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Ice Core Depth-Age Relation for Vostok δD and Dome Fuji δ^{18}O Records Based on the Devils Hole Paleotemperature Chronology

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by Jurate Maciunas Landwehr

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Multiply	By	To obtain
foot	0.3048	meter (m)
inch	25.4	millimeter (mm)

Ice Core Depth-Age Relation for Vostok δD and Dome Fuji $\delta^{18}O$ Records Based on the Devils Hole Paleotemperature Chronology

By Jurate Maciunas Landwehr

ABSTRACT

This report presents the data for the Vostok - Devils Hole chronology, termed V-DH chronology, for the Antarctic Vostok ice core record. This depth - age relation is based on a join between the Vostok deuterium profile (δD) and the stable oxygen isotope ratio ($\delta^{18}O$) record of paleotemperature from a calcitic core at Devils Hole, Nevada, using the algorithm developed by Landwehr and Winograd (2001). Both the control points defining the V-DH chronology and the numeric values for the chronology are given. In addition, a plausible chronology for a deformed bottom portion of the Vostok core developed with this algorithm is presented. Landwehr and Winograd (2001) demonstrated the broader utility of their algorithm by applying it to another appropriate Antarctic paleotemperature record, the Antarctic Dome Fuji ice core $\delta^{18}O$ record. Control points for this chronology are also presented in this report but deemed preliminary because, to date, investigators have published only the visual trace and not the numeric values for the Dome Fuji $\delta^{18}O$ record. The total uncertainty that can be associated with the assigned ages is also given.

INTRODUCTION

The ice core record from Vostok station in East Antarctica has provided unparalleled paleoclimatic information through four glacial-interglacial cycles (Petit and others, 1999). In particular, the deuterium content of the ice, expressed as the isotopic ratio δD (in per mill or ‰ with respect to Standard Mean Ocean Water, SMOW) is a proxy record for local temperature change. Another ice core from the East Antarctic plateau, the Dome Fuji core, also provides a proxy record for local temperature change, in particular with reference to the trace of the stable oxygen isotope ratio $\delta^{18}O$ (in ‰) (Watanabe and others, 1999). However, the development of an accurate chronology for the Vostok ice core record, as well as other Antarctic sites such as Dome Fuji, continues to be an open research question because these records cannot be dated directly (Parrenin and others, 2001).

In contrast, the calcitic core DH-11 taken from Devils Hole, Nevada, provides a precise uranium-series-dated 500,000-year record of paleotemperature in its trace of the stable oxygen isotope ratio $\delta^{18}O$ (in ‰, with respect to Vienna Standard Mean Ocean Water, VSMOW) (Winograd et al, 1992; Ludwig and others, 1992; Winograd and others, 1996; Landwehr and others, 1997; and Winograd and others, 1997). The $\delta^{18}O$ record from Devils Hole represents a paleotemperature record that can be argued to have a low-latitudinal Pacific sea surface temperature signal, as do the Vostok ice core δD record and the Dome Fuji $\delta^{18}O$ records which are proxies for paleotemperature on the East Antarctica plateau. Evidence

supportive of a teleconnection between Devils Hole and each of these Antarctic locations is discussed in Landwehr and Winograd (2001).

Landwehr and Winograd (2001) developed an objective method for transferring ages between paleoclimate records that are proxies for the same physical phenomenon, in the case where the paleoclimatic conditions forcing the two records can be considered to have occurred contemporaneously at both locations. No assumption is made on the magnitude of the climatic excursions, only that the timing of major climatic excursions was effectively synchronous. Drawing only on a strong inference that major shifts in paleotemperature recorded at the control and target locations occurred synchronously consistent with an atmospheric teleconnection, the method of Landwehr and Winograd (2001) was applied to these records, namely the Devils Hole DH-11 $\delta^{18}O$ record with the Vostok ice core δD record and the Devils Hole DH-11 $\delta^{18}O$ record with the Dome Fuji $\delta^{18}O$ record, to develop chronologies that are consistent with a uranium series-dated paleoclimatology.

CHRONOLOGY DEVELOPMENT

Landwehr and Winograd (2001) provide a detailed description of a new objective method for developing a chronology for an undated core by transferring age information between like proxies. Briefly, the method objectively defines control points for core depth – age matching on the basis of rescaled isotopic records. Control points are identified at midrange values (0.5) in the rescaled records, where the minimal isotopic value in stage 4, that is, event 4.2, is set equal to 0 and the maximum isotopic value in substage 5e value is set equal to 1. This method was applied to the published Vostok δD record (Petit and others, 1999) down to a depth of 3329 meters below surface (mbs) and 14 control points were identified. Twelve control points were identified for depths above 3310 mbs and two additional points were identified below 3310 mbs. Petit and others (1999) noted that the ice core probably exhibited an ice flow disturbance below 3310 meters. In addition to the identified control points, isotopic event 4.2 also was used in the development of a chronology because Devils Hole core DH-11 includes only the time span from ~60,000 to ~550,000 years ago. This information is given in table 1.

The V-DH chronology refers to the age-depth relation developed for the Vostok core based on the 4.2 event and the 12 control points down to the depth of 3310 mbs above the observed disturbance in the ice core. The defined relation is smooth and concave as would be expected by the physics of ice compaction (fig.1), but this has occurred independently of any preconditions placed on the method. In addition, it is noted that although Petit and others (1999) had to assume ages of 110,000 years and 390,000 years at the depths of 1,534 meters and 3,254 meters, respectively, to develop their GT4 chronology, the ages inherently assigned to these depths in the V-DH chronology are 109,000 and 391,000 years, respectively, with a corresponding error of ± 2 standard deviation ($\pm 2\sigma$) equal to 2,200 years and 9,600 years, respectively.

To demonstrate the general applicability of the age transference algorithm, Landwehr and Winograd (2001) developed the chronology for an additional comparable paleotemperature proxy record. The $\delta^{18}O$ profile for Dome Fuji has been published as a visual trace (Plate 1 in Watanabe and others, 1999) but not in tabular form. To develop a chronology for Dome Fuji, the published $\delta^{18}O$ profile was digitized and the Landwehr and Winograd algorithm was applied to it. Although the resolution from digitization is coarse, it was sufficient to successfully apply the algorithm described above. Seven control points were identified for what is here termed the DF-DH chronology; they are listed in table 2. The resulting relation between ice core depth and age for the DF-DH chronology is also smooth and concave (fig.1).

It is noted that an analogue to marine isotope event 5.4 occurs at a depth of 1,600 meters in the Dome Fuji core and was assigned an age of ~90,000 years by Watanabe and

Table 1. Control points identified for the Devils Hole age - Vostok ice core depth relation. The V-DH chronology is based on points located at depths less than 3310 meters below surface. Selection of control points is discussed and illustrated in Landwehr and Winograd (2001)

Depth (meters below surface)	Age (in thousands of years)	Comments
971	63.6	Event 4.2
1175	79.7	twelve control points down to 3310 meters below surface
1189	81.0	
1420	101.6	
1438	104.2	
1624	116.2	
1912	142.9	
2486	195.2	
2731	231.2	
2776	244.2	
3070	318.1	
3134	334.5	
3262	395.5	
3320	412.5	two additional control points
3329	459.3	

Table 2. Control points identified for the Devils Hole age - Dome Fuji depth relation. Selection of control points is discussed and illustrated in Landwehr and Winograd (2001)

Depth (meters below surface)	Age (in thousands of years)	Comments
1116	63.6	Event 4.2
1294	80	seven control points
1649	116.2	
1798	142.9	
2117	195.2	
2258	231.2	
2290	244.2	
2474	318.1	

others (1999). However, this is inconsistent with the 110,000-year age assumed by Petit and others (1999) for marine event 5.4, whereas the DF-DH chronology inherently assigns an age of ~110,000 years to the Dome Fuji ice core depth of 1,600 meters. Nonetheless, because the DF-DH chronology was derived from a digitized image, it is considered to be preliminary and awaiting refinement upon publication of the numeric values.

The error in the derived chronologies should be consistent with those in the matched uranium-series-dated record. The conservatively defined total uncertainty ($\pm 2\sigma$), including cutting, sampling and analytic error, for the ages derived by thermal ionization mass-spectrometric (TIMS) uranium-series dating of samples from Devils Hole core DH-11 is

Figure 1. Relations defined by control points transferring Devils Hole ages to ice core depths of the Vostok and Dome Fuji ice cores

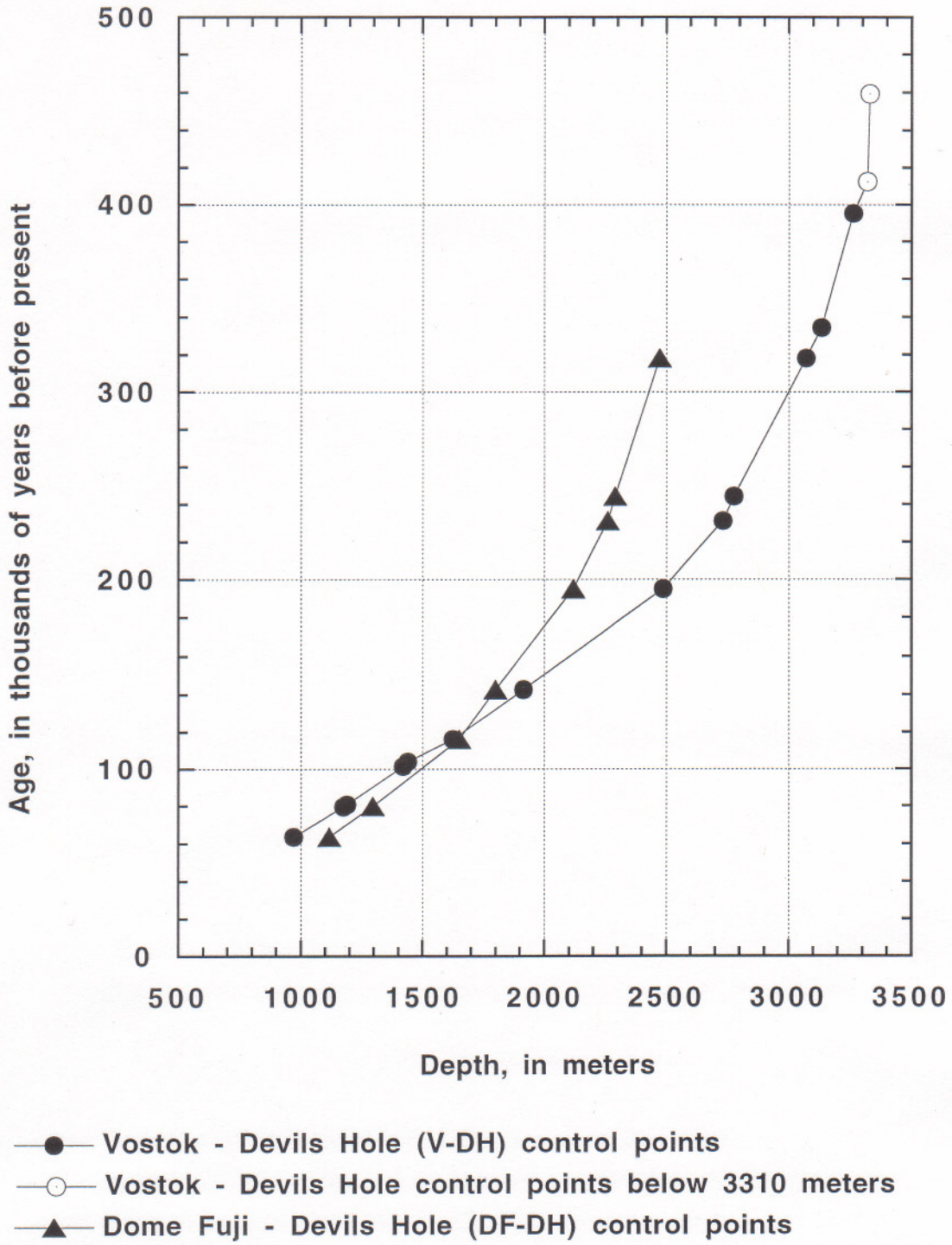

Table 3. Thermal Ionization Mass Spectrometric (TIMS) uranium-series ages and total uncertainty (±2σ) for samples from Devils Hole core DH-11. Based on information from Table 2 in Ludwig and others (1992), and from Winograd and others (1997) for the sample at a depth 51.5 mm

DH-11 core depth, in mm	TIMS age, in thousands of years	Total Uncertainty (±2σ) in thousands of years
1.0	60.3	1.7
16.0	80.6	2.5
41.0	119.7	2.1
44.5	122.4	2.6
48.5	131.9	3.0
51.5	143.8	3.0
54.0	149.8	2.6
58.5	156.2	3.1
98.5	211.0	2.9
111.0	235.9	3.1
126.0	269.1	4.2
137.0	285.7	3.5
171.5	327.5	6.4
188.0	354.1	6.2
219.0	395	10
227.0	402	10
250.0	438	13
277.0	461	20
318.5	513	20
334.5	531	20
344.5	546	20
357.5	566	20

given in table 3. Information is taken from Table 2 in Ludwig and others (1992) and from Winograd and others (1997) for the sample at a depth of 51.5-mm.

The V-DH chronology and the corresponding published δD record for the Vostok ice core (Petit and others, 1999) are listed in table 4. However, a chronology for the final portion of the Vostok core from the control point at 3262 mbs, the last control point above 3310 mbs, and the two additional control points down to 3329 mbs can also be developed (fig.1); this is presented in table 5. As shown in Plate 4 of Landwehr and Winograd (2001), the subsequent chronology yields a plausible isotopic trace and may imply that there is further paleoclimatic information to be gained even in the deformed portion of the Vostok record.

SUMMARY

Landwehr and Winograd (2001) developed an objective method for transferring ages between paleoclimate records that are proxies for the same physical phenomenon, in the case where the paleoclimatic conditions forcing the two records can be considered to have occurred contemporaneously at both locations. Drawing only on a strong inference that

major shifts in paleotemperature recorded in the Vostok ice core δD and the Devils Hole DH-11 $\delta^{18}O$ occurred synchronously, Landwehr and Winograd developed an age-depth relation, called the V-DH chronology, which is seen to be geometrically consistent with the physics of ice compaction. The algorithm was also applied to develop a plausible chronology for a deeper portion of the Vostok ice core that exhibits ice flow deformation, as well as a chronology for another East Antarctica ice core, that from Dome Fuji. The data values for these chronologies as well as the conservative errors estimated for the ages obtained for the Devils Hole core DH-11 record are presented in this report.

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Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001)

Core Depth (meters below surface)	δD (‰)	V-DH Age (thousands of years)
970	-480.50	63.52
971	-483.40	63.60
972	-479.70	63.68
973	-478.50	63.76
974	-481.90	63.84
975	-481.50	63.92
976	-483.10	63.99
977	-479.50	64.07
978	-472.10	64.15
979	-468.80	64.23
980	-470.70	64.31
981	-467.70	64.39
982	-468.50	64.47
983	-474.20	64.55
984	-475.60	64.63
985	-479.40	64.70
986	-478.10	64.78
987	-476.00	64.86
988	-473.50	64.94
989	-474.70	65.02
990	-478.10	65.10
991	-481.30	65.18
992	-480.60	65.26
993	-476.60	65.34
994	-476.80	65.42
995	-477.90	65.49
996	-473.50	65.57
997	-468.40	65.65
998	-468.40	65.73
999	-468.40	65.81
1000	-468.40	65.89
1001	-468.40	65.97
1002	-468.70	66.05
1003	-469.00	66.13
1004	-470.10	66.20
1005	-470.50	66.28
1006	-467.20	66.36
1007	-465.50	66.44
1008	-462.20	66.52
1009	-466.40	66.60
1010	-465.80	66.68
1011	-463.50	66.76
1012	-466.80	66.84
1013	-471.50	66.91
1014	-468.00	66.99
1015	-467.00	67.07

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

1016	-468.90	67.15
1017	-469.60	67.23
1018	-469.70	67.31
1019	-472.50	67.39
1020	-474.00	67.47
1021	-476.20	67.55
1022	-473.20	67.62
1023	-474.70	67.70
1024	-470.70	67.78
1025	-466.60	67.86
1026	-469.50	67.94
1027	-470.90	68.02
1028	-472.80	68.10
1029	-473.60	68.18
1030	-477.60	68.26
1031	-481.90	68.34
1032	-476.80	68.41
1033	-471.60	68.49
1034	-474.70	68.57
1035	-477.80	68.65
1036	-476.20	68.73
1037	-473.80	68.81
1038	-474.50	68.89
1039	-478.20	68.97
1040	-473.00	69.05
1041	-470.60	69.12
1042	-468.90	69.20
1043	-463.60	69.28
1044	-471.40	69.36
1045	-476.80	69.44
1046	-470.50	69.52
1047	-470.40	69.60
1048	-469.40	69.68
1049	-469.00	69.76
1050	-467.80	69.83
1051	-469.70	69.91
1052	-467.90	69.99
1053	-466.10	70.07
1054	-467.30	70.15
1055	-467.90	70.23
1056	-466.20	70.31
1057	-463.40	70.39
1058	-462.60	70.47
1059	-461.80	70.55
1060	-461.60	70.62
1061	-468.00	70.70
1062	-465.50	70.78
1063	-464.50	70.86
1064	-466.90	70.94
1065	-461.70	71.02
1066	-459.80	71.10
1067	-464.30	71.18

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

1068	-466.00	71.26
1069	-466.50	71.33
1070	-466.90	71.41
1071	-465.10	71.49
1072	-463.60	71.57
1073	-466.10	71.65
1074	-468.60	71.73
1075	-468.40	71.81
1076	-468.10	71.89
1077	-471.00	71.97
1078	-473.60	72.04
1079	-475.90	72.12
1080	-478.50	72.20
1081	-475.20	72.28
1082	-470.50	72.36
1083	-470.20	72.44
1084	-470.50	72.52
1085	-474.40	72.60
1086	-474.80	72.68
1087	-475.40	72.75
1088	-479.40	72.83
1089	-472.00	72.91
1090	-458.50	72.99
1091	-469.90	73.07
1092	-476.40	73.15
1093	-472.40	73.23
1094	-473.60	73.31
1095	-472.00	73.39
1096	-470.30	73.47
1097	-470.90	73.54
1098	-473.10	73.62
1099	-471.10	73.70
1100	-464.40	73.78
1101	-464.40	73.86
1102	-465.60	73.94
1103	-464.20	74.02
1104	-461.60	74.10
1105	-468.20	74.18
1106	-468.60	74.25
1107	-467.00	74.33
1108	-465.20	74.41
1109	-467.30	74.49
1110	-468.10	74.57
1111	-465.30	74.65
1112	-457.50	74.73
1113	-464.80	74.81
1114	-473.90	74.89
1115	-472.30	74.96
1116	-474.00	75.04
1117	-468.10	75.12
1118	-462.30	75.20
1119	-461.10	75.28

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

1120	-462.00	75.36
1121	-464.10	75.44
1122	-464.10	75.52
1123	-462.60	75.60
1124	-463.60	75.68
1125	-465.20	75.75
1126	-466.80	75.83
1127	-459.80	75.91
1128	-455.30	75.99
1129	-458.80	76.07
1130	-462.30	76.15
1131	-458.90	76.23
1132	-455.50	76.31
1133	-458.30	76.39
1134	-458.30	76.46
1135	-458.40	76.54
1136	-458.00	76.62
1137	-457.90	76.70
1138	-458.50	76.78
1139	-456.40	76.86
1140	-456.90	76.94
1141	-453.60	77.02
1142	-450.70	77.10
1143	-457.40	77.17
1144	-464.60	77.25
1145	-463.00	77.33
1146	-461.30	77.41
1147	-462.60	77.49
1148	-463.90	77.57
1149	-461.00	77.65
1150	-458.00	77.73
1151	-453.90	77.81
1152	-449.80	77.88
1153	-453.10	77.96
1154	-450.70	78.04
1155	-456.00	78.12
1156	-458.70	78.20
1157	-458.80	78.28
1158	-458.80	78.36
1159	-457.30	78.44
1160	-456.80	78.52
1161	-454.70	78.60
1162	-461.40	78.67
1163	-457.30	78.75
1164	-454.40	78.83
1165	-454.20	78.91
1166	-456.20	78.99
1167	-460.90	79.07
1168	-462.80	79.15
1169	-460.50	79.23
1170	-458.30	79.31
1171	-458.30	79.38

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

1172	-458.30	79.46
1173	-458.80	79.54
1174	-457.30	79.62
1175	-449.80	79.70
1176	-444.40	79.79
1177	-450.50	79.89
1178	-452.70	79.98
1179	-455.10	80.07
1180	-455.40	80.16
1181	-454.20	80.26
1182	-451.90	80.35
1183	-450.20	80.44
1184	-449.20	80.54
1185	-451.80	80.63
1186	-453.00	80.72
1187	-453.60	80.81
1188	-450.30	80.91
1189	-450.00	81.00
1190	-448.90	81.09
1191	-448.10	81.18
1192	-450.30	81.27
1193	-452.00	81.36
1194	-455.20	81.45
1195	-454.50	81.54
1196	-455.10	81.62
1197	-455.00	81.71
1198	-454.20	81.80
1199	-454.20	81.89
1200	-454.20	81.98
1201	-455.70	82.07
1202	-456.50	82.16
1203	-455.80	82.25
1204	-456.60	82.34
1205	-457.40	82.43
1206	-460.00	82.52
1207	-463.20	82.61
1208	-457.90	82.69
1209	-460.10	82.78
1210	-458.80	82.87
1211	-458.70	82.96
1212	-459.00	83.05
1213	-460.40	83.14
1214	-460.90	83.23
1215	-460.30	83.32
1216	-457.10	83.41
1217	-454.70	83.50
1218	-458.90	83.59
1219	-463.00	83.68
1220	-460.10	83.76
1221	-456.80	83.85
1222	-461.30	83.94
1223	-459.70	84.03

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

1224	-458.80	84.12
1225	-459.30	84.21
1226	-460.70	84.30
1227	-460.70	84.39
1228	-462.90	84.48
1229	-465.00	84.57
1230	-465.00	84.66
1231	-465.00	84.75
1232	-465.00	84.83
1233	-465.00	84.92
1234	-464.80	85.01
1235	-464.60	85.10
1236	-464.90	85.19
1237	-464.10	85.28
1238	-463.70	85.37
1239	-459.10	85.46
1240	-459.20	85.55
1241	-459.30	85.64
1242	-462.60	85.73
1243	-464.20	85.82
1244	-466.80	85.90
1245	-469.40	85.99
1246	-466.20	86.08
1247	-463.00	86.17
1248	-465.50	86.26
1249	-467.50	86.35
1250	-467.50	86.44
1251	-467.50	86.53
1252	-465.40	86.62
1253	-463.20	86.71
1254	-468.80	86.80
1255	-475.30	86.89
1256	-470.90	86.97
1257	-467.30	87.06
1258	-468.80	87.15
1259	-469.70	87.24
1260	-470.00	87.33
1261	-466.50	87.42
1262	-466.10	87.51
1263	-460.40	87.60
1264	-465.50	87.69
1265	-464.30	87.78
1266	-465.70	87.87
1267	-465.60	87.96
1268	-466.80	88.05
1269	-467.00	88.13
1270	-470.10	88.22
1271	-470.70	88.31
1272	-464.20	88.40
1273	-457.00	88.49
1274	-457.50	88.58
1275	-460.20	88.67

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

1276	-460.70	88.76
1277	-459.10	88.85
1278	-463.70	88.94
1279	-465.20	89.03
1280	-463.60	89.12
1281	-465.10	89.20
1282	-466.70	89.29
1283	-464.40	89.38
1284	-463.40	89.47
1285	-460.10	89.56
1286	-460.90	89.65
1287	-465.80	89.74
1288	-464.80	89.83
1289	-468.90	89.92
1290	-463.70	90.01
1291	-456.10	90.10
1292	-461.90	90.19
1293	-463.00	90.27
1294	-460.60	90.36
1295	-461.10	90.45
1296	-464.00	90.54
1297	-467.20	90.63
1298	-464.50	90.72
1299	-463.20	90.81
1300	-464.50	90.90
1301	-463.00	90.99
1302	-465.90	91.08
1303	-470.10	91.17
1304	-464.50	91.26
1305	-462.00	91.34
1306	-457.10	91.43
1307	-456.00	91.52
1308	-457.10	91.61
1309	-455.90	91.70
1310	-459.70	91.79
1311	-466.30	91.88
1312	-466.30	91.97
1313	-465.50	92.06
1314	-461.20	92.15
1315	-458.40	92.24
1316	-457.50	92.33
1317	-461.40	92.41
1318	-462.60	92.50
1319	-463.20	92.59
1320	-460.80	92.68
1321	-459.70	92.77
1322	-459.30	92.86
1323	-460.30	92.95
1324	-462.90	93.04
1325	-465.20	93.13
1326	-466.00	93.22
1327	-458.40	93.31

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

1328	-456.90	93.40
1329	-459.90	93.48
1330	-460.60	93.57
1331	-460.60	93.66
1332	-460.60	93.75
1333	-459.70	93.84
1334	-458.80	93.93
1335	-458.80	94.02
1336	-458.80	94.11
1337	-460.60	94.20
1338	-462.40	94.29
1339	-460.30	94.38
1340	-457.60	94.47
1341	-457.60	94.55
1342	-459.40	94.64
1343	-459.80	94.73
1344	-462.00	94.82
1345	-462.70	94.91
1346	-462.30	95.00
1347	-462.70	95.09
1348	-459.90	95.18
1349	-461.80	95.27
1350	-463.70	95.36
1351	-463.70	95.45
1352	-463.70	95.54
1353	-463.10	95.63
1354	-468.10	95.71
1355	-466.00	95.80
1356	-462.70	95.89
1357	-464.00	95.98
1358	-469.40	96.07
1359	-466.50	96.16
1360	-465.90	96.25
1361	-461.30	96.34
1362	-456.70	96.43
1363	-461.20	96.52
1364	-462.00	96.61
1365	-465.50	96.70
1366	-468.90	96.78
1367	-465.80	96.87
1368	-462.80	96.96
1369	-463.60	97.05
1370	-465.60	97.14
1371	-460.10	97.23
1372	-457.50	97.32
1373	-457.50	97.41
1374	-457.50	97.50
1375	-461.20	97.59
1376	-465.00	97.68
1377	-462.80	97.77
1378	-463.80	97.85
1379	-460.40	97.94

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

1380	-459.20	98.03
1381	-461.40	98.12
1382	-463.90	98.21
1383	-462.50	98.30
1384	-461.10	98.39
1385	-460.80	98.48
1386	-460.50	98.57
1387	-460.40	98.66
1388	-460.00	98.75
1389	-459.80	98.84
1390	-460.80	98.92
1391	-459.60	99.01
1392	-457.20	99.10
1393	-457.20	99.19
1394	-457.20	99.28
1395	-456.90	99.37
1396	-458.10	99.46
1397	-459.20	99.55
1398	-460.70	99.64
1399	-457.70	99.73
1400	-454.80	99.82
1401	-454.80	99.91
1402	-456.50	99.99
1403	-458.20	100.08
1404	-458.20	100.17
1405	-457.80	100.26
1406	-457.30	100.35
1407	-456.60	100.44
1408	-457.90	100.53
1409	-457.20	100.62
1410	-456.50	100.71
1411	-455.80	100.80
1412	-455.10	100.89
1413	-455.10	100.98
1414	-453.90	101.06
1415	-452.60	101.15
1416	-452.00	101.24
1417	-451.40	101.33
1418	-453.70	101.42
1419	-452.80	101.51
1420	-449.50	101.60
1421	-450.10	101.74
1422	-450.80	101.89
1423	-450.00	102.03
1424	-449.20	102.18
1425	-448.40	102.32
1426	-447.60	102.47
1427	-450.30	102.61
1428	-452.90	102.76
1429	-451.50	102.90
1430	-450.20	103.04
1431	-449.20	103.19

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

1432	-448.30	103.33
1433	-450.50	103.48
1434	-452.70	103.62
1435	-454.10	103.77
1436	-455.50	103.91
1437	-452.50	104.06
1438	-449.50	104.20
1439	-453.10	104.26
1440	-456.80	104.33
1441	-454.00	104.39
1442	-451.10	104.46
1443	-454.60	104.52
1444	-458.10	104.59
1445	-457.40	104.65
1446	-456.70	104.71
1447	-459.60	104.78
1448	-462.50	104.84
1449	-462.10	104.91
1450	-461.80	104.97
1451	-461.80	105.04
1452	-462.30	105.10
1453	-462.00	105.16
1454	-461.10	105.23
1455	-460.70	105.29
1456	-460.20	105.36
1457	-459.90	105.42
1458	-459.50	105.49
1459	-460.50	105.55
1460	-461.60	105.62
1461	-461.40	105.68
1462	-461.10	105.74
1463	-461.10	105.81
1464	-461.10	105.87
1465	-460.60	105.94
1466	-460.10	106.00
1467	-460.10	106.07
1468	-462.20	106.13
1469	-464.20	106.19
1470	-463.00	106.26
1471	-461.90	106.32
1472	-460.70	106.39
1473	-459.60	106.45
1474	-460.20	106.52
1475	-460.70	106.58
1476	-462.00	106.64
1477	-463.20	106.71
1478	-460.90	106.77
1479	-458.50	106.84
1480	-458.50	106.90
1481	-458.50	106.97
1482	-457.90	107.03
1483	-457.20	107.09

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

1484	-454.20	107.16
1485	-451.20	107.22
1486	-455.20	107.29
1487	-459.10	107.35
1488	-460.50	107.42
1489	-461.90	107.48
1490	-460.60	107.55
1491	-459.30	107.61
1492	-461.00	107.67
1493	-462.70	107.74
1494	-464.10	107.80
1495	-465.50	107.87
1496	-463.50	107.93
1497	-461.50	108.00
1498	-461.50	108.06
1499	-461.50	108.12
1500	-464.40	108.19
1501	-467.30	108.25
1502	-470.70	108.32
1503	-474.10	108.38
1504	-474.10	108.45
1505	-474.10	108.51
1506	-474.10	108.57
1507	-475.30	108.64
1508	-476.40	108.70
1509	-476.70	108.77
1510	-477.00	108.83
1511	-477.00	108.90
1512	-476.30	108.96
1513	-475.60	109.02
1514	-475.60	109.09
1515	-475.20	109.15
1516	-474.80	109.22
1517	-474.00	109.28
1518	-473.10	109.35
1519	-473.10	109.41
1520	-473.10	109.48
1521	-473.10	109.54
1522	-473.10	109.60
1523	-474.70	109.67
1524	-476.40	109.73
1525	-476.40	109.80
1526	-474.20	109.86
1527	-472.10	109.93
1528	-472.10	109.99
1529	-472.10	110.05
1530	-472.80	110.12
1531	-473.40	110.18
1532	-470.90	110.25
1533	-468.40	110.31
1534	-468.80	110.38
1535	-469.10	110.44

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

1536	-469.10	110.50
1537	-469.10	110.57
1538	-469.10	110.63
1539	-469.10	110.70
1540	-469.10	110.76
1541	-469.10	110.83
1542	-469.10	110.89
1543	-471.70	110.95
1544	-474.20	111.02
1545	-473.20	111.08
1546	-472.20	111.15
1547	-471.00	111.21
1548	-469.80	111.28
1549	-469.80	111.34
1550	-469.80	111.40
1551	-469.80	111.47
1552	-469.80	111.53
1553	-469.80	111.60
1554	-469.80	111.66
1555	-471.90	111.73
1556	-474.00	111.79
1557	-474.00	111.86
1558	-472.70	111.92
1559	-471.40	111.98
1560	-471.40	112.05
1561	-471.40	112.11
1562	-471.40	112.18
1563	-471.40	112.24
1564	-471.40	112.31
1565	-470.70	112.37
1566	-470.00	112.43
1567	-469.80	112.50
1568	-471.00	112.56
1569	-472.20	112.63
1570	-471.40	112.69
1571	-470.60	112.76
1572	-468.20	112.82
1573	-465.70	112.88
1574	-465.70	112.95
1575	-465.00	113.01
1576	-464.90	113.08
1577	-465.20	113.14
1578	-465.50	113.21
1579	-467.50	113.27
1580	-469.60	113.33
1581	-466.50	113.40
1582	-463.30	113.46
1583	-463.30	113.53
1584	-462.60	113.59
1585	-461.90	113.66
1586	-462.10	113.72
1587	-462.30	113.79

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

1588	-461.80	113.85
1589	-461.40	113.91
1590	-463.50	113.98
1591	-465.70	114.04
1592	-464.70	114.11
1593	-463.60	114.17
1594	-462.00	114.24
1595	-460.40	114.30
1596	-458.50	114.36
1597	-456.70	114.43
1598	-459.40	114.49
1599	-462.00	114.56
1600	-456.50	114.62
1601	-450.90	114.69
1602	-450.90	114.75
1603	-450.90	114.81
1604	-450.90	114.88
1605	-450.90	114.94
1606	-450.90	115.01
1607	-451.50	115.07
1608	-452.00	115.14
1609	-454.80	115.20
1610	-457.60	115.26
1611	-456.20	115.33
1612	-454.70	115.39
1613	-454.00	115.46
1614	-453.40	115.52
1615	-453.50	115.59
1616	-453.20	115.65
1617	-452.80	115.72
1618	-452.50	115.78
1619	-452.30	115.84
1620	-452.30	115.91
1621	-452.30	115.97
1622	-451.50	116.04
1623	-450.80	116.10
1624	-449.00	116.17
1625	-447.30	116.26
1626	-446.10	116.35
1627	-445.00	116.44
1628	-445.00	116.54
1629	-446.20	116.63
1630	-447.40	116.72
1631	-446.00	116.81
1632	-444.60	116.91
1633	-446.50	117.00
1634	-448.50	117.09
1635	-445.50	117.18
1636	-442.40	117.28
1637	-444.10	117.37
1638	-445.80	117.46
1639	-446.60	117.55

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

1640	-447.70	117.65
1641	-447.90	117.74
1642	-447.30	117.83
1643	-446.60	117.92
1644	-444.50	118.02
1645	-442.30	118.11
1646	-442.30	118.20
1647	-442.30	118.29
1648	-443.90	118.39
1649	-445.50	118.48
1650	-445.50	118.57
1651	-443.50	118.66
1652	-441.60	118.76
1653	-440.20	118.85
1654	-438.70	118.94
1655	-443.10	119.03
1656	-447.50	119.13
1657	-445.70	119.22
1658	-443.90	119.31
1659	-443.90	119.40
1660	-442.00	119.50
1661	-440.00	119.59
1662	-442.70	119.68
1663	-445.40	119.77
1664	-445.40	119.87
1665	-445.00	119.96
1666	-444.70	120.05
1667	-443.50	120.14
1668	-443.60	120.24
1669	-445.00	120.33
1670	-443.10	120.42
1671	-441.20	120.51
1672	-443.60	120.61
1673	-446.00	120.70
1674	-446.00	120.79
1675	-444.20	120.88
1676	-442.40	120.98
1677	-443.70	121.07
1678	-445.00	121.16
1679	-443.80	121.25
1680	-442.50	121.35
1681	-442.50	121.44
1682	-442.50	121.53
1683	-441.10	121.62
1684	-439.80	121.72
1685	-438.20	121.81
1686	-436.60	121.90
1687	-437.30	121.99
1688	-438.00	122.09
1689	-438.90	122.18
1690	-440.40	122.27
1691	-441.00	122.36

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

1692	-441.00	122.46
1693	-442.00	122.55
1694	-443.10	122.64
1695	-443.10	122.73
1696	-440.40	122.83
1697	-437.60	122.92
1698	-439.50	123.01
1699	-441.50	123.10
1700	-441.50	123.20
1701	-441.40	123.29
1702	-441.30	123.38
1703	-441.30	123.47
1704	-439.60	123.57
1705	-437.90	123.66
1706	-437.90	123.75
1707	-436.10	123.84
1708	-434.30	123.94
1709	-434.30	124.03
1710	-437.20	124.12
1711	-440.10	124.21
1712	-438.00	124.31
1713	-436.00	124.40
1714	-435.50	124.49
1715	-435.00	124.58
1716	-436.10	124.68
1717	-437.30	124.77
1718	-437.30	124.86
1719	-436.50	124.95
1720	-435.80	125.05
1721	-437.10	125.14
1722	-438.50	125.23
1723	-440.60	125.32
1724	-442.80	125.42
1725	-440.10	125.51
1726	-438.90	125.60
1727	-440.30	125.69
1728	-440.90	125.79
1729	-441.50	125.88
1730	-439.90	125.97
1731	-438.20	126.06
1732	-435.30	126.16
1733	-432.40	126.25
1734	-434.80	126.34
1735	-437.30	126.43
1736	-437.00	126.53
1737	-436.60	126.62
1738	-437.20	126.71
1739	-437.80	126.80
1740	-436.10	126.90
1741	-434.50	126.99
1742	-434.50	127.08
1743	-435.10	127.17

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

1744	-435.80	127.27
1745	-436.50	127.36
1746	-432.50	127.45
1747	-431.50	127.54
1748	-435.40	127.64
1749	-435.40	127.73
1750	-435.40	127.82
1751	-436.00	127.91
1752	-436.60	128.01
1753	-436.00	128.10
1754	-435.50	128.19
1755	-435.30	128.28
1756	-435.10	128.38
1757	-435.30	128.47
1758	-435.40	128.56
1759	-435.40	128.65
1760	-435.10	128.75
1761	-437.40	128.84
1762	-439.90	128.93
1763	-438.80	129.02
1764	-437.60	129.12
1765	-436.20	129.21
1766	-434.90	129.30
1767	-433.30	129.39
1768	-431.70	129.49
1769	-433.50	129.58
1770	-435.40	129.67
1771	-434.10	129.76
1772	-432.90	129.86
1773	-432.60	129.95
1774	-432.40	130.04
1775	-434.50	130.13
1776	-436.50	130.23
1777	-436.40	130.32
1778	-435.90	130.41
1779	-435.40	130.50
1780	-435.80	130.60
1781	-436.30	130.69
1782	-436.80	130.78
1783	-437.40	130.87
1784	-438.10	130.97
1785	-435.90	131.06
1786	-432.90	131.15
1787	-433.10	131.24
1788	-433.30	131.34
1789	-433.50	131.43
1790	-433.70	131.52
1791	-431.50	131.61
1792	-429.30	131.71
1793	-427.30	131.80
1794	-423.80	131.89
1795	-422.30	131.98

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

1796	-426.30	132.08
1797	-430.20	132.17
1798	-428.20	132.26
1799	-426.10	132.35
1800	-426.10	132.45
1801	-426.10	132.54
1802	-426.10	132.63
1803	-425.50	132.72
1804	-424.90	132.82
1805	-424.20	132.91
1806	-423.50	133.00
1807	-423.40	133.09
1808	-423.20	133.19
1809	-423.70	133.28
1810	-424.10	133.37
1811	-423.30	133.46
1812	-422.50	133.56
1813	-423.30	133.65
1814	-424.10	133.74
1815	-422.70	133.83
1816	-421.70	133.93
1817	-422.10	134.02
1818	-424.00	134.11
1819	-424.50	134.20
1820	-423.20	134.30
1821	-421.70	134.39
1822	-420.20	134.48
1823	-420.20	134.57
1824	-420.20	134.67
1825	-421.20	134.76
1826	-419.40	134.85
1827	-416.60	134.94
1828	-416.90	135.04
1829	-417.20	135.13
1830	-417.20	135.22
1831	-419.10	135.31
1832	-421.00	135.41
1833	-422.40	135.50
1834	-423.70	135.59
1835	-421.80	135.68
1836	-419.90	135.78
1837	-421.20	135.87
1838	-422.50	135.96
1839	-423.90	136.05
1840	-425.30	136.15
1841	-425.30	136.24
1842	-425.30	136.33
1843	-422.50	136.42
1844	-419.80	136.52
1845	-418.00	136.61
1846	-416.30	136.70
1847	-419.60	136.79

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

1848	-428.70	136.89
1849	-434.50	136.98
1850	-429.10	137.07
1851	-423.80	137.16
1852	-421.50	137.26
1853	-419.10	137.35
1854	-420.20	137.44
1855	-421.40	137.53
1856	-422.10	137.63
1857	-423.70	137.72
1858	-424.60	137.81
1859	-422.50	137.90
1860	-420.30	138.00
1861	-420.30	138.09
1862	-423.50	138.18
1863	-426.70	138.27
1864	-425.40	138.37
1865	-425.50	138.46
1866	-426.90	138.55
1867	-427.00	138.64
1868	-427.20	138.74
1869	-428.00	138.83
1870	-428.90	138.92
1871	-429.50	139.01
1872	-431.10	139.11
1873	-432.20	139.20
1874	-432.90	139.29
1875	-433.50	139.38
1876	-433.60	139.48
1877	-433.70	139.57
1878	-435.00	139.66
1879	-432.70	139.75
1880	-429.20	139.85
1881	-433.10	139.94
1882	-437.00	140.03
1883	-439.40	140.12
1884	-441.80	140.22
1885	-440.50	140.31
1886	-439.20	140.40
1887	-439.00	140.49
1888	-438.80	140.59
1889	-441.30	140.68
1890	-443.80	140.77
1891	-443.50	140.86
1892	-445.00	140.96
1893	-446.80	141.05
1894	-446.80	141.14
1895	-445.70	141.23
1896	-444.60	141.33
1897	-444.70	141.42
1898	-445.20	141.51
1899	-445.50	141.60

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

1900	-445.50	141.70
1901	-445.50	141.79
1902	-446.60	141.88
1903	-449.00	141.97
1904	-450.20	142.07
1905	-451.70	142.16
1906	-453.10	142.25
1907	-452.20	142.34
1908	-451.30	142.44
1909	-452.50	142.53
1910	-453.70	142.62
1911	-451.60	142.71
1912	-449.50	142.81
1913	-449.50	142.90
1914	-453.00	142.99
1915	-456.60	143.08
1916	-456.90	143.17
1917	-457.00	143.27
1918	-459.50	143.36
1919	-461.90	143.45
1920	-462.60	143.54
1921	-464.70	143.63
1922	-465.80	143.72
1923	-466.80	143.81
1924	-464.80	143.90
1925	-464.70	144.00
1926	-468.60	144.09
1927	-472.10	144.18
1928	-471.70	144.27
1929	-471.60	144.36
1930	-473.40	144.45
1931	-473.90	144.54
1932	-475.20	144.64
1933	-474.10	144.73
1934	-471.30	144.82
1935	-471.80	144.91
1936	-473.10	145.00
1937	-474.30	145.09
1938	-474.20	145.18
1939	-473.20	145.28
1940	-475.40	145.37
1941	-477.20	145.46
1942	-475.00	145.55
1943	-474.70	145.64
1944	-475.60	145.73
1945	-474.10	145.82
1946	-475.40	145.91
1947	-478.00	146.01
1948	-476.10	146.10
1949	-475.40	146.19
1950	-477.30	146.28
1951	-478.00	146.37

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

1952	-478.30	146.46
1953	-476.70	146.55
1954	-475.10	146.65
1955	-475.20	146.74
1956	-475.70	146.83
1957	-477.70	146.92
1958	-481.50	147.01
1959	-483.80	147.10
1960	-485.90	147.19
1961	-484.10	147.28
1962	-482.00	147.38
1963	-482.80	147.47
1964	-482.50	147.56
1965	-482.50	147.65
1966	-482.00	147.74
1967	-480.30	147.83
1968	-480.30	147.92
1969	-481.70	148.02
1970	-480.90	148.11
1971	-480.90	148.20
1972	-482.70	148.29
1973	-483.70	148.38
1974	-482.50	148.47
1975	-481.10	148.56
1976	-482.40	148.66
1977	-484.50	148.75
1978	-483.50	148.84
1979	-480.60	148.93
1980	-481.20	149.02
1981	-482.60	149.11
1982	-482.20	149.20
1983	-480.90	149.29
1984	-479.30	149.39
1985	-482.20	149.48
1986	-483.20	149.57
1987	-481.00	149.66
1988	-480.60	149.75
1989	-482.00	149.84
1990	-483.00	149.93
1991	-482.30	150.03
1992	-481.90	150.12
1993	-481.20	150.21
1994	-482.10	150.30
1995	-480.10	150.39
1996	-479.60	150.48
1997	-481.10	150.57
1998	-480.40	150.66
1999	-481.90	150.76
2000	-483.40	150.85
2001	-483.10	150.94
2002	-482.50	151.03
2003	-481.50	151.12

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

2004	-479.60	151.21
2005	-480.10	151.30
2006	-481.00	151.40
2007	-481.20	151.49
2008	-481.20	151.58
2009	-483.10	151.67
2010	-484.50	151.76
2011	-481.40	151.85
2012	-479.00	151.94
2013	-480.40	152.04
2014	-480.10	152.13
2015	-477.60	152.22
2016	-478.10	152.31
2017	-478.50	152.40
2018	-479.00	152.49
2019	-480.70	152.58
2020	-481.40	152.67
2021	-480.60	152.77
2022	-478.90	152.86
2023	-479.50	152.95
2024	-480.30	153.04
2025	-481.40	153.13
2026	-483.30	153.22
2027	-482.50	153.31
2028	-481.60	153.41
2029	-482.30	153.50
2030	-481.50	153.59
2031	-479.60	153.68
2032	-479.60	153.77
2033	-478.80	153.86
2034	-477.90	153.95
2035	-478.60	154.05
2036	-479.60	154.14
2037	-479.80	154.23
2038	-479.70	154.32
2039	-479.00	154.41
2040	-479.40	154.50
2041	-479.80	154.59
2042	-479.80	154.68
2043	-480.60	154.78
2044	-480.00	154.87
2045	-479.50	154.96
2046	-481.20	155.05
2047	-481.60	155.14
2048	-482.50	155.23
2049	-482.40	155.32
2050	-477.70	155.42
2051	-476.80	155.51
2052	-477.90	155.60
2053	-477.50	155.69
2054	-478.70	155.78
2055	-478.70	155.87

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

2056	-478.00	155.96
2057	-477.40	156.05
2058	-476.90	156.15
2059	-477.70	156.24
2060	-476.80	156.33
2061	-476.40	156.42
2062	-477.60	156.51
2063	-477.50	156.60
2064	-477.30	156.69
2065	-477.10	156.79
2066	-475.70	156.88
2067	-475.60	156.97
2068	-476.90	157.06
2069	-475.70	157.15
2070	-473.20	157.24
2071	-473.40	157.33
2072	-476.20	157.43
2073	-476.10	157.52
2074	-472.10	157.61
2075	-471.30	157.70
2076	-472.80	157.79
2077	-473.10	157.88
2078	-473.10	157.97
2079	-475.00	158.06
2080	-476.20	158.16
2081	-476.00	158.25
2082	-476.10	158.34
2083	-478.70	158.43
2084	-479.10	158.52
2085	-479.10	158.61
2086	-477.90	158.70
2087	-478.40	158.80
2088	-480.70	158.89
2089	-480.30	158.98
2090	-479.00	159.07
2091	-477.70	159.16
2092	-476.80	159.25
2093	-477.90	159.34
2094	-477.70	159.43
2095	-478.50	159.53
2096	-477.90	159.62
2097	-475.20	159.71
2098	-477.50	159.80
2099	-480.20	159.89
2100	-480.40	159.98
2101	-478.20	160.07
2102	-477.50	160.17
2103	-478.10	160.26
2104	-477.60	160.35
2105	-480.60	160.44
2106	-478.90	160.53
2107	-475.90	160.62

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

2108	-478.80	160.71
2109	-485.70	160.81
2110	-484.50	160.90
2111	-482.90	160.99
2112	-484.70	161.08
2113	-480.00	161.17
2114	-480.10	161.26
2115	-480.90	161.35
2116	-482.00	161.44
2117	-478.90	161.54
2118	-481.80	161.63
2119	-484.80	161.72
2120	-481.20	161.81
2121	-482.50	161.90
2122	-486.00	161.99
2123	-482.70	162.08
2124	-480.50	162.18
2125	-482.60	162.27
2126	-482.40	162.36
2127	-482.70	162.45
2128	-482.90	162.54
2129	-482.40	162.63
2130	-482.90	162.72
2131	-478.40	162.81
2132	-477.50	162.91
2133	-478.80	163.00
2134	-477.40	163.09
2135	-477.90	163.18
2136	-479.00	163.27
2137	-473.20	163.36
2138	-473.00	163.45
2139	-471.20	163.55
2140	-474.20	163.64
2141	-479.80	163.73
2142	-477.20	163.82
2143	-473.90	163.91
2144	-471.20	164.00
2145	-471.80	164.09
2146	-466.80	164.19
2147	-463.10	164.28
2148	-465.30	164.37
2149	-471.00	164.46
2150	-463.70	164.55
2151	-469.20	164.64
2152	-469.80	164.73
2153	-470.90	164.82
2154	-467.30	164.92
2155	-469.20	165.01
2156	-472.30	165.10
2157	-471.80	165.19
2158	-472.50	165.28
2159	-472.60	165.37

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

2160	-476.30	165.46
2161	-473.00	165.56
2162	-474.40	165.65
2163	-472.70	165.74
2164	-476.90	165.83
2165	-476.10	165.92
2166	-477.20	166.01
2167	-480.00	166.10
2168	-476.60	166.19
2169	-476.50	166.29
2170	-474.40	166.38
2171	-475.70	166.47
2172	-475.30	166.56
2173	-471.80	166.65
2174	-471.80	166.74
2175	-469.50	166.83
2176	-464.90	166.93
2177	-465.70	167.02
2178	-471.80	167.11
2179	-470.70	167.20
2180	-469.00	167.29
2181	-471.30	167.38
2182	-475.70	167.47
2183	-474.40	167.57
2184	-474.50	167.66
2185	-474.20	167.75
2186	-473.10	167.84
2187	-475.60	167.93
2188	-476.60	168.02
2189	-478.20	168.11
2190	-478.80	168.20
2191	-477.70	168.30
2192	-481.80	168.39
2193	-483.00	168.48
2194	-483.70	168.57
2195	-484.90	168.66
2196	-480.90	168.75
2197	-482.00	168.84
2198	-482.90	168.94
2199	-482.00	169.03
2200	-482.10	169.12
2201	-479.10	169.21
2202	-480.10	169.30
2203	-481.20	169.39
2204	-483.60	169.48
2205	-483.40	169.57
2206	-480.00	169.67
2207	-482.80	169.76
2208	-482.50	169.85
2209	-480.90	169.94
2210	-482.20	170.03
2211	-478.00	170.12

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

2212	-479.50	170.21
2213	-479.00	170.31
2214	-482.80	170.40
2215	-481.60	170.49
2216	-480.00	170.58
2217	-478.60	170.67
2218	-479.80	170.76
2219	-479.80	170.85
2220	-480.30	170.95
2221	-479.30	171.04
2222	-477.30	171.13
2223	-474.70	171.22
2224	-471.80	171.31
2225	-471.60	171.40
2226	-473.30	171.49
2227	-472.10	171.58
2228	-473.50	171.68
2229	-474.10	171.77
2230	-471.30	171.86
2231	-469.70	171.95
2232	-469.70	172.04
2233	-469.40	172.13
2234	-466.50	172.22
2235	-462.10	172.32
2236	-466.60	172.41
2237	-470.40	172.50
2238	-472.80	172.59
2239	-471.20	172.68
2240	-473.60	172.77
2241	-475.30	172.86
2242	-471.70	172.95
2243	-468.80	173.05
2244	-467.70	173.14
2245	-472.50	173.23
2246	-474.90	173.32
2247	-471.10	173.41
2248	-473.50	173.50
2249	-479.30	173.59
2250	-473.50	173.69
2251	-468.40	173.78
2252	-469.10	173.87
2253	-476.00	173.96
2254	-472.80	174.05
2255	-474.00	174.14
2256	-477.50	174.23
2257	-479.90	174.33
2258	-480.50	174.42
2259	-480.50	174.51
2260	-476.80	174.60
2261	-477.00	174.69
2262	-477.50	174.78
2263	-476.70	174.87

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

2264	-478.00	174.96
2265	-475.50	175.06
2266	-473.00	175.15
2267	-474.30	175.24
2268	-473.40	175.33
2269	-474.40	175.42
2270	-469.40	175.51
2271	-466.00	175.60
2272	-467.00	175.70
2273	-472.70	175.79
2274	-472.00	175.88
2275	-468.60	175.97
2276	-467.60	176.06
2277	-467.20	176.15
2278	-468.00	176.24
2279	-469.10	176.34
2280	-467.00	176.43
2281	-467.60	176.52
2282	-468.30	176.61
2283	-468.40	176.70
2284	-472.50	176.79
2285	-475.00	176.88
2286	-468.00	176.97
2287	-467.70	177.07
2288	-473.50	177.16
2289	-474.80	177.25
2290	-474.90	177.34
2291	-476.90	177.43
2292	-475.50	177.52
2293	-476.50	177.61
2294	-477.00	177.71
2295	-476.80	177.80
2296	-474.70	177.89
2297	-476.50	177.98
2298	-474.00	178.07
2299	-473.90	178.16
2300	-472.80	178.25
2301	-473.10	178.34
2302	-476.00	178.44
2303	-476.20	178.53
2304	-473.20	178.62
2305	-474.00	178.71
2306	-475.10	178.80
2307	-477.50	178.89
2308	-480.80	178.98
2309	-480.60	179.08
2310	-481.40	179.17
2311	-481.80	179.26
2312	-476.70	179.35
2313	-472.30	179.44
2314	-471.60	179.53
2315	-473.70	179.62

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

2316	-472.70	179.72
2317	-468.20	179.81
2318	-463.50	179.90
2319	-464.70	179.99
2320	-470.10	180.08
2321	-469.80	180.17
2322	-469.90	180.26
2323	-469.50	180.35
2324	-470.50	180.45
2325	-466.10	180.54
2326	-465.70	180.63
2327	-465.70	180.72
2328	-463.80	180.81
2329	-466.30	180.90
2330	-471.80	180.99
2331	-473.50	181.09
2332	-466.80	181.18
2333	-469.20	181.27
2334	-472.70	181.36
2335	-472.30	181.45
2336	-473.80	181.54
2337	-475.90	181.63
2338	-479.40	181.72
2339	-480.20	181.82
2340	-477.30	181.91
2341	-478.20	182.00
2342	-480.70	182.09
2343	-476.00	182.18
2344	-478.50	182.27
2345	-478.90	182.36
2346	-483.80	182.46
2347	-481.00	182.55
2348	-478.20	182.64
2349	-481.40	182.73
2350	-481.60	182.82
2351	-480.90	182.91
2352	-479.20	183.00
2353	-481.10	183.10
2354	-476.70	183.19
2355	-475.10	183.28
2356	-484.90	183.37
2357	-481.80	183.46
2358	-479.10	183.55
2359	-481.20	183.64
2360	-482.00	183.73
2361	-479.10	183.83
2362	-480.30	183.92
2363	-485.00	184.01
2364	-483.60	184.10
2365	-478.50	184.19
2366	-480.10	184.28
2367	-480.60	184.37

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

2368	-480.40	184.47
2369	-481.60	184.56
2370	-478.80	184.65
2371	-481.30	184.74
2372	-480.40	184.83
2373	-476.90	184.92
2374	-476.40	185.01
2375	-479.30	185.10
2376	-481.70	185.20
2377	-479.50	185.29
2378	-477.40	185.38
2379	-475.00	185.47
2380	-475.20	185.56
2381	-480.30	185.65
2382	-480.20	185.74
2383	-479.00	185.84
2384	-480.80	185.93
2385	-478.40	186.02
2386	-478.20	186.11
2387	-476.10	186.20
2388	-473.40	186.29
2389	-472.50	186.38
2390	-476.20	186.48
2391	-475.90	186.57
2392	-473.60	186.66
2393	-470.00	186.75
2394	-471.60	186.84
2395	-473.00	186.93
2396	-470.10	187.02
2397	-467.80	187.11
2398	-463.20	187.21
2399	-463.00	187.30
2400	-462.60	187.39
2401	-461.40	187.48
2402	-456.00	187.57
2403	-456.50	187.66
2404	-462.30	187.75
2405	-465.70	187.85
2406	-466.80	187.94
2407	-467.80	188.03
2408	-468.10	188.12
2409	-467.00	188.21
2410	-467.70	188.30
2411	-464.80	188.39
2412	-464.00	188.48
2413	-465.20	188.58
2414	-468.20	188.67
2415	-470.30	188.76
2416	-471.30	188.85
2417	-471.10	188.94
2418	-467.40	189.03
2419	-470.40	189.12

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

2420	-472.70	189.22
2421	-473.10	189.31
2422	-476.20	189.40
2423	-473.00	189.49
2424	-469.60	189.58
2425	-470.90	189.67
2426	-470.90	189.76
2427	-469.40	189.86
2428	-466.80	189.95
2429	-464.50	190.04
2430	-462.90	190.13
2431	-465.50	190.22
2432	-464.50	190.31
2433	-461.20	190.40
2434	-466.30	190.49
2435	-467.20	190.59
2436	-465.30	190.68
2437	-464.80	190.77
2438	-465.50	190.86
2439	-468.90	190.95
2440	-471.30	191.04
2441	-471.80	191.13
2442	-470.80	191.23
2443	-470.50	191.32
2444	-469.70	191.41
2445	-470.50	191.50
2446	-470.50	191.59
2447	-468.90	191.68
2448	-468.50	191.77
2449	-463.20	191.86
2450	-460.50	191.96
2451	-465.50	192.05
2452	-467.40	192.14
2453	-466.20	192.23
2454	-465.10	192.32
2455	-465.60	192.41
2456	-465.40	192.50
2457	-462.20	192.60
2458	-463.30	192.69
2459	-460.80	192.78
2460	-459.50	192.87
2461	-459.20	192.96
2462	-459.30	193.05
2463	-458.50	193.14
2464	-455.60	193.24
2465	-456.20	193.33
2466	-454.90	193.42
2467	-454.20	193.51
2468	-456.70	193.60
2469	-459.50	193.69
2470	-458.20	193.78
2471	-456.90	193.87

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

2472	-458.30	193.97
2473	-455.50	194.06
2474	-453.20	194.15
2475	-454.10	194.24
2476	-452.40	194.33
2477	-453.00	194.42
2478	-454.70	194.51
2479	-449.60	194.61
2480	-448.30	194.70
2481	-450.70	194.79
2482	-451.00	194.88
2483	-453.00	194.97
2484	-453.10	195.06
2485	-452.70	195.15
2486	-451.50	195.24
2487	-447.30	195.39
2488	-444.80	195.54
2489	-447.60	195.69
2490	-448.50	195.83
2491	-447.70	195.98
2492	-449.30	196.13
2493	-448.20	196.27
2494	-449.70	196.42
2495	-447.70	196.57
2496	-444.70	196.71
2497	-449.90	196.86
2498	-451.00	197.01
2499	-450.50	197.15
2500	-450.60	197.30
2501	-449.40	197.45
2502	-449.00	197.59
2503	-450.20	197.74
2504	-449.50	197.89
2505	-447.00	198.03
2506	-446.50	198.18
2507	-449.10	198.33
2508	-450.40	198.47
2509	-449.60	198.62
2510	-451.40	198.77
2511	-452.50	198.91
2512	-453.10	199.06
2513	-453.50	199.21
2514	-451.10	199.35
2515	-451.90	199.50
2516	-454.30	199.65
2517	-453.80	199.79
2518	-452.40	199.94
2519	-450.10	200.09
2520	-451.40	200.23
2521	-453.70	200.38
2522	-456.00	200.53
2523	-456.80	200.67

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

2524	-456.70	200.82
2525	-456.40	200.97
2526	-458.30	201.12
2527	-460.10	201.26
2528	-460.70	201.41
2529	-461.30	201.56
2530	-464.30	201.70
2531	-464.90	201.85
2532	-462.60	202.00
2533	-460.90	202.14
2534	-462.30	202.29
2535	-462.50	202.44
2536	-460.20	202.58
2537	-460.80	202.73
2538	-460.30	202.88
2539	-460.40	203.02
2540	-461.50	203.17
2541	-460.80	203.32
2542	-461.40	203.46
2543	-461.70	203.61
2544	-459.30	203.76
2545	-458.80	203.90
2546	-460.80	204.05
2547	-456.90	204.20
2548	-457.60	204.34
2549	-456.80	204.49
2550	-456.30	204.64
2551	-456.40	204.78
2552	-456.10	204.93
2553	-457.00	205.08
2554	-453.20	205.22
2555	-452.10	205.37
2556	-453.90	205.52
2557	-456.20	205.66
2558	-457.30	205.81
2559	-455.80	205.96
2560	-456.40	206.10
2561	-453.40	206.25
2562	-450.00	206.40
2563	-450.80	206.55
2564	-451.00	206.69
2565	-452.50	206.84
2566	-451.80	206.99
2567	-449.00	207.13
2568	-447.90	207.28
2569	-448.30	207.43
2570	-450.90	207.57
2571	-451.10	207.72
2572	-450.50	207.87
2573	-450.30	208.01
2574	-448.80	208.16
2575	-450.80	208.31

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

2576	-452.00	208.45
2577	-447.20	208.60
2578	-447.40	208.75
2579	-446.10	208.89
2580	-448.30	209.04
2581	-447.70	209.19
2582	-447.50	209.33
2583	-445.20	209.48
2584	-445.10	209.63
2585	-447.80	209.77
2586	-445.30	209.92
2587	-444.40	210.07
2588	-447.20	210.21
2589	-446.00	210.36
2590	-445.50	210.51
2591	-446.40	210.65
2592	-447.80	210.80
2593	-444.10	210.95
2594	-443.50	211.09
2595	-444.90	211.24
2596	-444.40	211.39
2597	-443.80	211.53
2598	-443.80	211.68
2599	-445.00	211.83
2600	-444.80	211.98
2601	-443.50	212.12
2602	-443.00	212.27
2603	-443.60	212.42
2604	-445.20	212.56
2605	-443.50	212.71
2606	-442.50	212.86
2607	-441.10	213.00
2608	-440.40	213.15
2609	-442.20	213.30
2610	-445.30	213.44
2611	-443.50	213.59
2612	-445.50	213.74
2613	-448.40	213.88
2614	-449.00	214.03
2615	-447.30	214.18
2616	-447.40	214.32
2617	-447.10	214.47
2618	-442.80	214.62
2619	-440.70	214.76
2620	-440.20	214.91
2621	-441.70	215.06
2622	-440.70	215.20
2623	-439.40	215.35
2624	-440.30	215.50
2625	-440.90	215.64
2626	-441.30	215.79
2627	-441.10	215.94

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

2628	-447.10	216.08
2629	-446.20	216.23
2630	-445.00	216.38
2631	-445.70	216.52
2632	-446.30	216.67
2633	-447.00	216.82
2634	-449.50	216.96
2635	-453.10	217.11
2636	-452.90	217.26
2637	-451.30	217.41
2638	-451.00	217.55
2639	-451.40	217.70
2640	-452.50	217.85
2641	-453.50	217.99
2642	-450.40	218.14
2643	-453.80	218.29
2644	-459.50	218.43
2645	-459.10	218.58
2646	-458.50	218.73
2647	-459.70	218.87
2648	-463.00	219.02
2649	-462.00	219.17
2650	-459.00	219.31
2651	-459.80	219.46
2652	-463.00	219.61
2653	-462.10	219.75
2654	-462.40	219.90
2655	-467.40	220.05
2656	-469.80	220.19
2657	-468.70	220.34
2658	-468.90	220.49
2659	-469.80	220.63
2660	-474.90	220.78
2661	-476.20	220.93
2662	-471.30	221.07
2663	-473.00	221.22
2664	-474.50	221.37
2665	-473.70	221.51
2666	-476.20	221.66
2667	-478.20	221.81
2668	-478.00	221.95
2669	-477.70	222.10
2670	-476.60	222.25
2671	-478.30	222.39
2672	-475.60	222.54
2673	-472.40	222.69
2674	-467.80	222.83
2675	-469.80	222.98
2676	-469.70	223.13
2677	-467.80	223.28
2678	-462.50	223.42
2679	-468.40	223.57

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

2680	-472.20	223.72
2681	-467.00	223.86
2682	-466.20	224.01
2683	-469.80	224.16
2684	-470.80	224.30
2685	-472.10	224.45
2686	-475.20	224.60
2687	-479.20	224.74
2688	-478.80	224.89
2689	-476.30	225.04
2690	-475.90	225.18
2691	-474.10	225.33
2692	-472.30	225.48
2693	-469.40	225.62
2694	-470.60	225.77
2695	-474.40	225.92
2696	-477.60	226.06
2697	-477.70	226.21
2698	-476.90	226.36
2699	-475.90	226.50
2700	-475.20	226.65
2701	-474.20	226.80
2702	-472.10	226.94
2703	-471.00	227.09
2704	-469.30	227.24
2705	-471.30	227.38
2706	-470.00	227.53
2707	-470.20	227.68
2708	-471.10	227.82
2709	-466.80	227.97
2710	-465.60	228.12
2711	-465.20	228.26
2712	-464.70	228.41
2713	-464.50	228.56
2714	-462.20	228.71
2715	-461.30	228.85
2716	-460.40	229.00
2717	-460.90	229.15
2718	-460.20	229.29
2719	-458.80	229.44
2720	-458.20	229.59
2721	-456.10	229.73
2722	-457.50	229.88
2723	-457.90	230.03
2724	-455.20	230.17
2725	-452.90	230.32
2726	-451.20	230.47
2727	-449.60	230.61
2728	-452.30	230.76
2729	-451.60	230.91
2730	-448.90	231.05
2731	-448.90	231.20

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

2732	-449.10	231.49
2733	-451.50	231.78
2734	-452.20	232.07
2735	-450.20	232.36
2736	-447.10	232.64
2737	-447.00	232.93
2738	-448.90	233.22
2739	-448.20	233.51
2740	-448.00	233.80
2741	-446.60	234.09
2742	-443.90	234.38
2743	-443.60	234.67
2744	-441.80	234.96
2745	-442.10	235.24
2746	-441.90	235.53
2747	-440.60	235.82
2748	-438.50	236.11
2749	-434.20	236.40
2750	-433.80	236.69
2751	-431.80	236.98
2752	-432.50	237.27
2753	-428.40	237.56
2754	-424.10	237.84
2755	-424.00	238.13
2756	-422.40	238.42
2757	-421.10	238.71
2758	-421.70	239.00
2759	-422.80	239.29
2760	-423.60	239.58
2761	-424.10	239.87
2762	-424.70	240.16
2763	-426.10	240.44
2764	-427.10	240.73
2765	-427.80	241.02
2766	-429.50	241.31
2767	-430.20	241.60
2768	-430.70	241.89
2769	-434.40	242.18
2770	-436.50	242.47
2771	-440.90	242.76
2772	-443.60	243.04
2773	-446.20	243.33
2774	-445.50	243.62
2775	-448.20	243.91
2776	-451.10	244.20
2777	-453.00	244.45
2778	-453.60	244.70
2779	-455.30	244.95
2780	-457.10	245.21
2781	-460.90	245.46
2782	-463.30	245.71
2783	-466.60	245.96

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

2784	-469.00	246.21
2785	-468.30	246.46
2786	-466.80	246.71
2787	-466.40	246.96
2788	-466.00	247.22
2789	-465.40	247.47
2790	-461.60	247.72
2791	-461.00	247.97
2792	-462.50	248.22
2793	-464.20	248.47
2794	-467.00	248.72
2795	-469.70	248.98
2796	-472.40	249.23
2797	-473.10	249.48
2798	-473.60	249.73
2799	-473.90	249.98
2800	-473.30	250.23
2801	-471.80	250.48
2802	-471.00	250.74
2803	-471.80	250.99
2804	-474.70	251.24
2805	-474.00	251.49
2806	-472.80	251.74
2807	-472.60	251.99
2808	-472.30	252.24
2809	-474.10	252.49
2810	-473.20	252.75
2811	-471.30	253.00
2812	-472.40	253.25
2813	-474.50	253.50
2814	-474.50	253.75
2815	-474.30	254.00
2816	-475.90	254.25
2817	-476.20	254.51
2818	-475.20	254.76
2819	-472.30	255.01
2820	-470.80	255.26
2821	-470.60	255.51
2822	-468.40	255.76
2823	-470.10	256.01
2824	-470.90	256.27
2825	-468.80	256.52
2826	-463.60	256.77
2827	-463.50	257.02
2828	-466.10	257.27
2829	-469.80	257.52
2830	-470.70	257.77
2831	-470.80	258.02
2832	-469.30	258.28
2833	-472.60	258.53
2834	-474.80	258.78
2835	-470.80	259.03

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

2836	-467.90	259.28
2837	-471.20	259.53
2838	-474.70	259.78
2839	-473.50	260.04
2840	-473.20	260.29
2841	-471.70	260.54
2842	-472.40	260.79
2843	-470.60	261.04
2844	-465.50	261.29
2845	-462.70	261.54
2846	-464.30	261.80
2847	-466.40	262.05
2848	-468.70	262.30
2849	-470.10	262.55
2850	-470.30	262.80
2851	-469.80	263.05
2852	-471.80	263.30
2853	-473.30	263.55
2854	-473.20	263.81
2855	-474.40	264.06
2856	-476.10	264.31
2857	-477.10	264.56
2858	-477.80	264.81
2859	-478.70	265.06
2860	-476.60	265.31
2861	-477.60	265.57
2862	-479.70	265.82
2863	-479.50	266.07
2864	-480.20	266.32
2865	-480.00	266.57
2866	-479.60	266.82
2867	-481.50	267.07
2868	-481.60	267.33
2869	-481.30	267.58
2870	-482.90	267.83
2871	-482.40	268.08
2872	-482.40	268.33
2873	-481.00	268.58
2874	-480.80	268.83
2875	-482.40	269.08
2876	-481.70	269.34
2877	-481.20	269.59
2878	-482.50	269.84
2879	-480.80	270.09
2880	-480.50	270.34
2881	-481.90	270.59
2882	-483.30	270.84
2883	-479.70	271.10
2884	-477.30	271.35
2885	-479.40	271.60
2886	-479.40	271.85
2887	-481.10	272.10

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

2888	-483.80	272.35
2889	-479.10	272.60
2890	-475.50	272.86
2891	-478.10	273.11
2892	-479.00	273.36
2893	-477.80	273.61
2894	-478.50	273.86
2895	-478.50	274.11
2896	-476.30	274.36
2897	-473.80	274.61
2898	-472.20	274.87
2899	-468.40	275.12
2900	-472.40	275.37
2901	-473.40	275.62
2902	-473.80	275.87
2903	-472.70	276.12
2904	-472.40	276.37
2905	-471.70	276.63
2906	-468.60	276.88
2907	-469.00	277.13
2908	-467.80	277.38
2909	-465.70	277.63
2910	-464.90	277.88
2911	-467.10	278.13
2912	-467.70	278.39
2913	-467.30	278.64
2914	-462.30	278.89
2915	-461.20	279.14
2916	-463.20	279.39
2917	-461.80	279.64
2918	-460.60	279.89
2919	-460.30	280.14
2920	-460.30	280.40
2921	-460.40	280.65
2922	-461.80	280.90
2923	-459.20	281.15
2924	-457.70	281.40
2925	-457.60	281.65
2926	-458.60	281.90
2927	-458.70	282.16
2928	-459.80	282.41
2929	-457.50	282.66
2930	-457.40	282.91
2931	-456.40	283.16
2932	-455.50	283.41
2933	-456.20	283.66
2934	-457.10	283.91
2935	-455.50	284.17
2936	-452.70	284.42
2937	-453.50	284.67
2938	-455.50	284.92
2939	-457.20	285.17

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

2940	-459.30	285.42
2941	-459.60	285.67
2942	-462.30	285.93
2943	-462.40	286.18
2944	-462.20	286.43
2945	-462.10	286.68
2946	-462.10	286.93
2947	-463.40	287.18
2948	-465.90	287.43
2949	-468.20	287.69
2950	-472.20	287.94
2951	-472.20	288.19
2952	-469.10	288.44
2953	-466.60	288.69
2954	-468.60	288.94
2955	-471.20	289.19
2956	-473.40	289.44
2957	-472.60	289.70
2958	-469.90	289.95
2959	-468.10	290.20
2960	-464.90	290.45
2961	-463.00	290.70
2962	-465.20	290.95
2963	-467.10	291.20
2964	-467.00	291.46
2965	-469.40	291.71
2966	-474.70	291.96
2967	-477.30	292.21
2968	-477.50	292.46
2969	-478.40	292.71
2970	-475.60	292.96
2971	-473.00	293.22
2972	-472.00	293.47
2973	-471.20	293.72
2974	-470.20	293.97
2975	-470.60	294.22
2976	-469.50	294.47
2977	-467.50	294.72
2978	-465.50	294.97
2979	-464.40	295.23
2980	-468.00	295.48
2981	-468.80	295.73
2982	-472.10	295.98
2983	-473.10	296.23
2984	-470.50	296.48
2985	-468.20	296.73
2986	-467.60	296.99
2987	-470.30	297.24
2988	-470.40	297.49
2989	-466.80	297.74
2990	-465.40	297.99
2991	-462.50	298.24

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

2992	-464.30	298.49
2993	-465.20	298.75
2994	-462.60	299.00
2995	-459.70	299.25
2996	-456.10	299.50
2997	-455.80	299.75
2998	-457.10	300.00
2999	-463.70	300.25
3000	-466.50	300.50
3001	-467.30	300.76
3002	-468.90	301.01
3003	-471.70	301.26
3004	-468.70	301.51
3005	-467.40	301.76
3006	-466.20	302.01
3007	-465.20	302.26
3008	-465.10	302.52
3009	-462.90	302.77
3010	-462.70	303.02
3011	-465.80	303.27
3012	-465.10	303.52
3013	-464.50	303.77
3014	-465.10	304.02
3015	-463.90	304.28
3016	-463.20	304.53
3017	-462.70	304.78
3018	-461.00	305.03
3019	-458.70	305.28
3020	-460.10	305.53
3021	-458.00	305.78
3022	-456.60	306.03
3023	-455.00	306.29
3024	-454.40	306.54
3025	-455.50	306.79
3026	-454.70	307.04
3027	-453.70	307.29
3028	-454.90	307.54
3029	-453.40	307.79
3030	-455.80	308.05
3031	-451.00	308.30
3032	-452.40	308.55
3033	-457.70	308.80
3034	-455.00	309.05
3035	-449.50	309.30
3036	-448.00	309.55
3037	-446.20	309.81
3038	-449.80	310.06
3039	-453.00	310.31
3040	-453.90	310.56
3041	-456.50	310.81
3042	-459.00	311.06
3043	-460.50	311.31

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

3044	-461.60	311.56
3045	-464.60	311.82
3046	-466.50	312.07
3047	-468.20	312.32
3048	-468.90	312.57
3049	-466.50	312.82
3050	-466.20	313.07
3051	-464.00	313.32
3052	-463.20	313.58
3053	-463.90	313.83
3054	-462.20	314.08
3055	-460.30	314.33
3056	-459.50	314.58
3057	-459.00	314.83
3058	-458.80	315.08
3059	-458.00	315.34
3060	-456.20	315.59
3061	-455.80	315.84
3062	-454.30	316.09
3063	-452.60	316.34
3064	-451.20	316.59
3065	-450.40	316.84
3066	-450.10	317.09
3067	-449.50	317.35
3068	-450.90	317.60
3069	-450.40	317.85
3070	-450.10	318.10
3071	-447.90	318.36
3072	-447.20	318.61
3073	-446.20	318.87
3074	-444.70	319.13
3075	-445.00	319.38
3076	-445.00	319.64
3077	-444.80	319.89
3078	-443.60	320.15
3079	-443.00	320.41
3080	-443.00	320.66
3081	-441.10	320.92
3082	-440.30	321.17
3083	-440.30	321.43
3084	-440.70	321.69
3085	-438.80	321.94
3086	-438.90	322.20
3087	-439.90	322.46
3088	-439.20	322.71
3089	-440.40	322.97
3090	-440.60	323.23
3091	-439.00	323.48
3092	-438.40	323.74
3093	-438.10	323.99
3094	-437.00	324.25
3095	-438.10	324.51

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

3096	-437.90	324.76
3097	-436.90	325.02
3098	-436.30	325.27
3099	-436.70	325.53
3100	-438.20	325.79
3101	-438.40	326.04
3102	-437.70	326.30
3103	-434.70	326.56
3104	-430.00	326.81
3105	-429.10	327.07
3106	-426.50	327.33
3107	-423.20	327.58
3108	-420.20	327.84
3109	-418.80	328.09
3110	-418.70	328.35
3111	-416.20	328.61
3112	-415.90	328.86
3113	-416.20	329.12
3114	-415.80	329.38
3115	-414.90	329.63
3116	-415.20	329.89
3117	-415.50	330.14
3118	-414.80	330.40
3119	-415.60	330.66
3120	-417.20	330.91
3121	-419.00	331.17
3122	-420.30	331.42
3123	-421.00	331.68
3124	-426.30	331.94
3125	-430.00	332.19
3126	-431.70	332.45
3127	-435.90	332.71
3128	-440.50	332.96
3129	-444.40	333.22
3130	-444.50	333.48
3131	-445.40	333.73
3132	-445.90	333.99
3133	-448.30	334.24
3134	-450.60	334.50
3135	-452.30	334.98
3136	-455.60	335.45
3137	-457.80	335.93
3138	-459.90	336.41
3139	-461.40	336.88
3140	-465.00	337.36
3141	-465.80	337.84
3142	-467.80	338.31
3143	-471.50	338.79
3144	-475.80	339.27
3145	-479.40	339.74
3146	-480.70	340.22
3147	-480.30	340.70

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

3148	-480.40	341.17
3149	-480.10	341.65
3150	-478.40	342.12
3151	-476.60	342.60
3152	-477.50	343.08
3153	-476.70	343.55
3154	-477.40	344.03
3155	-475.80	344.51
3156	-476.60	344.98
3157	-477.20	345.46
3158	-474.60	345.94
3159	-475.50	346.41
3160	-477.30	346.89
3161	-473.90	347.37
3162	-470.40	347.84
3163	-470.00	348.32
3164	-470.30	348.80
3165	-471.80	349.27
3166	-472.00	349.75
3167	-472.60	350.23
3168	-473.00	350.70
3169	-470.50	351.18
3170	-471.30	351.66
3171	-471.70	352.13
3172	-472.30	352.61
3173	-472.80	353.09
3174	-472.70	353.56
3175	-473.30	354.04
3176	-474.10	354.52
3177	-473.90	354.99
3178	-475.80	355.47
3179	-477.60	355.95
3180	-477.80	356.42
3181	-477.90	356.90
3182	-477.50	357.37
3183	-478.00	357.85
3184	-478.90	358.33
3185	-478.60	358.80
3186	-478.70	359.28
3187	-477.30	359.76
3188	-477.10	360.23
3189	-475.50	360.71
3190	-474.50	361.19
3191	-476.40	361.66
3192	-475.10	362.14
3193	-472.60	362.62
3194	-471.60	363.09
3195	-473.20	363.57
3196	-471.90	364.05
3197	-468.30	364.52
3198	-468.90	365.00
3199	-469.90	365.48

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

3200	-471.10	365.95
3201	-468.40	366.43
3202	-469.10	366.91
3203	-470.90	367.38
3204	-468.00	367.86
3205	-468.70	368.34
3206	-470.90	368.81
3207	-468.90	369.29
3208	-466.00	369.77
3209	-464.30	370.24
3210	-462.50	370.72
3211	-462.60	371.20
3212	-463.30	371.67
3213	-460.20	372.15
3214	-457.60	372.63
3215	-460.70	373.10
3216	-464.90	373.58
3217	-466.10	374.05
3218	-468.10	374.53
3219	-473.80	375.01
3220	-473.30	375.48
3221	-470.80	375.96
3222	-469.40	376.44
3223	-468.00	376.91
3224	-466.10	377.39
3225	-465.80	377.87
3226	-464.80	378.34
3227	-461.70	378.82
3228	-458.90	379.30
3229	-454.20	379.77
3230	-452.60	380.25
3231	-457.10	380.73
3232	-460.60	381.20
3233	-462.70	381.68
3234	-464.30	382.16
3235	-463.10	382.63
3236	-461.00	383.11
3237	-459.40	383.59
3238	-457.40	384.06
3239	-452.60	384.54
3240	-451.40	385.02
3241	-450.10	385.49
3242	-454.50	385.97
3243	-459.60	386.45
3244	-462.20	386.92
3245	-467.10	387.40
3246	-468.80	387.88
3247	-467.60	388.35
3248	-467.20	388.83
3249	-464.80	389.30
3250	-465.10	389.78
3251	-467.30	390.26

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

3252	-466.70	390.73
3253	-466.80	391.21
3254	-468.30	391.69
3255	-465.70	392.16
3256	-466.60	392.64
3257	-467.20	393.12
3258	-465.00	393.59
3259	-460.30	394.07
3260	-455.60	394.55
3261	-451.90	395.02
3262	-450.50	395.50
3263	-448.60	395.98
3264	-448.30	396.45
3265	-447.20	396.93
3266	-445.90	397.41
3267	-445.90	397.88
3268	-446.00	398.36
3269	-445.80	398.84
3270	-443.50	399.31
3271	-443.20	399.79
3272	-444.40	400.27
3273	-444.40	400.74
3274	-443.30	401.22
3275	-440.90	401.70
3276	-439.80	402.17
3277	-439.50	402.65
3278	-438.60	403.12
3279	-437.10	403.60
3280	-436.50	404.08
3281	-435.60	404.55
3282	-434.40	405.03
3283	-433.70	405.51
3284	-433.30	405.98
3285	-432.30	406.46
3286	-431.40	406.94
3287	-429.30	407.41
3288	-426.40	407.89
3289	-431.60	408.37
3290	-431.20	408.84
3291	-431.90	409.32
3292	-432.40	409.80
3293	-432.80	410.27
3294	-434.50	410.75
3295	-434.20	411.23
3296	-432.80	411.70
3297	-432.20	412.18
3298	-432.30	412.66
3299	-431.10	413.13
3300	-430.80	413.61
3301	-430.30	414.09
3302	-430.40	414.56
3303	-431.10	415.04

Table 4. For Vostok ice core record at core depth in meters below surface, the values of δD (from Petit and others, 1999) and ages, in thousands of years, for the V-DH chronology, as defined by Landwehr and Winograd (2001) -- continued

3304	-433.00	415.52
3305	-435.50	415.99
3306	-435.20	416.47
3307	-436.40	416.95
3308	-437.30	417.42
3309	-437.60	417.90
3310	-436.60	418.37

Table 5. For the Vostok ice core record at core depth in meters below surface (mbs), the values of δD (from Petit and others, 1999) and ages, in thousands of years, based on the Devils Hole core DH-11 record, for control points at 3262 mbs, 3320 mbs, and 3329 mbs, as developed by Landwehr and Winograd (2001)

Core Depth (meters below surface)	δD (‰)	Age (thousands of years)
3262	-450.50	395.50
3263	-448.60	395.79
3264	-448.30	396.08
3265	-447.20	396.36
3266	-445.90	396.65
3267	-445.90	396.94
3268	-446.00	397.23
3269	-445.80	397.52
3270	-443.50	397.81
3271	-443.20	398.09
3272	-444.40	398.38
3273	-444.40	398.67
3274	-443.30	398.96
3275	-440.90	399.25
3276	-439.80	399.53
3277	-439.50	399.82
3278	-438.60	400.11
3279	-437.10	400.40
3280	-436.50	400.69
3281	-435.60	400.97
3282	-434.40	401.26
3283	-433.70	401.55
3284	-433.30	401.84
3285	-432.30	402.13
3286	-431.40	402.42
3287	-429.30	402.70
3288	-426.40	402.99
3289	-431.60	403.28
3290	-431.20	403.57
3291	-431.90	403.86
3292	-432.40	404.14
3293	-432.80	404.43
3294	-434.50	404.72
3295	-434.20	405.01
3296	-432.80	405.30

Table 5. For the Vostok ice core record at core depth in meters below surface (mbs), the values of δD (from Petit and others, 1999) and ages, in thousands of years, based on the Devils Hole core DH-11 record, for control points at 3262 mbs, 3320mbs, and 3329 mbs, as developed by Landwehr and Winograd (2001) -- continued

3297	-432.20	405.58
3298	-432.30	405.87
3299	-431.10	406.16
3300	-430.80	406.45
3301	-430.30	406.74
3302	-430.40	407.03
3303	-431.10	407.31
3304	-433.00	407.60
3305	-435.50	407.89
3306	-435.20	408.18
3307	-436.40	408.47
3308	-437.30	408.75
3309	-437.60	409.04
3310	-436.60	409.33
3311	-435.10	409.62
3312	-434.40	409.91
3313	-436.10	410.19
3314	-437.00	410.48
3315	-435.70	410.77
3316	-434.30	411.06
3317	-435.10	411.35
3318	-436.40	411.64
3319	-435.20	411.92
3320	-438.40	412.21
3321	-456.10	412.50
3322	-471.30	418.35
3323	-475.30	424.19
3324	-477.40	430.04
3325	-478.10	435.89
3326	-477.40	441.74
3327	-470.90	447.58
3328	-459.20	453.43
3329	-448.50	459.28