# **Supplementary Table 5:** Dose rate data, equivalent doses (De) and overdispersion (OD) values, and OSL ages for sediment samples from the front of the site at Madjedbebe.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample** | **Depth below**  **surface (m)** | **Water**  **(%)#** | **Environmental dose rate (Gy/kyr)** | | |  | **De value (Gy)$** | **Number of**  **grains\*** | **OD**  **(%)&** | **Age (kyr)‡§** |
|  |  |  | **Beta** | **Gamma** | **Cosmic** | **Total** |  |  |  |  |
| SW7C | 2.89 | 1.2 | 0.23 ± 0.02 | 0.37 ± 0.02 | 0.069 | 0.70 ± 0.03 | 55.4 ± 1.2 | 116/500 (99) | 23 ± 2 | 79.0 ± 4.3 (3.3) |
| SW14A | 2.75 | <1 | 0.22 ± 0.02 | 0.26 ± 0.01 | 0.061 | 0.57 ± 0.03 | 46.8 ± 0.9 | 166/500 (150) | 21 ± 2 | 81.6 ± 4.6 (3.7) |
| SW6C | 2.74 | <1 | 0.27 ± 0.02 | 0.27 ± 0.02 | 0.070 | 0.64 ± 0.03 | 49.8 ± 1.3 | 136/500 (116) | 24 ± 2 | 77.6 ± 4.5 (3.7) |
| SW8C | 2.71 | <1 | 0.39 ± 0.02 | 0.39 ± 0.02 | 0.079 | 0.90 ± 0.04 | 63.2 ± 1.7 | 92/500 (78) | 19 ± 2 | 70.4 ± 3.7 (2.9) |
| SW5C | 2.62 | <1 | 0.26 ± 0.02 | 0.31 ± 0.02 | 0.071 | 0.67 ± 0.03 | 48.5 ± 1.1 | 149/500 (130) | 24 ± 2 | 72.7 ± 4.1 (3.3) |
| SW4C | 2.54 | <1 | 0.31 ± 0.02 | 0.31 ± 0.01ǁ | 0.071 | 0.70 ± 0.03 | 44.1 ± 1.2 | 112/500 (100) | 25 ± 2 | 62.7 ± 3.5 (2.7) |
| KTL162 | 2.52 | — | 0.25 ± 0.04 | 0.31 ± 0.05 | 0.063 | 0.66 ± 0.09 | 41.2 ± 0.6 | 282/1000 (226) | 18 ± 1 | 62.3 ± 8.7 |
| SW3C | 2.50 | <1 | 0.34 ± 0.02 | 0.30 ± 0.01ǁ | 0.072 | 0.74 ± 0.03 | 47.1 ± 1.0 | 142/500 (116) | 19 ± 2 | 64.0 ± 3.5 (2.5) |
| NW14 | 2.50 | 2.7 | 0.23 ± 0.02 | 0.31 ±0.01 | 0.064 | 0.64 ± 0.03 | 40.3 ± 1.0 | 131/400 (108) | 22 ± 2 | 62.8 ± 3.5 (2.7) |
| SW13A | 2.45 | <1 | 0.25 ± 0.02 | 0.31 ± 0.01 | 0.063 | 0.64 ± 0.03 | 39.8 ± 0.9 | 133/500 (114) | 21 ± 2 | 62.6 ± 3.3 (2.6) |
| KTL158 | 2.44 | — | 0.27 ± 0.04 | 0.32 ± 0.04 | 0.064 | 0.68 ± 0.08 | 40.0 ± 0.7 | 229/700 (181) | 23 ± 1 | 58.6 ± 7.2 |
| SW2C | 2.39 | <1 | 0.30 ± 0.02 | 0.32 ± 0.01 | 0.073 | 0.72 ± 0.03 | 47.0 ± 0.9 | 169/500 (145) | 20 ± 2 | 64.9 ± 3.3 (2.3) |
| NW13 | 2.37 | 4.0 | 0.26 ± 0.02 | 0.33 ± 0.01ǁ | 0.068 | 0.69 ± 0.03 | 40.2 ± 0.9 | 183/500 (163) | 25 ± 2 | 58.2 ± 3.1 (2.4) |
| NW12 | 2.29 | <1 | 0.27 ± 0.02 | 0.33 ± 0.01 | 0.069 | 0.70 ± 0.03 | 38.7 ± 0.7 | 152/400 (128) | 20 ± 2 | 55.5 ± 2.9 (2.2) |
| SW11A | 2.28 | <1 | 0.28 ± 0.02 | 0.35 ± 0.02 | 0.064 | 0.73 ± 0.03 | 46.0 ± 1.0 | 156/500 (121) | 16 ± 2 | 63.4 ± 3.3 (2.6) |
|  |  |  |  |  |  |  | 38.3 ± 0.7† |  | 16 ± 2 | 51.7 ± 2.6 (2.0) |
| KTL164 | 2.28 | — | 0.32 ± 0.03 | 0.38 ± 0.03 | 0.066 | 0.80 ± 0.06 | 42.1 ± 0.6 | 280/900 (240) | 21 ± 1 | 52.6 ± 4.4 |
| NW11 | 2.20 | <1 | 0.29 ± 0.02 | 0.35 ± 0.02ǁ | 0.072 | 0.74 ± 0.03 | 38.8 ± 0.8 | 126/500 (101) | 17 ± 2 | 52.6 ± 2.7 (2.0) |
| SW10A | 2.16 | <1 | 0.32 ± 0.02 | 0.32 ± 0.01 | 0.065 | 0.73 ± 0.03 | 40.3 ± 0.6 | 191/500 (160) | 18 ± 1 | 55.3 ± 2.6 (1.9) |
| NW9B | 2.10 | <1 | 0.25 ± 0.02 | 0.35 ± 0.02 | 0.075 | 0.71 ± 0.03 | 40.0 ± 0.7 | 182/500 (151) | 29 ± 1 | 56.7 ± 3.0 (2.3) |
| NW15 | 2.07 | <1 | 0.31 ± 0.03 | 0.35 ± 0.02ǁ | 0.071 | 0.76 ± 0.03 | 36.8 ± 0.6 | 213/500 (175) | 20 ± 1 | 48.4 ± 2.5 (1.9) |
| SW9A | 2.03 | <1 | 0.30 ± 0.02 | 0.33 ± 0.01ǁ | 0.066 | 0.73 ± 0.03 | 37.9 ± 0.7 | 195/500 (164) | 21 ± 1 | 51.9 ± 2.6 (2.0) |
| NE1B | 2.02 | 1.1 | 0.26 ± 0.02 | 0.36 ± 0.02 | 0.085 | 0.73 ± 0.03 | 38.7 ± 0.8 | 206/500 (176) | 24 ± 2 | 53.0 ± 2.6 (1.9) |
| NW10 | 1.95 | <1 | 0.30 ± 0.02 | 0.36 ± 0.02 | 0.074 | 0.77 ± 0.03 | 33.5 ± 0.5 | 227/500 (196) | 21 ± 1 | 43.8 ± 2.1 (1.6) |
| NW8B | 1.94 | <1 | 0.29 ± 0.02 | 0.34 ± 0.01ǁ | 0.076 | 0.74 ± 0.03 | 34.3 ± 0.6 | 226/500 (194) | 22 ± 1 | 46.3 ± 2.3 (1.8) |
| SW8A | 1.81 | <1 | 0.28 ± 0.02 | 0.33 ± 0.01 | 0.067 | 0.71 ± 0.03 | 30.4 ± 0.6 | 194/500 (166) | 23 ± 1 | 42.8 ± 2.1 (1.6) |

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|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample** | **Depth below surface (m)** | **Water (%)#** | **Environmental dose rate (Gy/kyr)** | | |  | **De value (Gy)$** | **Number of grains\*** | **OD (%)&** | **Age (kyr)‡§** |
|  |  |  | **Beta** | **Gamma** | **Cosmic** | **Total** |  |  |  |  |
| NW9 | 1.75 | <1 | 0.29 ± 0.02 | 0.36 ± 0.02ǁ | 0.076 | 0.76 ± 0.03 | 27.7 ± 0.5 | 263/500 (214) | 24 ± 1 | 36.5 ± 1.8 (1.3) |
| SW7B | 1.69 | <1 | 0.24 ± 0.02 | 0.34 ± 0.01ǁ | 0.079 | 0.70 ± 0.03 | 27.4 ± 0.5 | 252/500 (208) | 26 ± 1 | 39.3 ± 2.1 (1.6) |
| SW7A | 1.61 | <1 | 0.32 ± 0.02 | 0.33 ± 0.02ǁ | 0.069 | 0.75 ± 0.03 | 25.1 ± 0.5 | 196/400 (165) | 26 ± 1 | 33.5 ± 1.6 (1.2) |
| NW8 | 1.53 | 4.7 | 0.33 ± 0.02 | 0.38 ± 0.02 | 0.078 | 0.82 ± 0.03 | 23.2 ± 0.4 | 225/500 (187) | 21 ± 1 | 28.1 ± 1.4 (1.1) |
| SW6B | 1.47 | <1 | 0.29 ± 0.03 | 0.37 ± 0.02 | 0.080 | 0.77 ± 0.04 | 23.4 ± 0.5 | 206/500 (171) | 24 ± 2 | 30.4 ± 1.7 (1.4) |
| KTL165 | 1.47 | — | 0.39 ± 0.05 | 0.46 ± 0.05 | 0.070 | 0.95 ± 0.10 | 21.4 ± 0.6 | 142/300 (114) | 29 ± 2 | 22.5 ± 2.6 |
| SW6A | 1.41 | 1.3 | 0.29 ± 0.02 | 0.37 ± 0.02 | 0.070 | 0.76 ± 0.03 | 20.8 ± 0.4 | 140/300 (113) | 21 ± 2 | 27.3 ± 1.4 (1.1) |
| NW7 | 1.34 | 4.6 | 0.33 ± 0.02 | 0.38 ± 0.02ǁ | 0.079 | 0.82 ± 0.03 | 19.5 ± 0.3 | 221/500 (184) | 23 ± 1 | 23.8 ± 1.1 (0.9) |
| SW5B | 1.25 | <1 | 0.27 ± 0.02 | 0.37 ± 0.02ǁ | 0.083 | 0.75 ± 0.03 | 17.3 ± 0.6 | 182/400 (166) | 42 ± 2 | 23.0 ± 1.3 (1.0) |
| SW5A | 1.22 | 2.5 | 0.31 ± 0.02 | 0.37 ± 0.02 | 0.072 | 0.79 ± 0.03 | 17.4 ± 0.4 | 163/400 (134) | 23 ± 2 | 22.0 ± 1.1 (0.8) |
| NW6 | 1.16 | <1 | 0.29 ± 0.02 | 0.37 ± 0.02 | 0.081 | 0.77 ± 0.03 | 16.3 ± 0.3 | 249/500 (201) | 23 ± 1 | 21.2 ± 1.0 (0.7) |
| SW4B | 1.04 | <1 | 0.25 ± 0.02 | 0.35 ± 0.02 | 0.085 | 0.72 ± 0.03 | 10.5 ± 0.3 | 144/300 (122) | 28 ± 2 | 14.7 ± 0.8 (0.6) |
| SW4A | 1.04 | <1 | 0.22 ± 0.02 | 0.26 ± 0.01 | 0.073 | 0.58 ± 0.03 | 8.7 ± 0.2 | 177/400 (151) | 29 ± 2 | 14.9 ± 0.9 (0.7) |
| NW5 | 0.95 | 4.5 | 0.24 ± 0.02 | 0.36 ± 0.02ǁ | 0.083 | 0.71 ± 0.03 | 9.2 ± 0.2 | 188/500 (156) | 32 ± 2 | 12.8 ± 0.7 (0.5) |
| SW3B | 0.85 | <1 | 0.28 ± 0.02 | 0.33 ± 0.01 | 0.087 | 0.73 ± 0.04 | 8.2 ± 0.2 (C)  7.2 ± 0.2 (M) | 150/400 (121) | 21 ± 2 | 11.3 ± 0.7  *9.9 ± 0.6 (0.5)* |
| SW3A | 0.85 | 1.1 | 0.23 ± 0.02 | 0.33 ± 0.01 | 0.075 | 0.67 ± 0.03 | 7.6 ± 0.2 (C)  6.7 ± 0.2 (M) | 113/300 (86) | 20 ± 2 | 11.2 ± 0.6  *9.9 ± 0.5 (0.4)* |
| NW4 | 0.74 | 2.9 | 0.22 ± 0.02 | 0.26 ± 0.01 | 0.085 | 0.59 ± 0.03 | 5.1 ± 0.3 | 202/400 (176) | 27 ± 2 | 8.7 ± 0.7 (0.6) |
| SW2B | 0.68 | <1 | 0.28 ± 0.02 | 0.33 ± 0.01 | 0.088 | 0.73 ± 0.03 | 5.9 ± 0.2 | 191/400 (145) | 35 ± 2 | 8.1 ± 0.4 (0.3) |
| SW2A | 0.66 | 1.1 | 0.23 ± 0.02 | 0.32 ± 0.01 | 0.076 | 0.66 ± 0.03 | 5.9 ± 0.1 | 165/400 (133) | 22 ± 2 | 8.9 ± 0.5 (0.4) |
| NW3 | 0.54 | 3.0 | 0.24 ± 0.02 | 0.35 ± 0.01ǁ | 0.087 | 0.71 ± 0.03 | 5.6 ± 0.1 (C)  4.3 ± 0.2 (M) | 181/400 (150) | 28 ± 2 | 7.9 ± 0.4 (0.3)  *6.1 ± 0.4 (0.3)* |
| SW1B | 0.49 | <1 | 0.30 ± 0.02 | 0.36 ± 0.02 | 0.090 | 0.78 ± 0.03 | 5.0 ± 0.1 | 178/400 (144) | 33 ± 2 | 6.4 ± 0.3 (0.3) |
| NW2 | 0.33 | 1.6 | 0.32 ± 0.02 | 0.35 ± 0.02 | 0.089 | 0.79 ± 0.03 | 4.4 ± 0.1 (C)  3.3 ± 0.2 (M) | 129/400 (102) | 27 ± 2 | 5.5 ± 0.3  *4.1 ± 0.3 (0.3)* |
| NW1 | 0.19 | 4.4 | 0.32 ± 0.02 | 0.38 ± 0.02 | 0.091 | 0.83 ± 0.03 | 2.4 ± 0.2 (M) | 96/400 (81) | 55 ± 5 | 2.9 ± 0.2 (0.2) |

# Current measured water contents of the sediment samples. A value of 5 ± 2% was used for all samples as an estimate of the long-term water content in calculations of dose rate.

$De values for all samples were obtained using the central age model (CAM, C), except for NW1, NW2, NW3, SW3A and SW3B where the minimum age model (MAM, M) values are also provided.

\*Number of grains accepted for De determination / total number of grains measured. Numbers in brackets represent the number of grains included in the CAM De value after identification and rejection of outlier grains using the normalised median absolute deviation (nMAD) criterion.

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&The De and OD values are for the De distributions after outlier rejection. The corresponding De and OD values for the samples including these outliers are provided in Supplementary Table 7.

†This sample was measured using a preheat combination of 260°C for 10 s (PH1) and 220°C for 0 s (PH2); see text in Supplementary Information for details.

‡Ages in italics are the preferred ages.

§The uncertainties provided in parentheses are the random-only uncertainties; those provided after the ± symbol represent the full (random plus systematic) uncertainty at 1σ.

ǁSamples for which gamma dose rates were not directly measured in the field.

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**Supplementary Table 6:** Dose rate data, equivalent doses (De) and overdispersion (OD) values, and OSL ages for sediment samples from the NE sample series at Madjedbebe.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample** | **Depth below**  **surface (m)** | **Water**  **(%)$** | **Environmental dose rate (Gy/kyr)** | | |  | **De value**  **(Gy) #,&** | **Number of**  **grains\*** | **OD (%)&** | **Age (kyr)†** |
|  |  |  | **Beta** | **Gamma** | **Cosmic** | **Total** |  |  |  |  |
| NE8 | -2.4 | 1.1 | 0.20 ± 0.02 | 0.31 ± 0.01 | 0.035 | 0.58 ± 0.03 | 45.7 ± 1.0 | 106/400 (84) | 16 ± 2 | 78.6 ± 4.2 (3.4) |
| NE7 | -2.10 | <1 | 0.20 ± 0.02 | 0.31 ± 0.01 | 0.036 | 0.58 ± 0.03 | 39.2 ± 1.2 | 92/400 (77) | 24 ± 2 | 67.1 ± 4.0 (3.4) |
| NE6 | -1.80 | 3.0 | 0.25 ± 0.02 | 0.34 ± 0.01 | 0.037 | 0.66 ± 0.03 | 35.2 ± 0.5 | 251/400 (212) | 20 ± 1 | 53.6 ± 2.6 (2.0) |
| NE5 | -1.50 | <1 | 0.20 ± 0.02 | 0.33 ± 0.01 | 0.039 | 0.60 ± 0.03 | 24.9 ± 0.4 | 214/400 (182) | 21 ± 1 | 41.6 ± 2.3 (1.7) |
| NE4 | -1.2 | <1 | 0.27 ± 0.02 | 0.33 ± 0.01 | 0.040 | 0.67 ± 0.03 | 20.5 ± 0.5 | 196/400 (173) | 32 ± 2 | 30.4 ± 1.6 (1.4) |
| NE3 | -0.90 | <1 | 0.28 ± 0.02 | 0.34 ± 0.01 | 0.041 | 0.69 ± 0.03 | 11.2 ± 0.4 | 174/400 (152) | 42 ± 3 | 16.1 ± 0.9 (0.8) |
| NE2 | -0.60 | <1 | 0.28 ± 0.02 | 0.35 ± 0.02 | 0.043 | 0.70 ± 0.03 | 7.6 ± 0.3 | 113/400 (91) | 33 ± 3 | 10.9 ± 0.6 (0.5) |
| NE1 | -0.30 | 2.8 | 0.34 ± 0.02 | 0.37 ± 0.02 | 0.044 | 0.78 ± 0.03 | 0.6 ± 0.1 | 93/400 (93) | 94 ± 6 | 0.80 ± 0.09 (0.08) |

# Current measured water contents of the sediment samples. A value of 5 ± 2% was used for all samples as an estimate of the long-term water content in calculations of dose rate.

$De values for all samples were obtained using the central age model (CAM), except for NE1 where the minimum age model (MAM) was applied to the full De distribution.

\*Number of grains accepted for De determination / total number of grains measured. Numbers in brackets represent the number of grains included in the CAM De value after identification and rejection of outlier grains using the normalised median absolute deviation (nMAD) criterion.

&The De and OD values are for the De distributions after outlier rejection. The corresponding De and OD values for the samples including these outliers are provided in Supplementary Table 7.

†The uncertainties provided in brackets are the random-only uncertainties; those provided after the ± symbol represent the full (random plus systematic) uncertainty at 1σ.

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