

# **Palaeo-tsunami inundation distances deduced from roundness of gravel particles in tsunami deposits**

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## **Supplementary Figures and Tables**

Supplementary Table S1 Estimated ages of the E4–E11 tsunami deposits

| Event No.                                                                                      | Estimated age ( $2\sigma$ ) [cal yr BP] |
|------------------------------------------------------------------------------------------------|-----------------------------------------|
| E4                                                                                             | 1290–970                                |
| E5                                                                                             | 1710–1440                               |
| E6                                                                                             | 2220–1690                               |
| E7                                                                                             | 2710–2240                               |
| E8                                                                                             | 2860–2580                               |
| E9                                                                                             | 3240–2820                               |
| E10                                                                                            | 3430–3210                               |
| E11                                                                                            | 3880–3420                               |
| This is after reference No. 24. BP stands for "Before Present" and 0 BP is defined as AD 1950. |                                         |

Supplementary Table S2 Endmember parameters used for mixture ratio calculations

| Name       | Mean   | Standard deviation |
|------------|--------|--------------------|
| Beach 1    | 0.5405 | 0.0885             |
| Beach 2    | 0.7068 | 0.0846             |
| East river | 0.3477 | 0.0570             |
| West river | 0.4305 | 0.0703             |

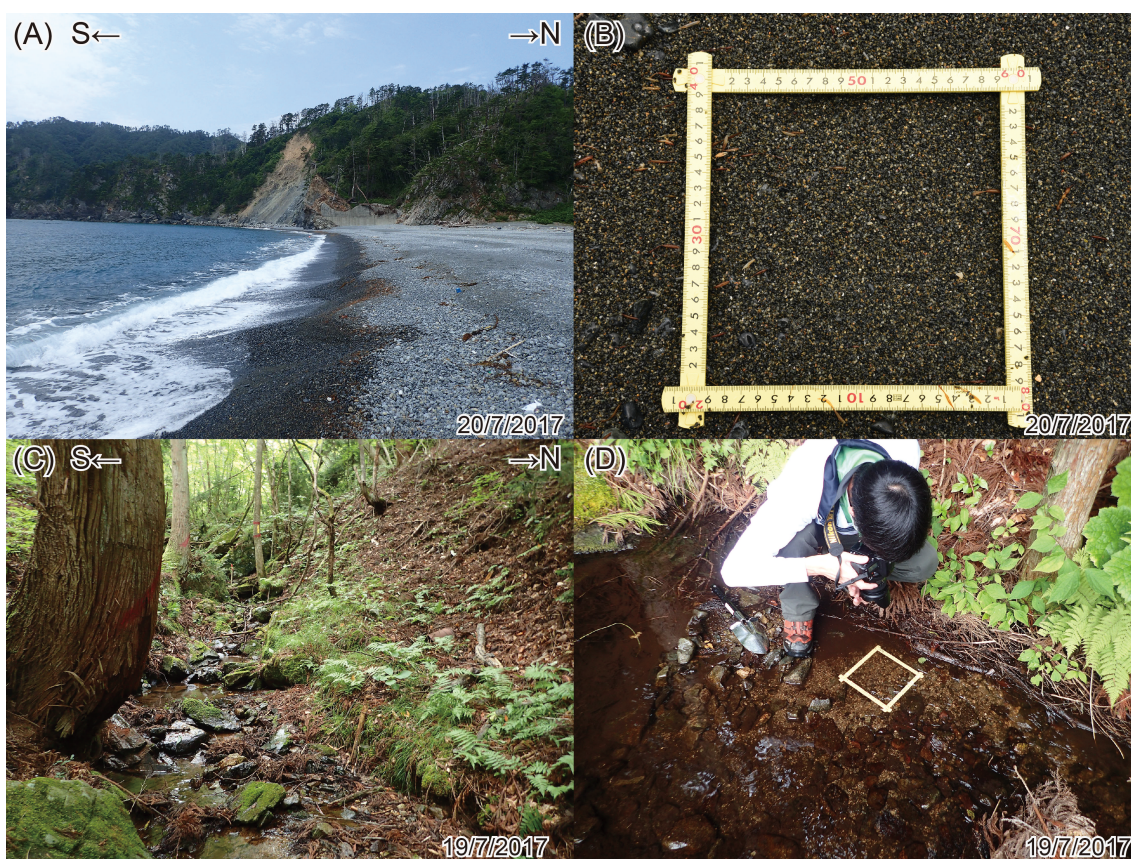
Supplementary Table S3 Mixture ratio calculation results for Figure 3

| Event No. | Sample name | Distance from coastline [m] | Beach[%] | W river[%] | E river[%] |
|-----------|-------------|-----------------------------|----------|------------|------------|
| E1        | Trench      | 338–325                     | 85.4     | 0.1        | 14.4       |
|           | HGS 0–30 m  | 338–308                     | 94.4     | 0.1        | 5.5        |
|           | HGS 30–60m  | 308–278                     | 95.2     | 0.0        | 4.8        |
|           | HGS 60–90m  | 278–248                     | 93.3     | 0.4        | 6.3        |
|           | HGS 90–110m | 248–228                     | 88.7     | 0.7        | 10.5       |
| E2        | Trench      | 338–325                     | 51.1     | 0.2        | 48.7       |
|           | HGS 30–60m  | 308–278                     | 96.1     | 0.1        | 3.8        |
|           | HGS 60–90m  | 278–248                     | 94.1     | 0.2        | 5.7        |
|           | HGS 90–110m | 248–228                     | 98.9     | 0.1        | 1.0        |
| E3        | Trench      | 338–325                     | 90.0     | 3.0        | 7.0        |
|           | HGS 0–30 m  | 338–308                     | 90.8     | 2.0        | 7.1        |
|           | HGS 30–60m  | 308–278                     | 82.0     | 7.3        | 10.7       |
|           | HGS 60–90m  | 278–248                     | 82.8     | 10.2       | 7.0        |
|           | HGS 90–110m | 248–228                     | 86.6     | 5.0        | 8.4        |
| E4        | Trench      | 338–325                     | 57.2     | 3.0        | 39.9       |
|           | HGS 0–30 m  | 338–308                     | 68.2     | 0.8        | 30.9       |
|           | HGS 30–60m  | 308–278                     | 65.4     | 8.6        | 26.0       |
|           | HGS 60–90m  | 278–248                     | 83.7     | 0.1        | 16.2       |
|           | HGS 90–110m | 248–228                     | 90.6     | 0.1        | 8.7        |



Supplementary Table S4 Mixture ratio calculation results for Figure 4

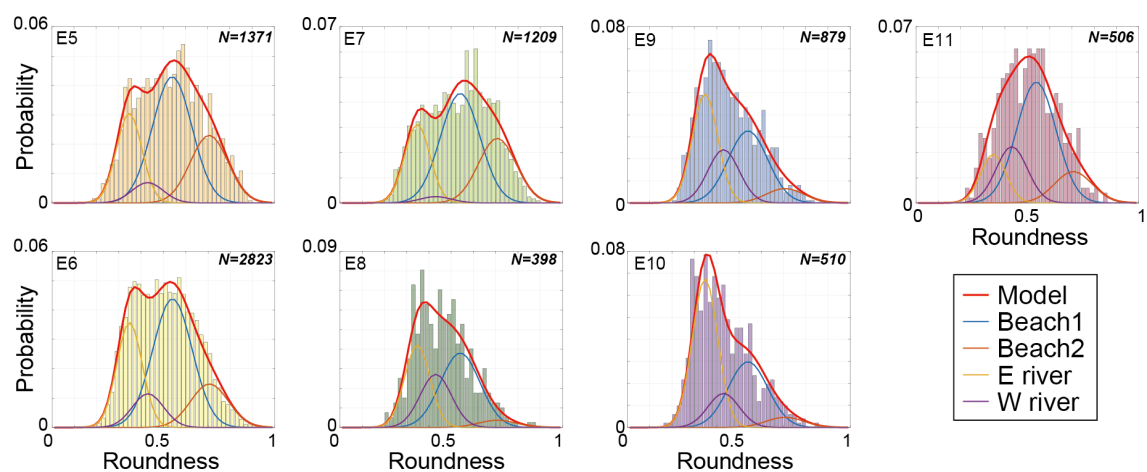
| Event No. | Sample name       | Distance from coastline [m] | Altitude [m] | Number of particles | Beach[%] | W river[%] | E river[%] |
|-----------|-------------------|-----------------------------|--------------|---------------------|----------|------------|------------|
| E1        | HGS 0–20m         | 338–318                     | 2.7–2.9      | 399                 | 93.0     | 0.1        | 6.9        |
|           | HGS 10–30m        | 328–308                     | 2.6–2.8      | 529                 | 94.1     | 0.2        | 5.7        |
|           | HGS 20–40m        | 318–298                     | 2.6–2.7      | 476                 | 96.3     | 0.1        | 3.6        |
|           | HGS 30–50m        | 308–288                     | 2.5–2.6      | 643                 | 95.4     | 0.3        | 4.2        |
|           | HGS 40–60m        | 298–278                     | 2.5–2.6      | 596                 | 92.7     | 3.1        | 4.2        |
|           | HGS 50–70m        | 288–268                     | 2.4–2.5      | 338                 | 92.7     | 0.3        | 6.9        |
|           | HGS 60–80m        | 278–258                     | 2.3–2.5      | 502                 | 91.7     | 0.2        | 8.1        |
|           | HGS 70–90m        | 268–248                     | 2.3–2.4      | 841                 | 93.6     | 0.4        | 6.0        |
|           | HGS 80–100m       | 258–238                     | 2.2–2.3      | 968                 | 88.3     | 0.0        | 11.7       |
|           | HGS 90–110m       | 248–228                     | 2.2–2.3      | 1156                | 89.6     | 1.5        | 8.9        |
|           | Loc. 1 (outcrop)  | 202                         | 2.6          | 1213                | 99.5     | 0.2        | 0.2        |
|           | Loc. 2 (outcrop)  | 232                         | 2.1          | 670                 | 92.9     | 0.4        | 6.7        |
|           | Loc. 3 (outcrop)  | 280                         | 2.5          | 378                 | 96.7     | 0.9        | 2.4        |
|           | Loc. 4 (HGS)      | 289                         | 2.5          | 276                 | 95.2     | 0.0        | 4.8        |
|           | Loc. 6 (outcrop)  | 374                         | 3.5          | 955                 | 87.8     | 0.1        | 12.1       |
|           | Loc. 7 (HGS)      | 390                         | 3.6          | 1068                | 79.2     | 0.0        | 20.8       |
|           | Loc. 8 (outcrop)  | 414                         | 4.0          | 1408                | 94.7     | 0.4        | 4.9        |
|           | Loc. 9 (outcrop)  | 583                         | 9.2          | 576                 | 33.9     | 2.4        | 63.7       |
|           | Loc. 10 (outcrop) | 665                         | 11.8         | 414                 | 27.7     | 0.4        | 71.9       |
| E2        | HGS 40–60m        | 298–278                     | 2.5–2.6      | 216                 | 96.0     | 0.6        | 3.4        |
|           | HGS 50–70m        | 288–268                     | 2.4–2.5      | 381                 | 95.0     | 0.1        | 5.0        |
|           | HGS 60–80m        | 278–258                     | 2.3–2.5      | 324                 | 91.8     | 0.1        | 8.1        |
|           | HGS 70–90m        | 268–248                     | 2.3–2.4      | 501                 | 91.2     | 0.5        | 8.3        |
|           | HGS 80–100m       | 258–238                     | 2.2–2.3      | 1068                | 96.0     | 0.4        | 3.6        |
|           | HGS 90–110m       | 248–228                     | 2.2–2.3      | 1116                | 98.8     | 0.1        | 1.2        |
|           | Loc. 4 (HGS)      | 289                         | 2.5          | 466                 | 80.4     | 0.3        | 19.2       |
| E3        | HGS 0–20m         | 338–318                     | 2.7–2.9      | 2115                | 88.4     | 3.5        | 8.1        |
|           | HGS 10–30m        | 328–308                     | 2.6–2.8      | 1832                | 87.6     | 5.0        | 7.4        |
|           | HGS 20–40m        | 318–298                     | 2.6–2.7      | 1622                | 90.4     | 6.0        | 3.6        |
|           | HGS 30–50m        | 308–288                     | 2.5–2.6      | 1222                | 87.9     | 4.0        | 8.0        |
|           | HGS 40–60m        | 298–278                     | 2.5–2.6      | 1509                | 77.9     | 10.5       | 11.6       |
|           | HGS 50–70m        | 288–268                     | 2.4–2.5      | 2138                | 81.9     | 9.7        | 8.3        |
|           | HGS 60–80m        | 278–258                     | 2.3–2.5      | 1741                | 85.0     | 7.4        | 7.6        |
|           | HGS 70–90m        | 268–248                     | 2.3–2.4      | 1494                | 82.9     | 9.7        | 7.4        |
|           | HGS 80–100m       | 258–238                     | 2.2–2.3      | 1250                | 83.0     | 7.3        | 9.7        |
|           | HGS 90–110m       | 248–228                     | 2.2–2.3      | 1204                | 86.0     | 6.0        | 8.0        |
|           | Loc. 5 (outcrop)  | 373                         | 3.4          | 350                 | 89.7     | 2.0        | 8.3        |
| E4        | HGS 0–20m         | 338–318                     | 2.7–2.9      | 393                 | 68.2     | 1.3        | 30.5       |
|           | HGS 10–30m        | 328–308                     | 2.6–2.8      | 656                 | 67.1     | 1.0        | 32.0       |
|           | HGS 20–40m        | 318–298                     | 2.6–2.7      | 505                 | 67.5     | 0.8        | 31.7       |
|           | HGS 30–50m        | 308–288                     | 2.5–2.6      | 498                 | 63.2     | 2.1        | 34.7       |
|           | HGS 40–60m        | 298–278                     | 2.5–2.6      | 730                 | 66.1     | 10.5       | 23.4       |
|           | HGS 50–70m        | 288–268                     | 2.4–2.5      | 1034                | 72.6     | 7.0        | 20.4       |
|           | HGS 60–80m        | 278–258                     | 2.3–2.5      | 629                 | 79.2     | 0.4        | 20.3       |
|           | HGS 70–90m        | 268–248                     | 2.3–2.4      | 923                 | 85.6     | 0.1        | 14.3       |
|           | HGS 80–100m       | 258–238                     | 2.2–2.3      | 645                 | 90.8     | 0.4        | 8.9        |
|           | HGS 90–110m       | 248–228                     | 2.2–2.3      | 311                 | 88.6     | 0.4        | 11.0       |
| E5        | Trench            | 338–325                     | 2.8–3.0      | 1371                | 72.1     | 6.1        | 21.8       |
| E6        | Trench            | 338–325                     | 2.8–3.0      | 2823                | 64.3     | 10.1       | 25.5       |
| E7        | Trench            | 338–325                     | 2.8–3.0      | 1209                | 75.5     | 2.2        | 22.3       |
| E8        | Trench            | 338–325                     | 2.8–3.0      | 398                 | 46.1     | 23.9       | 30.1       |
| E9        | Trench            | 338–325                     | 2.8–3.0      | 879                 | 43.2     | 21.3       | 35.4       |
| E10       | Trench            | 338–325                     | 2.8–3.0      | 510                 | 38.0     | 13.6       | 48.3       |
| E11       | Trench            | 338–325                     | 2.8–3.0      | 506                 | 66.5     | 19.7       | 13.8       |



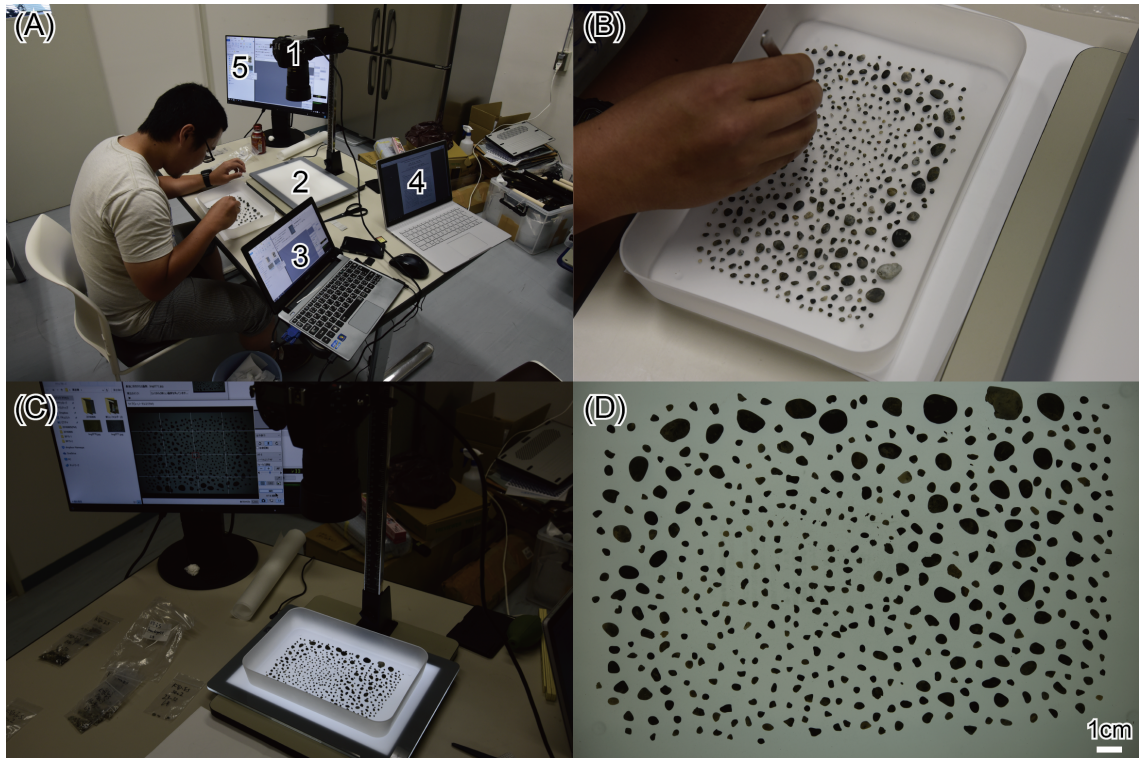
Supplementary Fig. S1 Landscapes at the sampling sites

(A) Beach in 2017. (B) Close-up photograph of beach sediments. (C) West river in 2017.

(D) East river in 2017.



Supplementary Fig. S2 Roundness distributions of the E5 to E11 tsunami deposits at the trench site



Supplementary Fig. S3 Photographic procedure

(A) Photographic system. 1: Camera (the camera body and lens are a Nikon D810 and a Nikon AF-S Micro NIKKOR 60 mm f/2.8G ED, respectively). 2: Tracing table. 3: Computer for photography. 4: Computer for image analysis. 5: Monitor for sample positioning. (B) Placement of gravel particles by hand. (C) Photography of gravel particles. (D) Example photograph of gravel particles. The image resolution is  $7360 \times 4912$  pixels, and the image scale is 328 to 343 pixels per centimetre.