200.0	3.970700	1.907119	0.100000	2.47000	4.120000	5.400000	8.720000
Vitrinite Reflectance (%)	200.0	1.571440	0.240634	0.744000	1.41600	1.568000	1.714000	2.296000
Aroot(K)	200.0	50.000000	11.505310	24.437856	41.96103	49.692285	58.986667	77.270733

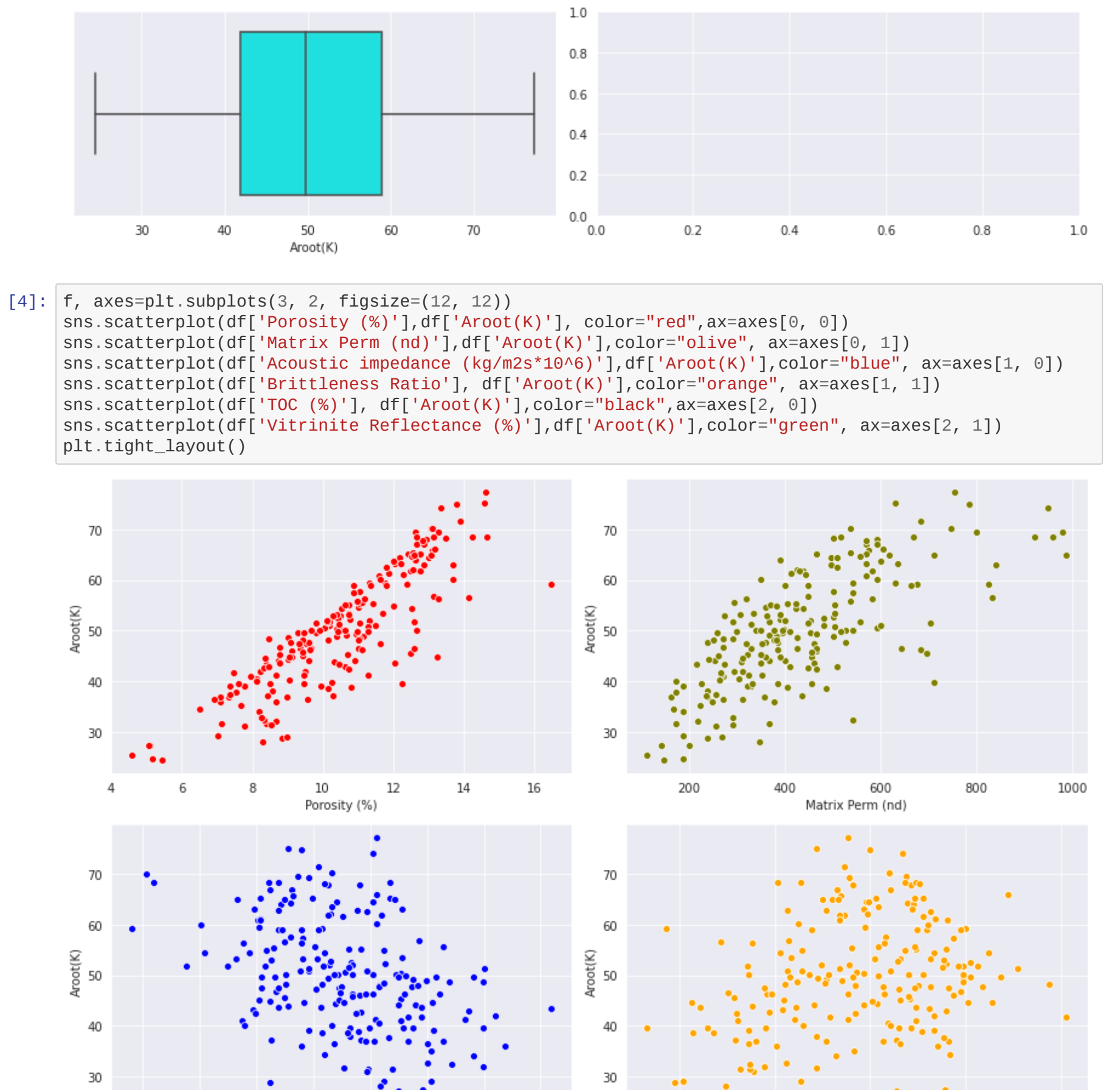
In [2]:
```
f, axes=plt.subplots(4, 2, figsize=(14, 13))
sns.distplot(df['Porosity (%)'], color="red", ax=axes[0, 0])
sns.distplot(df['Matrix Perm (nd)'], color="olive", ax=axes[0, 1])
sns.distplot(df['Acoustic impedance (kg/m2s*10^6)'],color="blue", ax=axes[1, 0])
sns.distplot(df['Brittleness Ratio'],color="orange", ax=axes[1, 1])
sns.distplot(df['TOC (%)'], color="black", ax=axes[2, 0])
sns.distplot(df['Vitrinite Reflectance (%)'], color="green",ax=axes[2, 1])
sns.distplot(df['Aroot(K)'], color="cyan", ax=axes[3, 0])
plt.tight_layout()
```



In [3]:
```
f, axes=plt.subplots(4, 2, figsize=(12, 12))
sns.boxplot(df['Porosity (%)'], color="red", ax=axes[0, 0])
sns.boxplot(df['Matrix Perm (nd)'], color="olive", ax=axes[0, 1])
sns.boxplot(df['Acoustic impedance (kg/m2s*10^6)'], color="blue",ax=axes[1, 0])
sns.boxplot(df['Brittleness Ratio'], color="orange", ax=axes[1, 1])
sns.boxplot(df['TOC (%)'], color="grey", ax=axes[2, 0])
sns.boxplot(df['Vitrinite Reflectance (%)'], color="green",ax=axes[2, 1])
sns.boxplot(df['Aroot(K)'], color="cyan", ax=axes[3, 0])
plt.tight_layout()
```

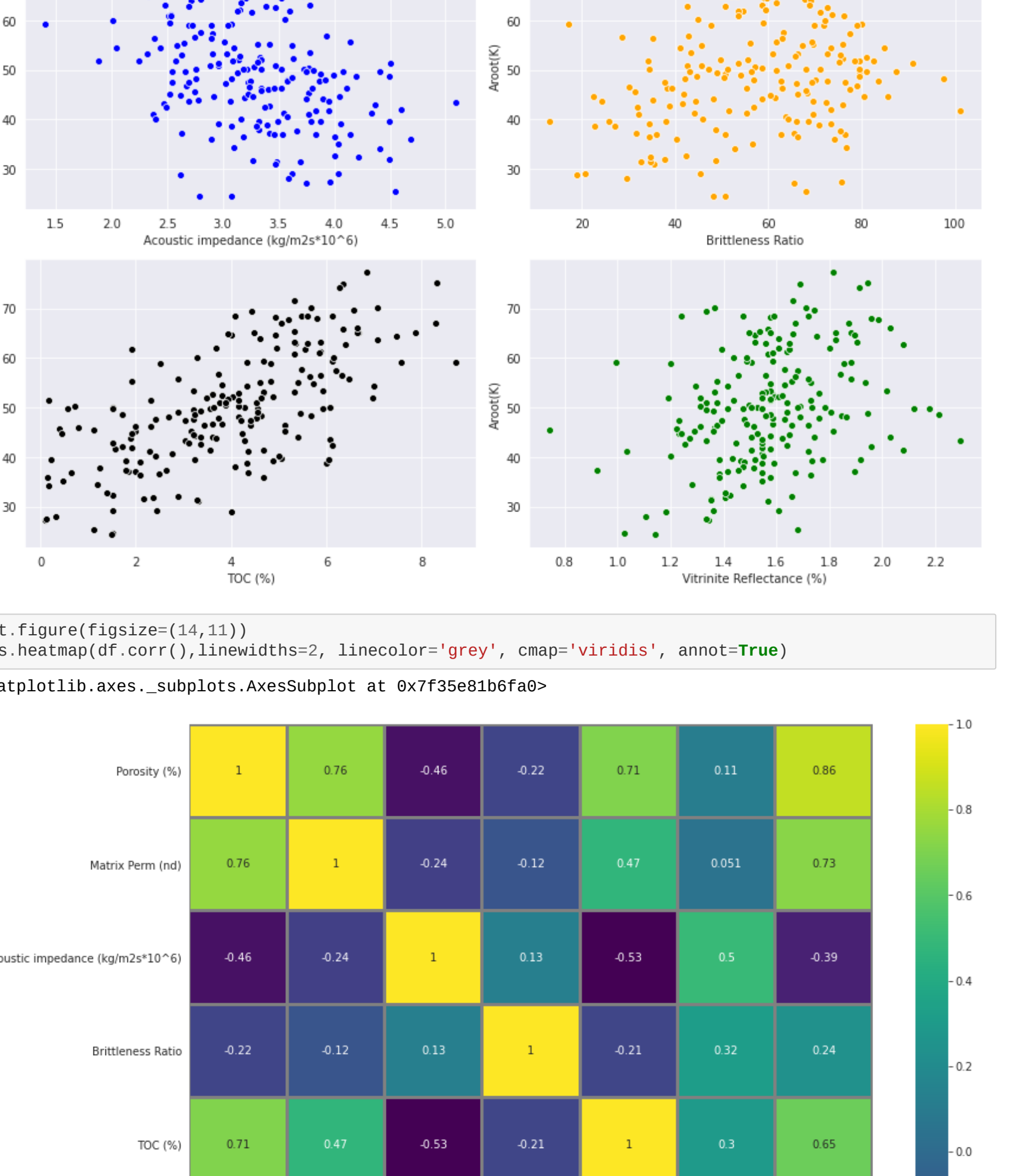


In [4]:
```
f, axes=plt.subplots(3, 2, figsize=(12, 12))
sns.scatterplot(df['Porosity (%)'],df['Aroot(K)'], color="red",ax=axes[0, 0])
sns.scatterplot(df['Matrix Perm (nd)'],df['Aroot(K)'],color="olive", ax=axes[0, 1])
sns.scatterplot(df['Acoustic impedance (kg/m2s*10^6)'],df['Aroot(K)'],color="blue", ax=axes[1, 0])
sns.scatterplot(df['Brittleness Ratio'], df['Aroot(K)'],color="orange", ax=axes[1, 1])
sns.scatterplot(df['TOC (%)'],df['Aroot(K)'],color="black",ax=axes[2, 0])
sns.scatterplot(df['Vitrinite Reflectance (%)'],df['Aroot(K)'],color="green", ax=axes[2, 1])
plt.tight_layout()
```



In [5]:
```
plt.figure(figsize=(14,11))
sns.heatmap(df.corr(),linewidths=2, linecolor='grey', cmap='viridis', annot=True)
```

Out[5]: <matplotlib.axes._subplots.AxesSubplot at 0x7f35e81b6fa0>



In [6]:
```
df.drop(['TOC (%)','Matrix Perm (nd)'], axis=1, inplace=True)
```

In [7]:
```
from sklearn import preprocessing
scaler=preprocessing.MinMaxScaler(feature_range=(0,1))
scaler.fit(df)
df_scaled=scaler.transform(df)
print(df_scaled)
```

```
[[0.32529412 0.45373134 0.9600763  0.71134021 0.45177576]
 [0.34294118 0.57910448 0.48003815 0.48969072 0.31917731]
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```

In [8]:
```
df_scaled=pd.DataFrame(df_scaled, columns=['Porosity(%)','Acoustic impedance (kg/m2s*10^6)','Brittleness Ratio','Vitrinite Reflectance (%)', 'Aroot(K)'])
```

In [9]:
```
y_scaled=df_scaled['Aroot(K)']
x_scaled=df_scaled.drop(['Aroot(K)'], axis=1)
```

In [10]:
```
from sklearn.model_selection import train_test_split
seed=1000
np.random.seed(seed)
X_train, X_test, y_train, y_test=train_test_split(x_scaled,y_scaled, test_size=0.3)
X_train
```

Out[10]:

	Porosity(%)	Acoustic impedance (kg/m2s*10^6)	Brittleness Ratio	Vitrinite Reflectance (%)
44	0.695294	0.382090	0.453468	0.726804
101	0.401176	0.525373	0.562611	0.407216
25	0.042353	0.635821	0.594359	0.386598
3	0.654118	0.402985	0.393378	0.489691
68	0.487647	0.641791	0.515874	0.608247
...	...	...	...	...
94	0.541176	0.459701	0.814007	0.572165
192	0.812941	0.325373	0.365445	0.546392
71	0.448235	0.489552	0.658945	0.505155
87	0.490000	0.602985	0.713585	0.567010
179	0.039412	0.692537	0.710587	0.381443

140 rows × 4 columns

In [11]:
```
from sklearn.model_selection import train_test_split
seed=1000
np.random.seed(seed)
X_train, X_test, y_train, y_test=train_test_split(x_scaled,y_scaled, test_size=0.3)
X_test
```

Out[11]:

	Porosity(%)	Acoustic impedance (kg/m2s*10^6)	Brittleness Ratio	Vitrinite Reflectance (%)
118	0.334118	0.519403	0.405096	0.469072
70	0.210588	0.659701	0.720125	0.515464
163	0.297059	0.268657	0.580461	0.293814
161	0.673529	0.128358	0.238725	0.288660
73	0.592353	0.307463	0.278921	0.314433
96	0.611765	0.304478	0.687968	0.577320
16	0.764706	0.537313	0.334514	0.525773
120	0.543529	0.516418	0.712631	0.587629
74	0.664706	0.501493	0.657038	0.417526
143	0.323529	0.576119	0.428124	0.432990
83	0.420000	0.665672	0.798338	0.572165
127	0.547647	0.435821	0.552528	0.628866
62	0.685882	0.614925	0.546668	0.695876
122	0.731176	0.420896	0.483172	0.381443
49	0.684118	0.594030	0.470636	0.680412
157	0.554118	0.402985	0.566971	0.597938
195	0.317647	0.504478	0.766317	0.582474
152	0.713529	0.364179	0.441613	0.484536
10	0.499412	0.280597	0.683608	0.432990
184	0.677647	0.480597	0.241586	0.603093
106	0.407647	0.492537	0.604442	0.396907
37	0.588235	0.298507	0.714675	0.530928
57	0.509412	0.546269	0.292002	0.453608
15	0.281765	0.641791	0.641641	0.628866
66	0.449412	0.420896	0.241995	0.463918
141	0.534118	0.468657	0.407276	0.396907
108	0.841765	0.373134	0.403733	0.773196
172	0.258824	0.713433	0.492165	0.515464
126	0.581176	0.400000	0.334650	0.407216
154	0.521765	0.453731	0.109552	0.515464
182	0.195882	0.704478	0.602943	0.634021
191	0.000000	0.850746	0.623382	0.603093
107	0.624706	0.319403	0.369805	0.536082
98	0.315294	0.295522	0.496525	0.329897
38	0.510000	0.668657	0.426489	0.685567
39	0.470000	0.226866	0.753917	0.365979
28	0.342941	0.838806	0.278785	0.587629
80	0.495294	0.474627	0.598310	0.654639
33	0.413529	0.498507	0.561657	0.654639
165	0.591765	0.164179	0.670255	0.479381
132	0.246471	0.611940	0.708543	0.494845
167	0.369412	0.558209	0.257937	0.597938
24	0.712353	0.032836	0.577872	0.402062
125	0.488824	0.405970	0.675296	0.525773
131	0.648235	0.304478	0.458237	0.541237
171	0.640588	0.644776	0.632102	0.747423
119	0.666471	0.573134	0.526911	0.742268
110	0.494118	0.420896	0.882818	0.448454
136	0.490000	0.653731	0.549802	0.432990
153	0.375882	0.477612	0.372667	0.520619
188	0.564118	0.561194	0.369124	0.577320
22	0.357059	0.328358	0.064586	0.283505
65	0.542353	0.841791	0.457828	0.536082
150	0.679412	0.614925	0.615206	0.628866
17	0.531176	0.373134	0.251942	0.489691
64	0.658824	0.429851	0.659218	0.731959
129	0.627059	0.450746	0.125085	0.515464
178	0.749412	0.459701	0.648862	0.536082
59	0.379412	0.543284	0.730345	0.402062
103	0.726471	0.408955	0.104783	0.314433

In [12]:
```
from sklearn.linear_model import LinearRegression
np.random.seed(seed)
lm=LinearRegression()
```

In [13]:
```
lm.fit(X_train,y_train)
```

Out[13]: LinearRegression()

In [14]:
```
print(lm.intercept_)
```

-0.2956531626291044

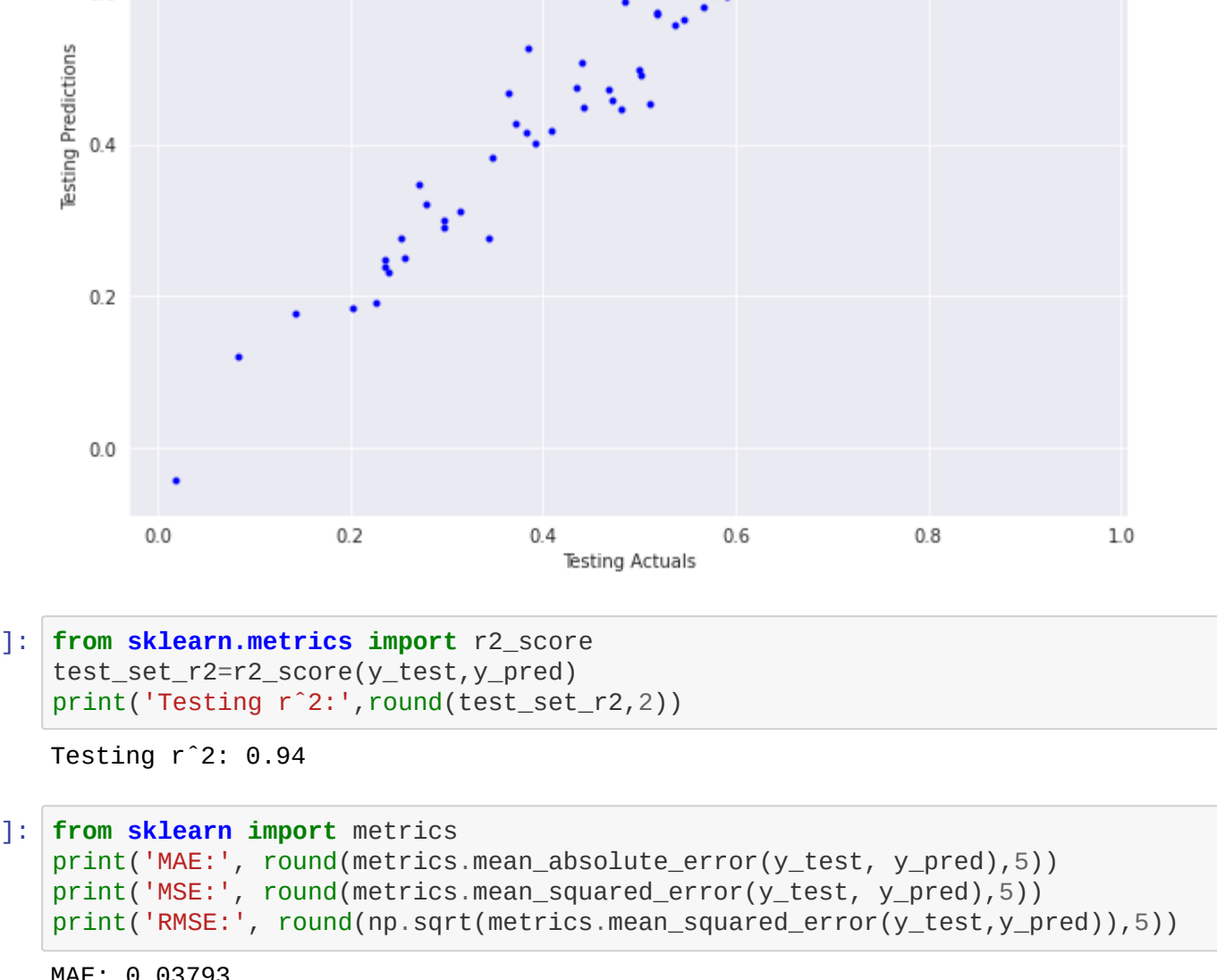
In [15]:
```
coeff_df=pd.DataFrame(lm.coef_,x_scaled.columns,columns=['Coefficient'])
coeff_df
```

Out[15]:

	Coefficient
Porosity(%)	1.069765
Acoustic impedance (kg/m2s*10^6)	-0.178141
Brittleness Ratio	0.426330
Vitrinite Reflectance (%)	0.231669

In [17]:
```
plt.figure(figsize=(10,8))
y_pred=lm.predict(X_test)
plt.plot(y_test,y_pred, 'b.')
plt.xlabel('Testing Actuals')
plt.ylabel('Testing Predictions')
plt.title('Actual Vs. Predicted, Testing Data Set (30% of the data)')
```

Out[17]: Text(0.5, 1.0, 'Actual Vs. Predicted, Testing Data Set (30% of the data)')



In [18]:
```
from sklearn.metrics import r2_score
test_set_r2=r2_score(y_test,y_pred)
print('Testing r^2:',round(test_set_r2,2))
```

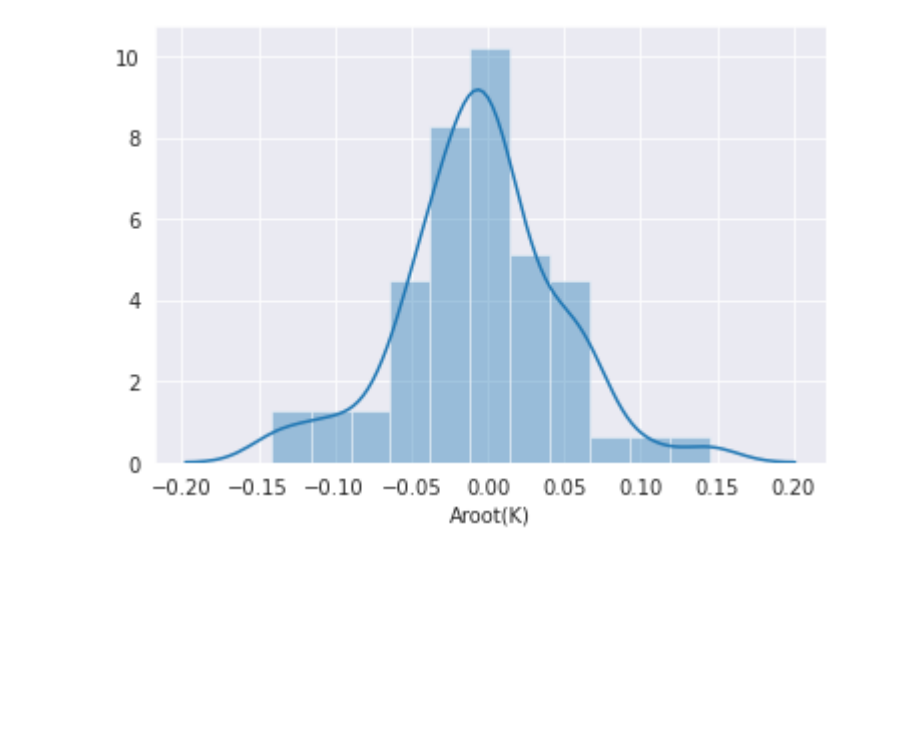
Testing r^2: 0.94

In [19]:
```
from sklearn import metrics
print('MAE:', round(metrics.mean_absolute_error(y_test, y_pred),5))
print('MSE:', round(metrics.mean_squared_error(y_test, y_pred),5))
print('RMSE:', round(np.sqrt(metrics.mean_squared_error(y_test,y_pred)),5))
```

MAE: 0.03793
MSE: 0.00266
RMSE: 0.05159

In [20]:
```
sns.distplot((y_test-y_pred))
```

Out[20]: <matplotlib.axes._subplots.AxesSubplot at 0x7f35e9f372b0>



In [21]:

```python
import statsmodels.api as sm
X=sm.add_constant(X_train)
model=sm.OLS(y_train,X).fit()
predictions=model.predict(X)
model_stats=model.summary()
print(model_stats)
```

```
                            OLS Regression Results                            
==============================================================================
Dep. Variable:               Aroot(K)   R-squared:                       0.946
Model:                            OLS   Adj. R-squared:                  0.944
Method:                 Least Squares   F-statistic:                     589.0
Date:                Mon, 07 Mar 2022   Prob (F-statistic):           2.26e-84
Time:                        08:43:49   Log-Likelihood:                 218.23
No. Observations:                 140   AIC:                            -426.5
Df Residuals:                     135   BIC:                            -411.7
Df Model:                           4                                         
Covariance Type:            nonrobust                                         
=====================================================================================================
                                        coef    std err          t      P>|t|      [0.025      0.975]
-----------------------------------------------------------------------------------------------------
const                                -0.2957      0.030     -9.761      0.000      -0.356      -0.236
Porosity(%)                           1.0698      0.035     30.654      0.000       1.001       1.139
Acoustic impedance (kg/m2s*10^6)     -0.1781      0.040     -4.400      0.000      -0.258      -0.098
Brittleness Ratio                     0.4263      0.027     16.083      0.000       0.374       0.479
Vitrinite Reflectance (%)             0.2317      0.039      5.899      0.000       0.154       0.309
==============================================================================
Omnibus:                        6.746   Durbin-Watson:                   2.148
Prob(Omnibus):                  0.034   Jarque-Bera (JB):                9.002
Skew:                          -0.252   Prob(JB):                       0.0111
Kurtosis:                       4.136   Cond. No.                         20.9
==============================================================================

Warnings:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

In [ ]: