volcanoes-around-the-world

December 2, 2023

0.1 Introduction

In this notebook, I will use basemap and pyplot to illustrate the data published by "The Smithsonian Institution" and "US Geological Survey". The Volcanoes dataset contains the recent details about volcanoes and their eruptive history over the past 10,000 years. The Earthquakes dataset contains the date, time, location, depth, magnitude, and source of every earthquake with a reported magnitude 5.5 or higher since 1965.

Work in progress :)

[3]:
```
import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)
from pandas import Series
import matplotlib.pyplot as plt
plt.style.use('ggplot')
# from mpl_toolkits.basemap import Basemap
import warnings
warnings.filterwarnings('ignore')
%matplotlib inline


volcanoes = pd.read_csv("database.csv")
```

[5]:
```
volcanoes.columns
```

[5]:
```
Index(['Number', 'Name', 'Country', 'Region', 'Type', 'Activity Evidence',
       'Last Known Eruption', 'Latitude', 'Longitude', 'Elevation (Meters)',
       'Dominant Rock Type', 'Tectonic Setting'],
      dtype='object')
```

[7]:
```
volcanoes.head()
```

[7]:

	Number	Name	Country	Region	\
0	210010	West Eifel Volcanic Field	Germany	Mediterranean and Western Asia	
1	210020	Chaine des Puys	France	Mediterranean and Western Asia	
2	210030	Olot Volcanic Field	Spain	Mediterranean and Western Asia	
3	210040	Calatrava Volcanic Field	Spain	Mediterranean and Western Asia	
4	211001	Larderello	Italy	Mediterranean and Western Asia	

```
                 Type  Activity Evidence Last Known Eruption  Latitude  \
0             Maar(s)     Eruption Dated            8300 BCE    50.170
1         Lava dome(s)     Eruption Dated            4040 BCE    45.775
2  Pyroclastic cone(s)  Evidence Credible             Unknown    42.170
3  Pyroclastic cone(s)     Eruption Dated            3600 BCE    38.870
4  Explosion crater(s)  Eruption Observed             1282 CE    43.250

   Longitude  Elevation (Meters)               Dominant Rock Type  \
0       6.85                 600                          Foidite
1       2.97                1464            Basalt / Picro-Basalt
2       2.53                 893  Trachybasalt / Tephrite Basanite
3      -4.02                1117            Basalt / Picro-Basalt
4      10.87                 500                          No Data

                            Tectonic Setting
0        Rift Zone / Continental Crust (>25 km)
1        Rift Zone / Continental Crust (>25 km)
2       Intraplate / Continental Crust (>25 km)
3       Intraplate / Continental Crust (>25 km)
4  Subduction Zone / Continental Crust (>25 km)
```

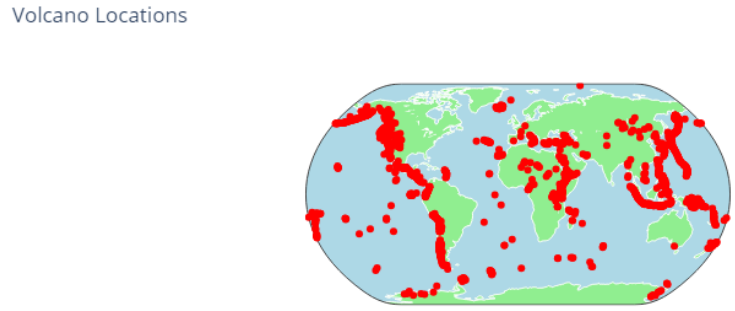
Bar type figure definition

[10]:
```
def fig_p(data):
    series=Series(data).value_counts().sort_index()
    series.plot(kind='bar')
```

0.2 Data Visualization

Recent location of eruption

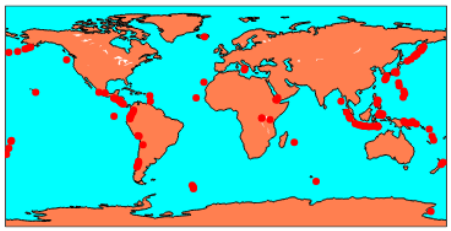
[14]:
```
import plotly.express as px

# Assuming 'volcanoes' is your DataFrame containing volcano data
fig = px.scatter_geo(
    volcanoes,
    lat='Latitude',
    lon='Longitude',
    title='Volcano Locations',
    color_discrete_sequence=['red'],  # Set marker color to red
    projection='natural earth',  # Choose a map projection
)

fig.update_geos(coastlinecolor="white", showland=True, landcolor="lightgreen",␣
 ↪showocean=True, oceancolor="lightblue")

fig.show()
```



Where volcanoes erupted and where earthquakes happen in the last 5 years?

[19]:
```
import plotly.express as px
import pandas as pd

# Filter recently active volcanoes
recent_active = volcanoes[(volcanoes["Last Known Eruption"] >= '2012 CE') &␣
 ↪(volcanoes["Last Known Eruption"] <= '2016 CE')]

# Create Plotly figure
fig = px.scatter_geo(
    recent_active,
    lat='Latitude',
    lon='Longitude',
    color_discrete_sequence=['red'],
    title='Recently Active Volcanoes  (2012-2016)',
)



# Update layout
fig.update_geos(
    coastlinecolor="black",
    showland=True,
    landcolor="coral",
    showocean=True,
    oceancolor="aqua",
)

# Show the plot
fig.show()
```

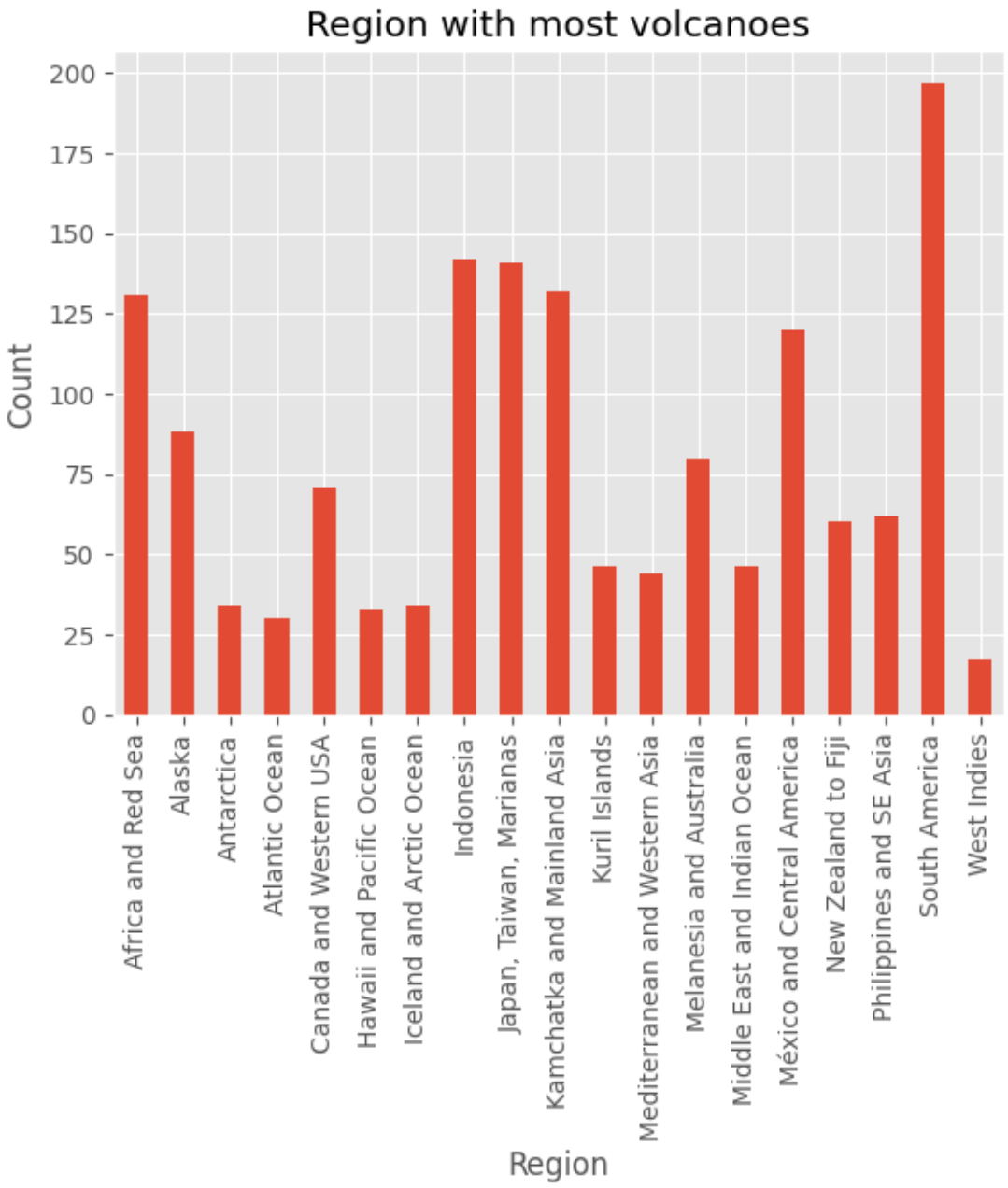
Recently Active Volcanoes (2012-2016)



Distribution of volcanoes by region

[7]:
```
fig_p(volcanoes["Region"])
plt.ylabel("Count")
plt.title("Region with most volcanoes")
```

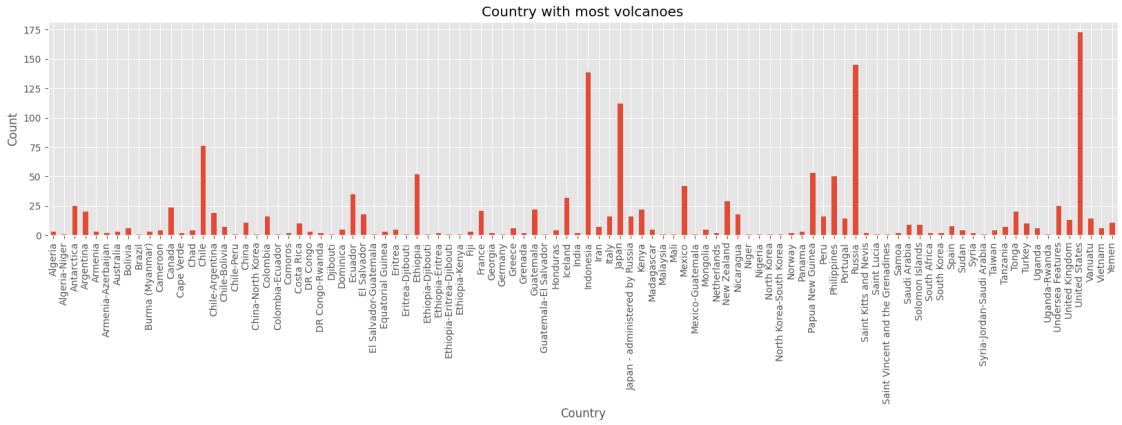
[7]:
```
Text(0.5, 1.0, 'Region with most volcanoes')
```



Distribution of volcanoes by country

[8]:
```
plt.figure(figsize=(20,4))
fig_p(volcanoes["Country"])
plt.ylabel("Count")
plt.title("Country with most volcanoes")
```

[8]:
```
Text(0.5, 1.0, 'Country with most volcanoes')
```



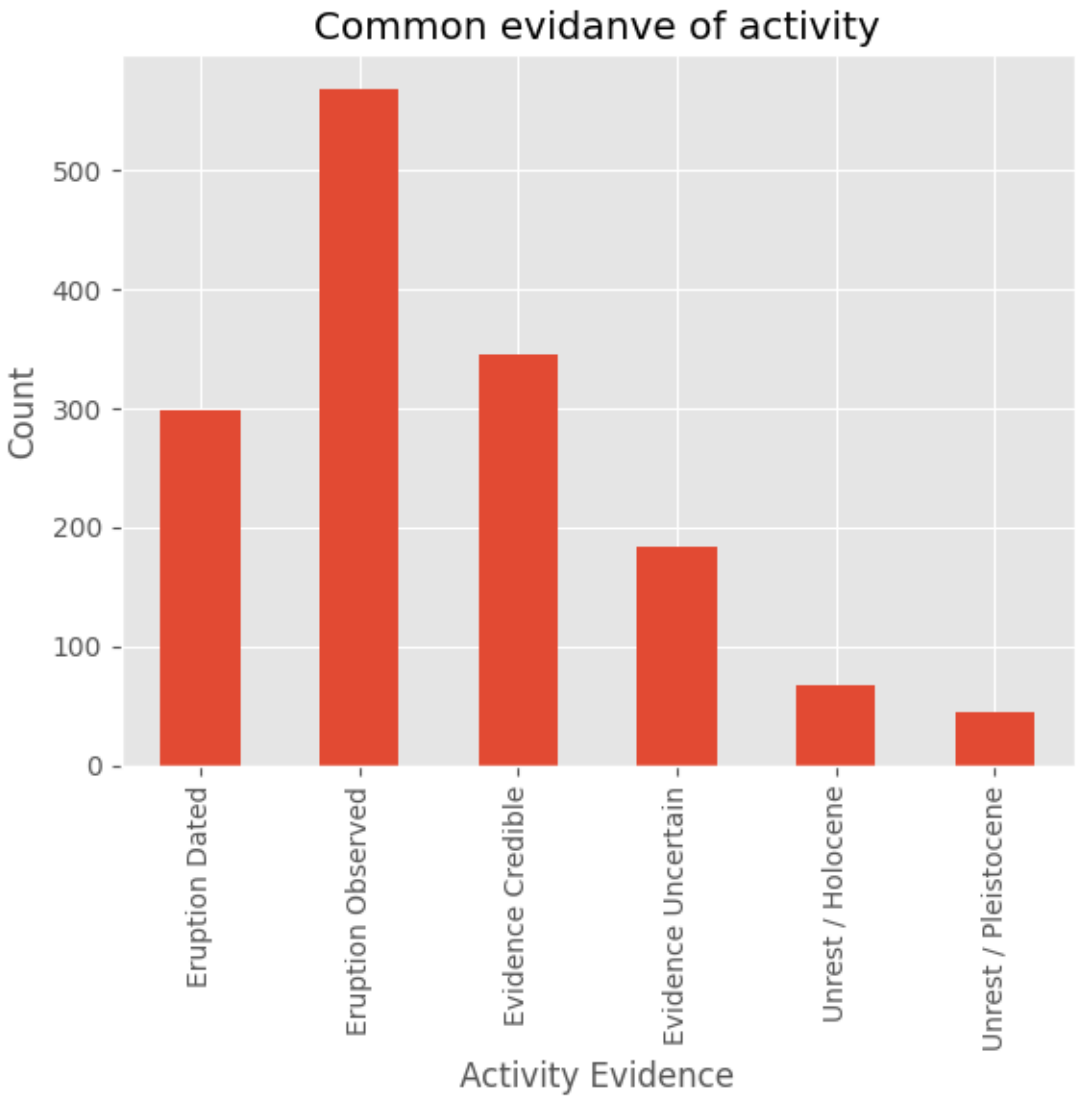
[9]:
```
most_vol_region = volcanoes["Region"].value_counts().idxmax()
most_vol_country = volcanoes["Country"].value_counts().idxmax()

print("The region with the most volcanoes is:", most_vol_region)
print("The country with the most volcanoes is:", most_vol_country)
```

```
The region with the most volcanoes is: South America
The country with the most volcanoes is: United States
```

What is the main evidence of eruption?

[10]:
```
fig_p(volcanoes["Activity Evidence"])
plt.ylabel("Count")
plt.title("Common evidanve of activity")
```

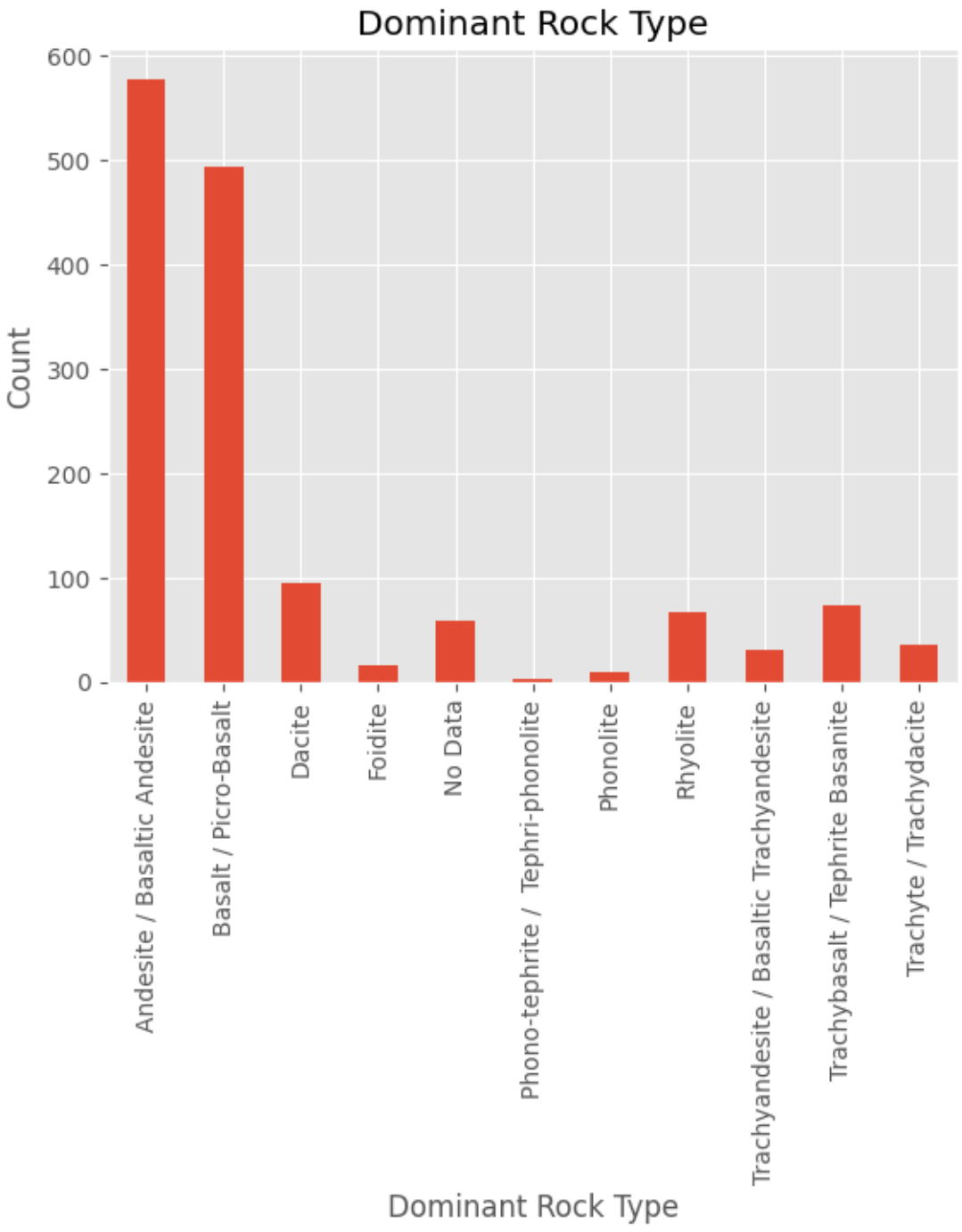
[10]:
```
Text(0.5, 1.0, 'Common evidanve of activity')
```



What is the most common rock type of volcanoes?

[11]:
```
fig_p(volcanoes["Dominant Rock Type"])
plt.ylabel("Count")
plt.title("Dominant Rock Type")
```

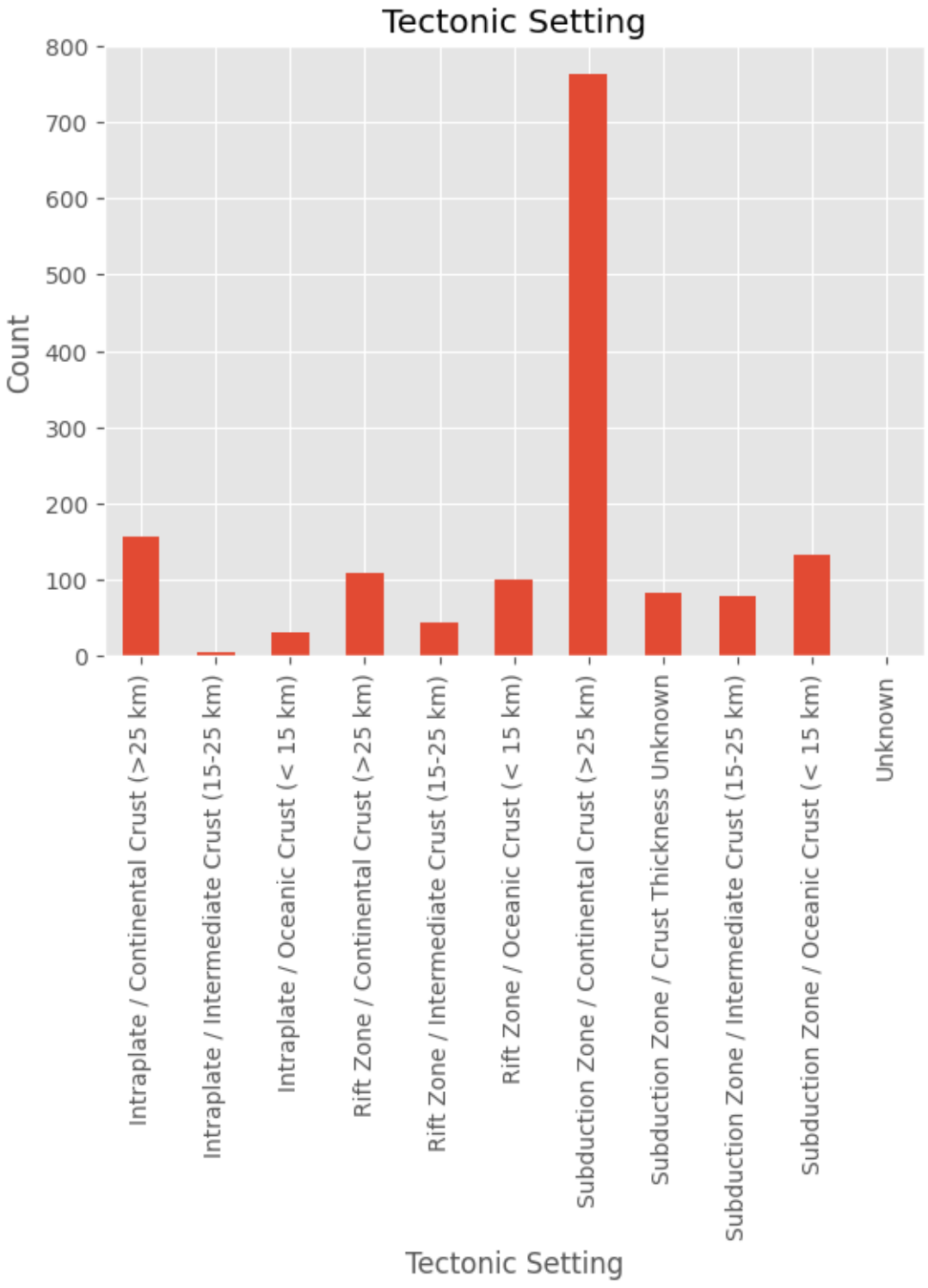
[11]:
```
Text(0.5, 1.0, 'Dominant Rock Type')
```



How mant volcanoes are located on each of the tectonic settings?

[12]:
```
fig_p(volcanoes["Tectonic Setting"])
plt.ylabel("Count")
plt.title("Tectonic Setting")
```

[12]: Text(0.5, 1.0, 'Tectonic Setting')



0.3 Conclusions

It has been amazing to see the exact locations of each volcano and earthquake in the map and to imagine a line between them to find the boundaries between the tectonic plates. 54 percent of the volcanoes presented in the data are located close to the equator and 64 percent of the earthquakes occur in the same area, this is a sign that the earth's axis is becoming more unstable.

[ ]: