Data Replication Assignment

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The purpose of this paper was to determine where the ceramic sherds(pieces) originated in Peru by using Instrumental Neutron Activation Analysis, which will show the source of the clay used.

## Neutron Activation Analysis of Inca and Colonial Ceramics

## from Central Highland Ecuador

library(readxl)  
library(ggplot2)  
library(tidyselect)  
library(dplyr)  
#Reading in the data from table 1 in order to make table 2  
f <- "data-reanalysis1.xlsx"  
ceramic <- read\_excel(f, sheet = 1, col\_names = TRUE)  
head(ceramic)

## # A tibble: 6 x 31  
## Site No. Al Ca Dy Mn Ti V K Na As U La  
## <chr> <chr> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 Spain HUM … 7.7 9.5 4 750 3030 126 1.2 0.95 4.3 1.67 31.6  
## 2 Inca QUI … 11.3 1.3 1.1 271 3670 115 0.6 1.34 5.4 1.86 13.6  
## 3 Panama LAM … 8.8 4.6 1.2 878 3370 160 1.3 1.65 4.4 1.43 25.2  
## 4 Panama LAM … 10 1.9 4.2 1250 2570 111 1.3 1.32 10.7 1.58 28.4  
## 5 Panama QUI … 9.1 1.4 3.5 737 2810 85 1.6 1.49 16.4 2.86 25.5  
## 6 Cuenca IGL … 9.2 0.9 3.1 327 4030 106 0.8 0.99 17.6 1.81 17.7  
## # … with 18 more variables: Yb <dbl>, Sb <dbl>, Sm <dbl>, Ba <dbl>, Ce <dbl>,  
## # Co <dbl>, Cr <dbl>, Cs <dbl>, Eu <dbl>, Fe <dbl>, Tb <dbl>, Nd <dbl>,  
## # Ni <dbl>, Sc <dbl>, Sr <dbl>, Ta <dbl>, Th <dbl>, Hf <dbl>

summary(ceramic)

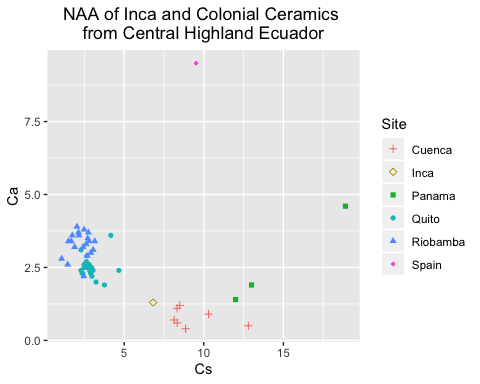
## Site No. Al Ca   
## Length:53 Length:53 Min. : 7.40 Min. :0.400   
## Class :character Class :character 1st Qu.: 9.20 1st Qu.:2.200   
## Mode :character Mode :character Median : 9.50 Median :2.600   
## Mean : 9.56 Mean :2.687   
## 3rd Qu.:10.00 3rd Qu.:3.400   
## Max. :12.00 Max. :9.500   
## Dy Mn Ti V   
## Min. :1.000 Min. : 271.0 Min. :2380 Min. : 64.0   
## 1st Qu.:1.500 1st Qu.: 653.0 1st Qu.:3020 1st Qu.:103.0   
## Median :2.600 Median : 776.0 Median :3510 Median :127.0   
## Mean :2.487 Mean : 797.3 Mean :3552 Mean :128.5   
## 3rd Qu.:3.100 3rd Qu.: 934.0 3rd Qu.:4000 3rd Qu.:157.0   
## Max. :4.700 Max. :1250.0 Max. :5420 Max. :204.0   
## K Na As U   
## Min. :0.3000 Min. :0.420 Min. : 1.300 Min. :0.430   
## 1st Qu.:0.6000 1st Qu.:1.580 1st Qu.: 2.000 1st Qu.:0.850   
## Median :0.7000 Median :1.850 Median : 3.500 Median :1.300   
## Mean :0.7283 Mean :1.716 Mean : 5.908 Mean :1.325   
## 3rd Qu.:0.8000 3rd Qu.:2.010 3rd Qu.: 6.300 3rd Qu.:1.690   
## Max. :1.6000 Max. :2.310 Max. :22.300 Max. :2.890   
## La Yb Sb Sm   
## Min. :13.60 Min. :0.780 Min. :0.1100 Min. :2.610   
## 1st Qu.:18.00 1st Qu.:1.080 1st Qu.:0.3100 1st Qu.:3.740   
## Median :22.60 Median :1.260 Median :0.4500 Median :4.220   
## Mean :23.43 Mean :1.447 Mean :0.9658 Mean :4.356   
## 3rd Qu.:26.50 3rd Qu.:1.610 3rd Qu.:1.4600 3rd Qu.:4.900   
## Max. :37.40 Max. :3.090 Max. :4.5900 Max. :6.610   
## Ba Ce Co Cr   
## Min. : 410.0 Min. :24.40 Min. : 4.70 Min. : 18.00   
## 1st Qu.: 660.0 1st Qu.:37.10 1st Qu.:10.70 1st Qu.: 34.00   
## Median : 721.0 Median :44.60 Median :15.20 Median : 41.00   
## Mean : 743.7 Mean :46.84 Mean :15.34 Mean : 57.49   
## 3rd Qu.: 828.0 3rd Qu.:55.10 3rd Qu.:19.50 3rd Qu.: 89.00   
## Max. :1360.0 Max. :77.10 Max. :27.30 Max. :115.00   
## Cs Eu Fe Tb   
## Min. : 1.070 Min. :0.700 Min. :2.96 Min. :0.2100   
## 1st Qu.: 2.420 1st Qu.:1.000 1st Qu.:3.85 1st Qu.:0.4800   
## Median : 2.800 Median :1.200 Median :4.33 Median :0.5500   
## Mean : 4.381 Mean :1.147 Mean :4.28 Mean :0.5857   
## 3rd Qu.: 4.160 3rd Qu.:1.300 3rd Qu.:4.75 3rd Qu.:0.6900   
## Max. :18.900 Max. :1.600 Max. :6.13 Max. :1.0200   
## Nd Ni Sc Sr   
## Min. : 5.00 Min. :38.00 Min. : 8.74 Min. : 64.0   
## 1st Qu.:16.00 1st Qu.:43.00 1st Qu.:10.30 1st Qu.:270.0   
## Median :22.00 Median :46.00 Median :13.30 Median :326.0   
## Mean :21.49 Mean :47.32 Mean :13.03 Mean :325.7   
## 3rd Qu.:27.00 3rd Qu.:50.00 3rd Qu.:15.10 3rd Qu.:408.0   
## Max. :37.00 Max. :60.00 Max. :22.80 Max. :731.0   
## Ta Th Hf   
## Min. :0.2300 Min. : 4.100 Min. :3.500   
## 1st Qu.:0.4900 1st Qu.: 5.700 1st Qu.:4.300   
## Median :0.6300 Median : 7.300 Median :5.000   
## Mean :0.6587 Mean : 7.508 Mean :5.183   
## 3rd Qu.:0.8600 3rd Qu.: 8.900 3rd Qu.:5.500   
## Max. :1.2700 Max. :14.400 Max. :9.000

#For all of the cells that has a less than symbol, I made them equal to instead,  
#which may end up changing the results a tiny bit.  
#In order to create Table 2 from the article, I used group\_by and summarize to find  
#the means.  
s <- group\_by(ceramic, Site) %>%  
 summarize(  
 meanAL = mean(Al),  
 meanCA = mean(Ca),  
 meanDy = mean(Dy),  
 meanMn = mean(Mn),  
 meanTi = mean(Ti),  
 meanV = mean(V),  
 meanK = mean(K),  
 meanNa = mean(Na),  
 meanAs = mean(As),   
 meanU = mean(U),  
 meanLa = mean(La),  
 meanYb = mean(Yb),  
 meanSb = mean(Sb),   
 meanSm = mean(Sm),   
 meanBa = mean(Ba),  
 meanCe = mean(Ce),  
 meanCo = mean(Co),  
 meanCr = mean(Cr),  
 meanCs = mean(Cs),  
 meanEu = mean(Eu),  
 meanFe = mean(Fe),  
 meanTb = mean(Tb),  
 meanNd = mean(Nd),  
 meanNi = mean(Ni),  
 meanSc = mean(Sc),  
 meanSr = mean(Sr),  
 meanTa = mean(Ta),  
 meanTh = mean(Th),  
 meanHf = mean(Hf)  
 )  
 s

## # A tibble: 6 x 30  
## Site meanAL meanCA meanDy meanMn meanTi meanV meanK meanNa meanAs meanU  
## <chr> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>  
## 1 Cuen… 8.17 0.771 3.13 672. 4389. 101. 0.743 0.791 17.0 2.16   
## 2 Inca 11.3 1.3 1.1 271 3670 115 0.6 1.34 5.4 1.86   
## 3 Pana… 9.3 2.63 2.97 955 2917. 119. 1.4 1.49 10.5 1.96   
## 4 Quito 9.71 2.50 2.19 732. 3091. 110. 0.724 1.97 5.39 1.28   
## 5 Riob… 9.93 3.28 2.50 915. 3860. 160. 0.61 1.87 1.98 0.937  
## 6 Spain 7.7 9.5 4 750 3030 126 1.2 0.95 4.3 1.67   
## # … with 19 more variables: meanLa <dbl>, meanYb <dbl>, meanSb <dbl>,  
## # meanSm <dbl>, meanBa <dbl>, meanCe <dbl>, meanCo <dbl>, meanCr <dbl>,  
## # meanCs <dbl>, meanEu <dbl>, meanFe <dbl>, meanTb <dbl>, meanNd <dbl>,  
## # meanNi <dbl>, meanSc <dbl>, meanSr <dbl>, meanTa <dbl>, meanTh <dbl>,  
## # meanHf <dbl>

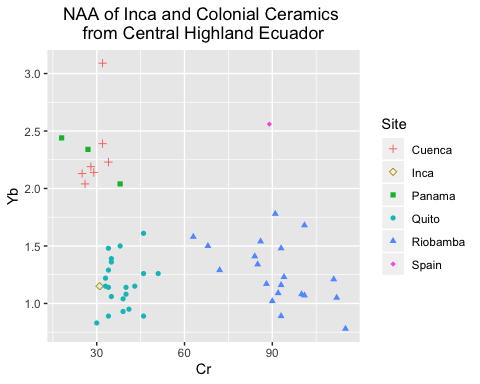
## Figure 4

## [1] "Site" "No." "Al" "Ca" "Dy" "Mn" "Ti" "V" "K" "Na"   
## [11] "As" "U" "La" "Yb" "Sb" "Sm" "Ba" "Ce" "Co" "Cr"   
## [21] "Cs" "Eu" "Fe" "Tb" "Nd" "Ni" "Sc" "Sr" "Ta" "Th"   
## [31] "Hf"



## Figure 6

## [1] "Site" "No." "Al" "Ca" "Dy" "Mn" "Ti" "V" "K" "Na"   
## [11] "As" "U" "La" "Yb" "Sb" "Sm" "Ba" "Ce" "Co" "Cr"   
## [21] "Cs" "Eu" "Fe" "Tb" "Nd" "Ni" "Sc" "Sr" "Ta" "Th"   
## [31] "Hf"



Note that the echo = FALSE parameter was added to the code chunk to prevent printing of the R code that generated the plot.