

Stable Isotope Analysis

Analytical Methods in R

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Motivation

Stable isotope analysis (SIA) is one of the most exciting developments in forensic chemistry in the 21st century. In addition to the substantial academic hype surrounding SIA, we also find numerous real-world applications including pinning down serial killers, tracing drugs to their distributors, determining the origin of illegal pollutants in protected environments, and enabling archeologists and paleontologists to better understand environmental conditions from eras long past. Our goal is to be able to create models that leverage this powerful technique to trace where a sample was created, and where it has been.

Loading the data

```
# Load required libraries.
```

```
library(tidyverse)
```

```
library(lubridate)
```

```
# Read local csv file, munging it slightly.
```

```
df_mega <- read_csv("mega.csv")
```

```
df_mega %>% mutate(TIMESTAMP = ymd_hm(TIMESTAMP)) %>% drop_na() %>%
```

```
  select(TIMESTAMP, Delta_180, Delta_D, Location = Name) -> df_mega
```

```
df_mega %>% head() %>% print()
```

```
## # A tibble: 6 x 4
```

##	TIMESTAMP	Delta_180	Delta_D	Location
##	<dtm>	<dbl>	<dbl>	<chr>
## 1	2013-06-18 15:00:00	-13.6	-126.	Teide
## 2	2013-06-18 16:00:00	-15.8	-146.	Teide
## 3	2013-06-18 17:00:00	-20.7	-183.	Teide
## 4	2013-06-18 18:00:00	-25.9	-224.	Teide
## 5	2013-06-18 19:00:00	-26.9	-231.	Teide
## 6	2013-06-18 20:00:00	-29.5	-252.	Teide

Plots

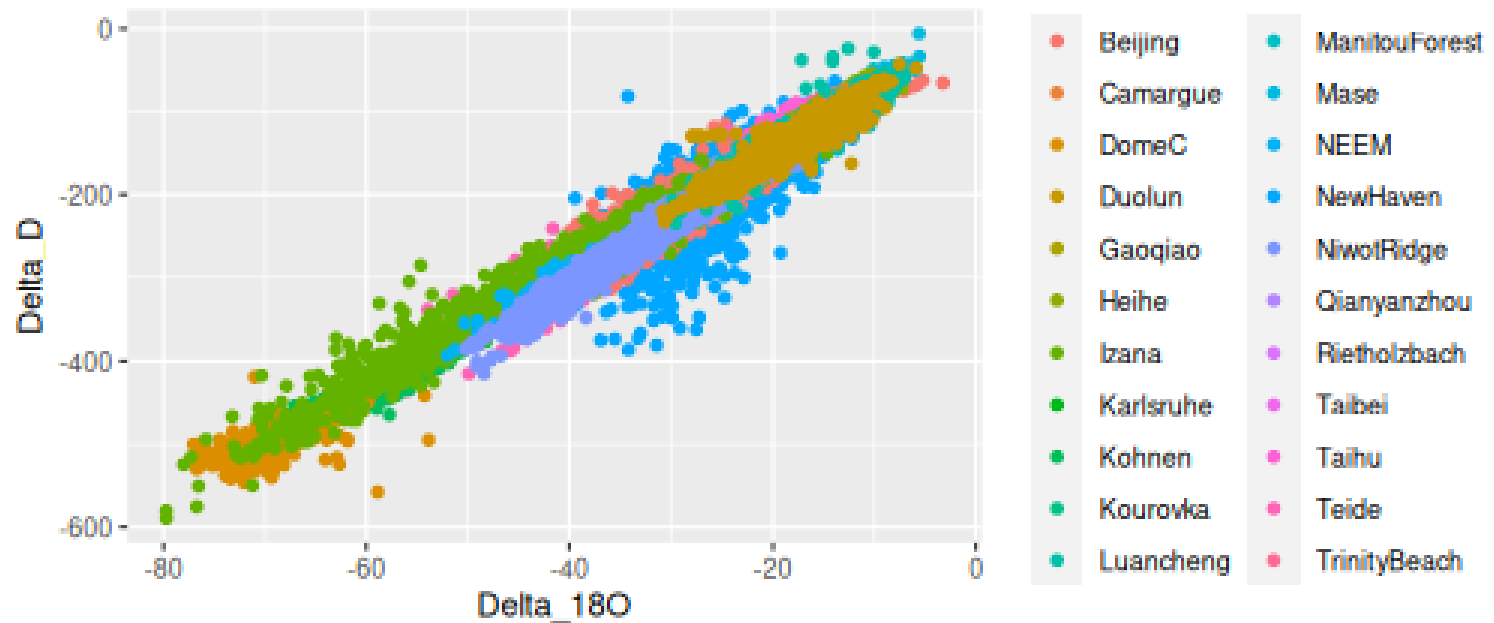
```
df_mega %>%  
  ggplot(aes(x = TIMESTAMP, y = Concentration, color = variable)) +  
  geom_point(aes(y = Delta_180, col = "Delta_180")) +  
  geom_point(aes(y = Delta_D, col = "Delta_D")) +  
  facet_wrap(Location ~ ., ncol = 8) +  
  theme(axis.text.x = element_text(angle = -90, hjust = 1))
```

Plots

```
df_mega %>%  
  filter(Location %in% c("Taihu", "Teide")) %>%  
  ggplot(aes(x = TIMESTAMP, y = Concentration, color = variable)) +  
  geom_point(aes(y = Delta_180, col = "Delta_180")) +  
  geom_point(aes(y = Delta_D, col = "Delta_D")) +  
  facet_wrap(Location ~ .) +  
  theme(axis.text.x = element_text(angle = -90, hjust = 1))
```

Plots

```
df_mega %>%  
  ggplot(aes(x = Delta_180, y = Delta_D, color = Location)) +  
  geom_point()
```



Plots

```
df_mega %>%  
  ggplot(aes(x = Delta_180, y = Delta_D, color = Location)) +  
  geom_point() +  
  facet_wrap(Location ~ .)
```

