Redone Stats

2023-02-02

Import Packages

Build Radiocarbon Data

The code below calibrates radiocarbon data from Table 1 in the text with SHCal20 for the four layers at Sehonghong.

```
# Input is from Pargeter et al. (2017)
# Refer to article for full table with dates and lab ID
cal <- rcarbon::calibrate(x = c(11090, 12180, 12200, 12250, 12410, 12470,
                                12800, 13000, 13200, 20600, 15700, 17820),
                          errors = c(230, 11, 250, 300, 45, 100,
                                     250, 140, 150, 100, 150, 270),
                          calCurves = "shcal20")
```

```
## [1] "Calibrating radiocarbon ages..."
##   |                                                                      |
## [1] "Done."
```

```
summary(cal)
```

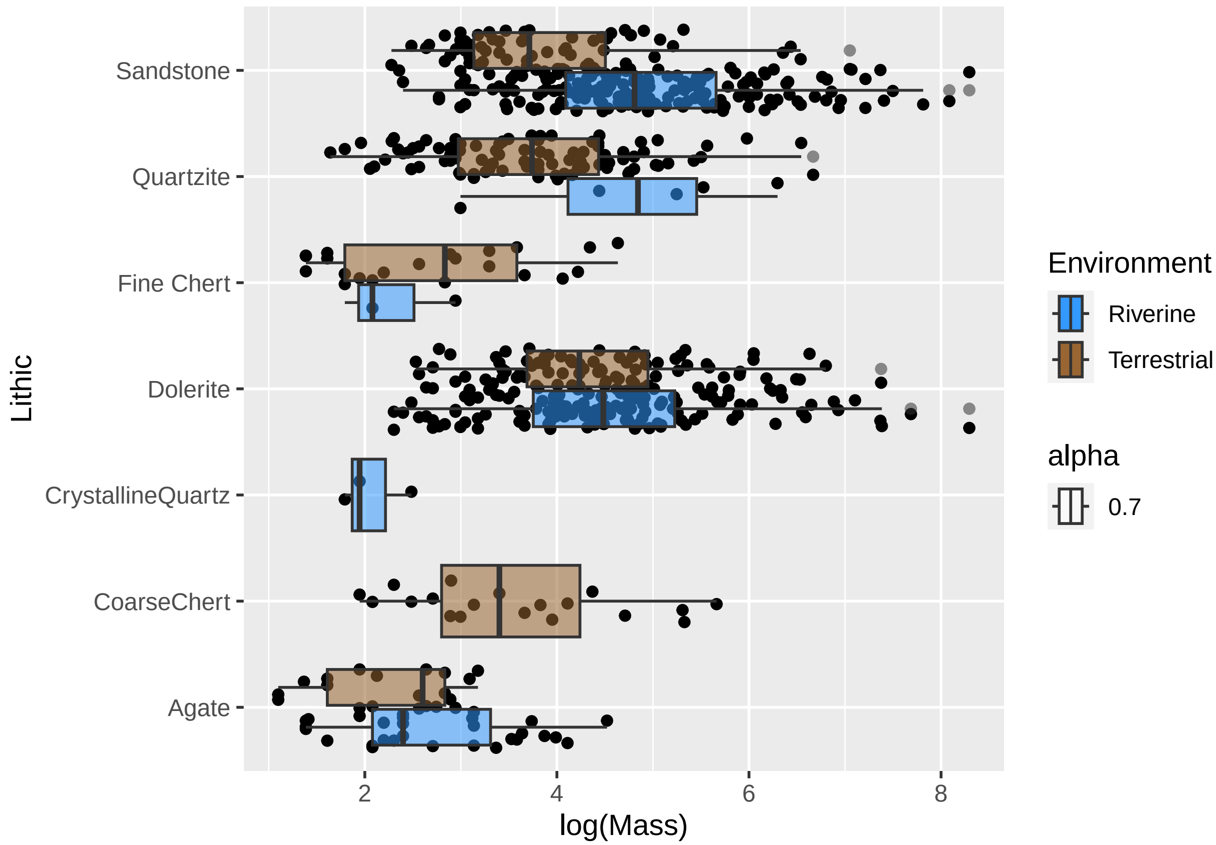
```
##    DateID MedianBP  OneSigma_BP_1  OneSigma_BP_2  TwoSigma_BP_1  TwoSigma_BP_2
## 1       1    12982 13159 to 13129 13119 to 12768 13420 to 12618 12525 to 12518
## 2       2    14054 14077 to 14035       NA to NA 14100 to 14006 13919 to 13882
## 3       3    14212 14809 to 14708 14523 to 13783 15046 to 13582 13549 to 13515
## 4       4    14321 14834 to 14680 14613 to 13798 15226 to 13571 13559 to 13504
## 5       5    14451 14803 to 14715 14512 to 14245 14845 to 14666 14634 to 14165
## 6       6    14589 14875 to 14769 14744 to 14324 15023 to 14147       NA to NA
## 7       7    15165 15652 to 14834 14681 to 14609 15894 to 14184       NA to NA
## 8       8    15508 15700 to 15297       NA to NA 15920 to 15118       NA to NA
## 9       9    15798 16027 to 15582       NA to NA 16229 to 15330       NA to NA
## 10     10    24773 24954 to 24619       NA to NA 25076 to 24357       NA to NA
## 11     11    18956 19094 to 18811       NA to NA 19331 to 18685       NA to NA
## 12     12    21563 21973 to 21195       NA to NA 22238 to 20880       NA to NA
```

Import data

Import Sehonghong Data

Figure 4

Description of Landscape Survey



Compute ANOVA for Mass as a Function of Lithic Material and Environment

```
# Model 1
aov1 <- aov(lm.land <- lm(log(Mass)~Lithic*Environment, data=df.land))
summary(aov1)
```

```
##                      Df Sum Sq Mean Sq F value   Pr(>F)
## Lithic                6  302.2   50.36   41.01  < 2e-16 ***
## Environment           1   33.1   33.14   26.98 2.77e-07 ***
## Lithic:Environment    4   21.0    5.26    4.28    0.002 **
## Residuals           634  778.6    1.23
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 4281 observations deleted due to missingness
```

```
# Pairwise comparison
tuk.aov1 <- TukeyHSD(aov1)
round(tuk.aov1$`Lithic:Environment`[which(tuk.aov1$`Lithic:Environment`[,4]<.05),],3)
```

```
##                                               diff   lwr   upr p adj
## Dolerite:Riverine-Agate:Riverine             1.896 1.178 2.613 0.000
## Quartzite:Riverine-Agate:Riverine            2.083 0.430 3.735 0.002
## Sandstone:Riverine-Agate:Riverine            2.262 1.562 2.962 0.000
```

```
## Dolerite:Terrestrial-Agate:Riverine              1.742  0.984  2.499 0.000
## Quartzite:Terrestrial-Agate:Riverine             1.052  0.303  1.801 0.000
## Sandstone:Terrestrial-Agate:Riverine             1.279  0.485  2.073 0.000
## Dolerite:Riverine-CrystallineQuartz:Riverine     2.491  0.313  4.670 0.010
## Quartzite:Riverine-CrystallineQuartz:Riverine    2.678  0.040  5.316 0.043
## Sandstone:Riverine-CrystallineQuartz:Riverine    2.858  0.685  5.030 0.001
## Dolerite:Terrestrial-CrystallineQuartz:Riverine  2.337  0.145  4.529 0.024
## Fine Chert:Riverine-Dolerite:Riverine           -2.294 -4.472 -0.115 0.028
## Agate:Terrestrial-Dolerite:Riverine             -2.299 -3.286 -1.311 0.000
## CoarseChert:Terrestrial-Dolerite:Riverine       -0.998 -1.914 -0.083 0.018
## Fine Chert:Terrestrial-Dolerite:Riverine        -1.817 -2.693 -0.940 0.000
## Quartzite:Terrestrial-Dolerite:Riverine         -0.843 -1.350 -0.337 0.000
## Sandstone:Terrestrial-Dolerite:Riverine         -0.617 -1.188 -0.046 0.021
## Sandstone:Riverine-Fine Chert:Riverine           2.660  0.487  4.833 0.003
## Agate:Terrestrial-Quartzite:Riverine            -2.486 -4.272 -0.699 0.000
## Fine Chert:Terrestrial-Quartzite:Riverine       -2.004 -3.731 -0.276 0.008
## Agate:Terrestrial-Sandstone:Riverine            -2.665 -3.640 -1.690 0.000
## CoarseChert:Terrestrial-Sandstone:Riverine      -1.365 -2.267 -0.463 0.000
## Dolerite:Terrestrial-Sandstone:Riverine         -0.521 -1.015 -0.026 0.028
## Fine Chert:Terrestrial-Sandstone:Riverine       -2.183 -3.046 -1.321 0.000
## Quartzite:Terrestrial-Sandstone:Riverine        -1.210 -1.692 -0.728 0.000
## Sandstone:Terrestrial-Sandstone:Riverine        -0.983 -1.533 -0.434 0.000
## CoarseChert:Terrestrial-Agate:Terrestrial        1.300  0.034  2.566 0.037
## Dolerite:Terrestrial-Agate:Terrestrial           2.144  1.128  3.161 0.000
## Quartzite:Terrestrial-Agate:Terrestrial          1.455  0.445  2.466 0.000
## Sandstone:Terrestrial-Agate:Terrestrial          1.682  0.637  2.726 0.000
## Fine Chert:Terrestrial-Dolerite:Terrestrial     -1.662 -2.572 -0.753 0.000
## Quartzite:Terrestrial-Dolerite:Terrestrial      -0.689 -1.251 -0.128 0.003
## Quartzite:Terrestrial-Fine Chert:Terrestrial     0.973  0.071  1.876 0.021
## Sandstone:Terrestrial-Fine Chert:Terrestrial     1.200  0.260  2.140 0.002
```

```r
# Simple count data for observation per raw material and environment and survey area (ID)
df.land %>%
  dplyr::select(Lithic, Mass, Environment) %>%
  dplyr::filter(!is.na(Mass)) %>%
  dplyr::group_by(Lithic, Environment) %>%
  dplyr::summarise(count=n(), Mass=sum(Mass))
```

```
## `summarise()` has grouped output by 'Lithic'. You can override using the
## `.groups` argument.
```

```
## # A tibble: 12 x 4
## # Groups:   Lithic [7]
##    Lithic            Environment count   Mass
##    <chr>             <chr>       <int>  <dbl>
##  1 Agate             Riverine       34   712.
##  2 Agate             Terrestrial    16   190.
##  3 CoarseChert       Terrestrial    19  1245.
##  4 CrystallineQuartz Riverine        3    25
##  5 Dolerite          Riverine      132 30133
##  6 Dolerite          Terrestrial    85 13048.
##  7 Fine Chert        Riverine        3    33
##  8 Fine Chert        Terrestrial    21   554
##  9 Quartzite         Riverine        6  1144.
## 10 Quartzite         Terrestrial    92  6937.
```

```
## 11 Sandstone          Riverine      172 50864.
## 12 Sandstone          Terrestrial    63  6648.
```

Figure 5

Compare Survey Data to Sehonghong Flakes

Below is the proportional comaprison between the surveyed raw materials and the flakes recovered from Sehonghong.

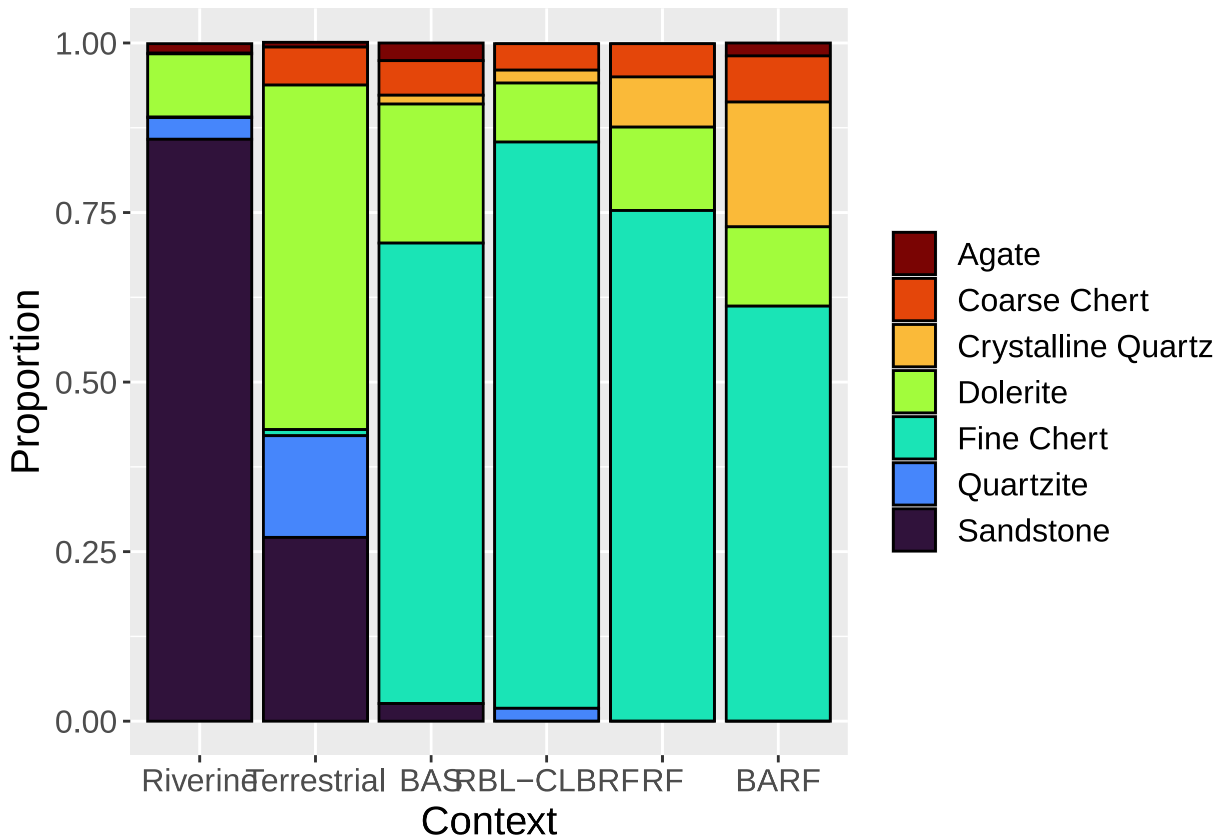


Figure 6

Compare Survey Data to Sehonghong Cores

Below is the comparison between the raw material surveyed and the cores recovered from Sehonghong.

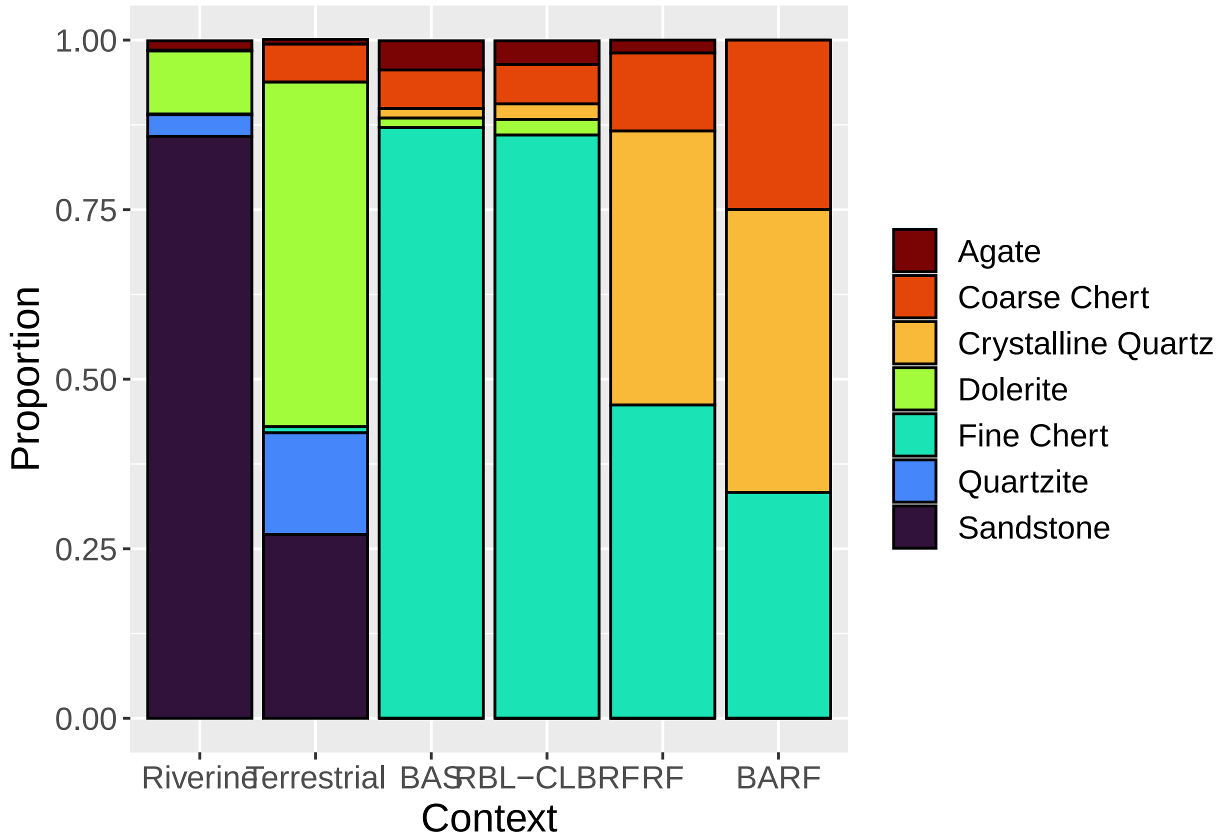


Figure 7

Flake to Core ratios

Here, we will compute the flake-to-core ratios with combined datasets

```
## # A tibble: 8 x 4
## # Groups:   Class [2]
##   RawMaterial Level      Class count
##   <chr>       <fct>      <chr> <int>
## 1 FineChert   barf       core      4
## 2 FineChert   barf       flake    63
## 3 FineChert   bas        core     61
## 4 FineChert   bas        flake    53
## 5 FineChert   rbl-clbrf  core     74
## 6 FineChert   rbl-clbrf  flake    86
## 7 FineChert   rf         core     24
## 8 FineChert   rf         flake    61
```

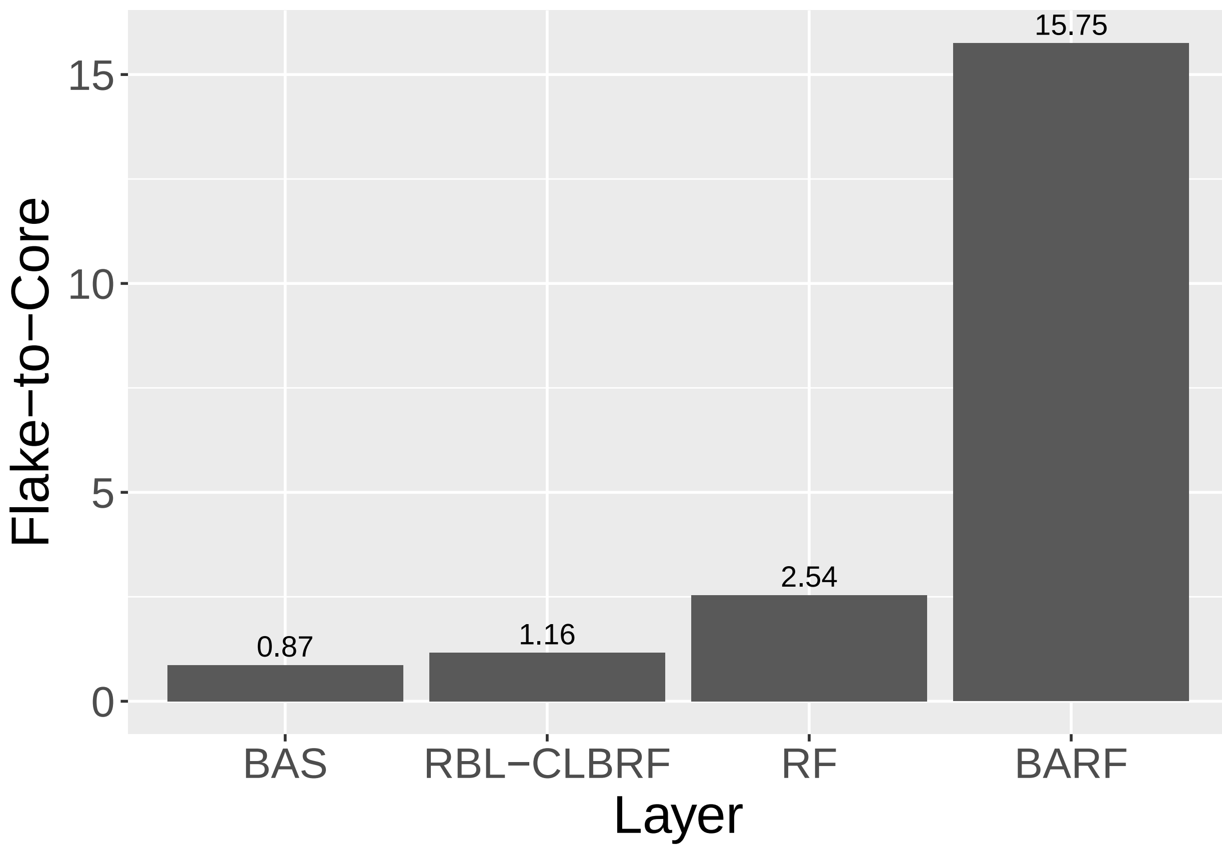
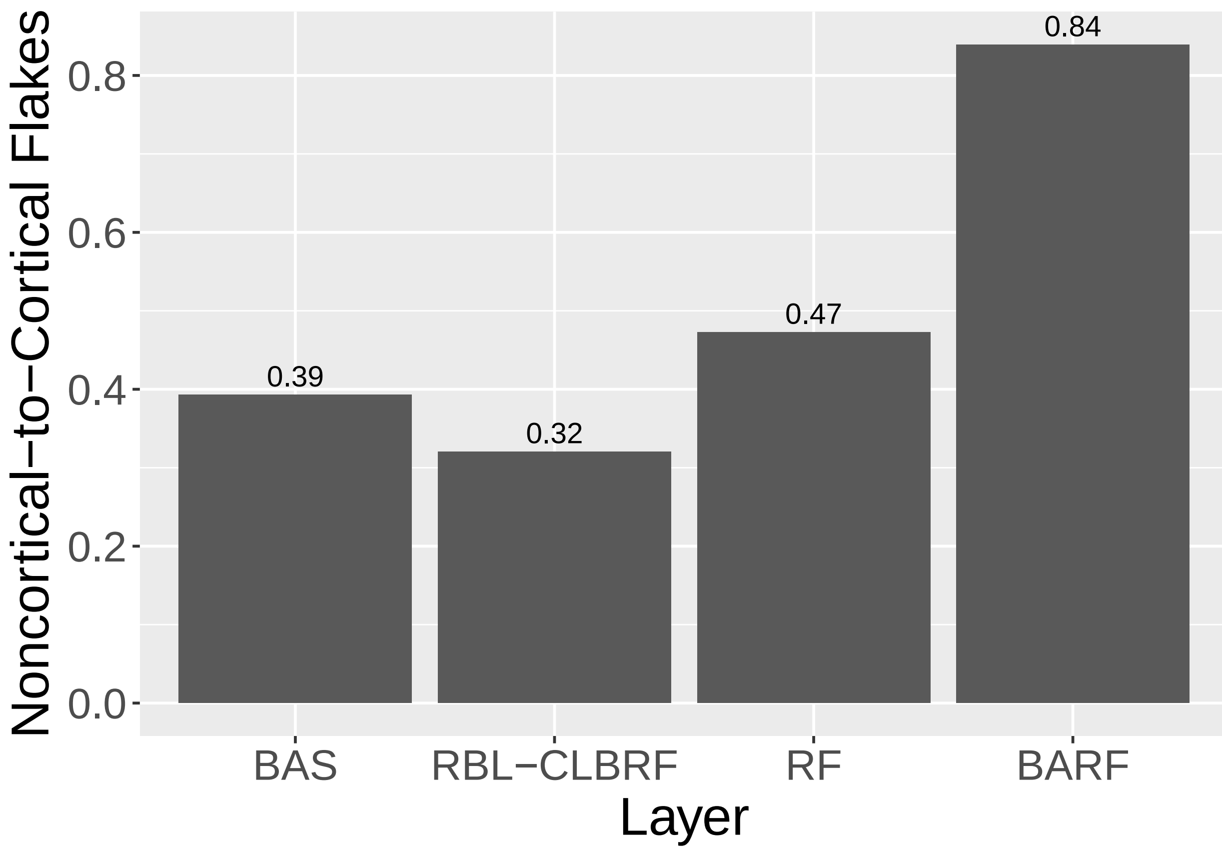


Figure 8

Cortical to non-cortical ratios

Below, the noncortical to cortical flakes show high amounts of cortex in BAS and RBL-CLBRF. COmbine this with the low flake to core ratio and this suggest local movement and materials being depsotied. As we transition to RF, we still have a lot of cores deposited but far less cortex, suggesting a potential affect of changes in knapping behavior that does not focus on cortical cores as much (little cortex but still a lot of cores to flakes). BARF is a clear change with little cortex to noncortex and very few cores compared to flakes, suggesting massive switch in procurement and mobility.

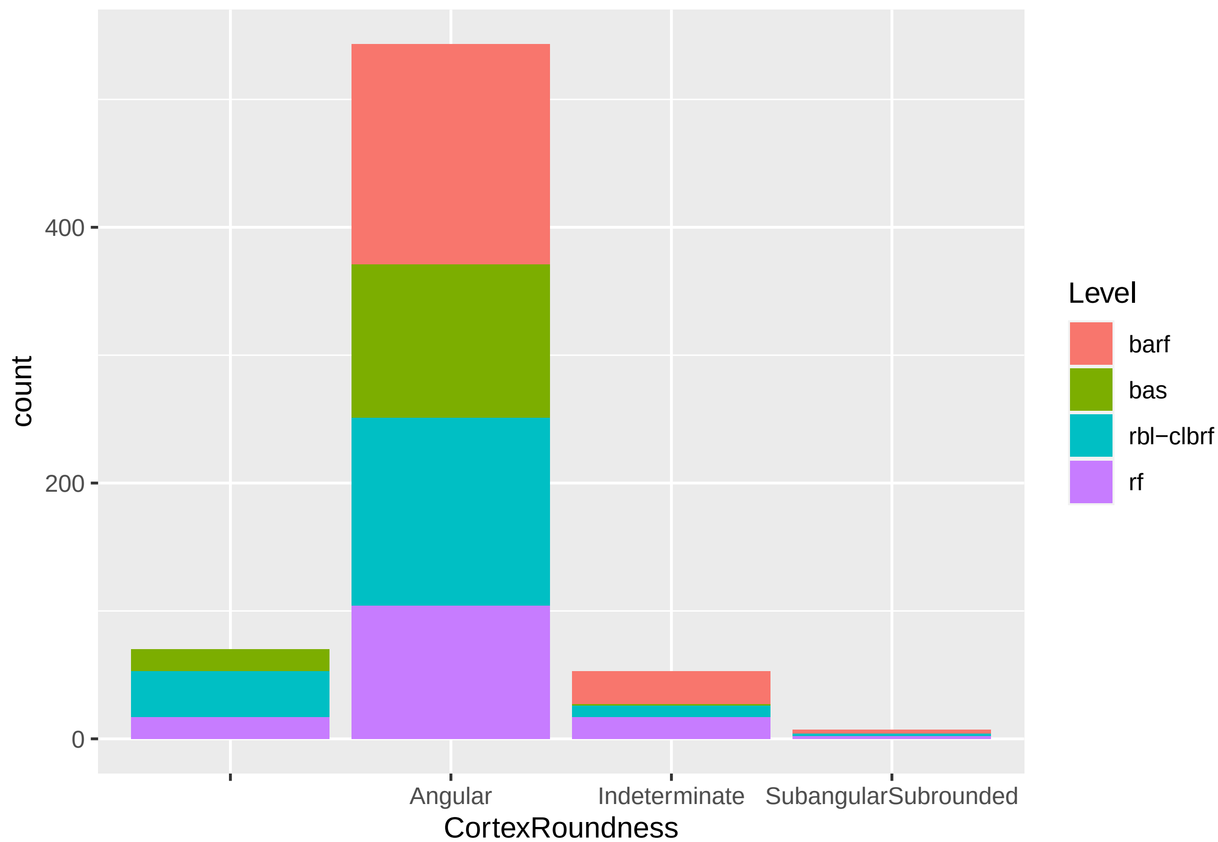
```
## # A tibble: 8 x 3
## # Groups:   CortexArea [2]
##   CortexArea   Level     count
##   <chr>        <fct>     <int>
## 1 Cortical     bas          56
## 2 Cortical     rbl-clbrf    78
## 3 Cortical     rf           55
## 4 Cortical     barf         56
## 5 Non-cortical bas          22
## 6 Non-cortical rbl-clbrf    25
## 7 Non-cortical rf           26
## 8 Non-cortical barf         47
```

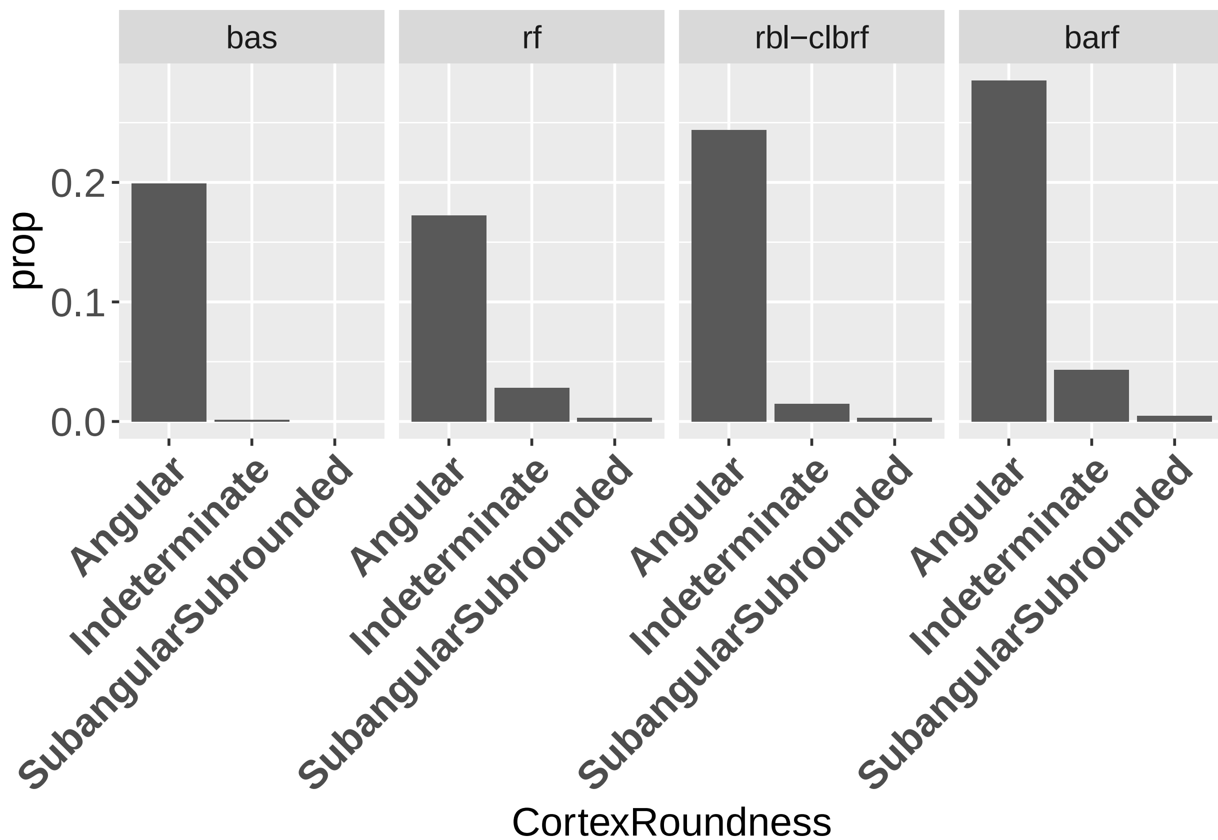


Cortex type summary

Based on observed data from Sehonghong, the cortica surface area is highly rounded and very few pieces exhibit angular cortex. This suggests that cortex is derived from fluvial environments.

Below we have the absolute count for cortical type by layer at Sehonghong and then the proportional amount of cortical type by layer.




bas
rf
rbl−clbrf
barf
prop
0.2
0.1
0.0
Angular
Indeterminate
SubangularSubrounded
CortexRoundness