

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

GRAY MILNE TRUST

# SEISMOLOGICAL TABLES

BY

**HAROLD JEFFREYS**

M.A., D.Sc., F.R.S.

AND

**K. E. BULLEN**

M.A., B.Sc., Ph.D.

LONDON

OFFICE OF THE BRITISH ASSOCIATION

BURLINGTON HOUSE, W.1

1967

A

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

GRAY MILNE TRUST

First Published 1940  
Printed by  
Neill & Co. Ltd., Edinburgh

Reprinted 1958  
by Percy Lund, Humphries  
The Country Press, Bradford

Reprinted 1967  
by Smith & Ritchie Ltd., Edinburgh

K. E. BULLEN  
M.A., B.Sc., Ph.D.

LONDON

OFFICE OF THE BRITISH ASSOCIATION

BURLINGTON HOUSE, W.1

1967

## INTRODUCTION

By Harold Jeffreys

A solid can transmit both longitudinal and transverse waves through its interior, the former travelling faster; hence the longitudinal waves are usually denoted by the letter *P* for *primary* and the transverse ones by *S* for *secondary*. The words *push* or *pull* and *shake* may be taken as descriptive of the movement. At any place they have definite velocities independent of the wave-length; but in the earth the velocities vary with distance from the centre and the paths, corresponding to the rays in optics, are curved. At interfaces between different materials, and at free surfaces, reflexion can take place, and refraction also occurs at interfaces. The behaviour on reflexion and refraction is more complicated than in optics, because in general two new waves in each medium are generated; thus a *P*-wave incident at a free surface gives both a reflected *P* and a reflected *S*, and so does an incident *S*, while either type incident on an interface gives a reflected *P* and *S* and also a transmitted pair. The angles of incidence are related according to the principle of stationary time in all cases. A *P* wave reflected at the outer surface as *P* is denoted by *PP*, one reflected as *S* by *PS*; similarly an *S* wave reflected as *S* is denoted by *SS*, and one reflected as *P* by *SP*. This notation can be extended indefinitely; thus *SSPP* would mean a wave reflected three times, being of *S* type in the first two stages of its path and of *P* type in the third and fourth. Many earthquakes occur at appreciable depths, and for these there is another complication because reflected waves then do not occur within a certain distance, and beyond that distance they are duplicated. *PP* in a shallow earthquake, for instance, is reflected at half the distance to the observing station; in a deep one reflexion occurs at about this distance, and this reflexion is still denoted by *PP*, but there is also reflexion near the epicentre, analogous to the rays apparently proceeding from the image in a concave mirror. These near reflexions are denoted by *pP*, *sP*, *sS* and so on, and the intervals between the arrival of *P* and *pP*, *S* and *sS* at a given station give valuable information about the depth of the focus.

At a depth of about 0.45 of the radius there is a discontinuity, originally inferred by R. D. Oldham; the velocity of *P* there decreases suddenly with depth, and *S* below it does not appear to exist. For this and other reasons this central core is generally believed to be liquid. Several notations have been used for waves through it; here they are denoted by *K*, following

Sohon. Thus a wave starting as  $P$ , transmitted into the core, and again emerging as  $P$ , is denoted by  $PKP$ ; one starting as  $S$ , passing through the core, and emerging as  $S$ , by  $SKS$ , and so on. There are also reflected waves  $PcP$ ,  $PcS$ ,  $ScS$ , reflected on the outside of the core; the letter  $c$  is needed here to distinguish them from  $PP$ ,  $PS$ ,  $SS$ , reflected at the outer surface. The notation can again be extended; thus  $SKKS$  is a wave starting as  $S$ , transmitted into the core, once reflected inside the core boundary, and emerging as  $S$ .

In the continents there are one or more upper layers, resting on the main layer that extends down to the core. Comparison of waves in these layers in different regions seems to show appreciable differences. Most of the evidence appears to favour an upper layer transmitting waves denoted by  $Pg$  and  $Sg$ , and an intermediate one transmitting  $P^*$  and  $S^*$ .  $P$  and  $S$  without suffixes always refer to waves that have passed beneath these layers. The corresponding results for the ocean floors are not known, but it is suggested that the tables computed for continental foci should be used as a basis of comparison until evidence leads to definite estimates of the differences.

Since the publication of the tables of Dr. Bullen and myself in 1935, and their adoption as a basis of comparison in the International Seismological Summary, some systematic errors have been corrected and much additional observational material has been used. Apart from near earthquake phases, empirical times are now available for  $P$ ,  $S$ ,  $PcP$ ,  $ScS$ ,  $PKP$  and  $SKS$ , mostly with standard errors of under a second. These have been used as the basic tables, and all others are calculated from them by means of the principle of stationary time. The phases in the upper layers are not altogether satisfactory, since estimates relevant to crustal structure derived from different earthquakes do not agree so closely as would be expected from their apparent accuracy. The structure finally adopted is based on the  $pP-P$  and  $sS-S$  intervals in Japanese deep-focus earthquakes, and on Stoneley's studies of the dispersion of surface waves. The upper layer is taken to be  $15 \pm 3$  km. thick, the intermediate one  $18 \pm 4$  km. The velocities in these are taken from European studies.

A main object has been to construct a self-consistent standard of comparison. It is somewhat surprising that differences between travel times in different regions are so small, but there is some evidence that they exist. For  $P$ , the times rest mostly on European observations of European and American earthquakes, but there are signs that those for South Pacific earthquakes about  $50^\circ$  are about  $1^s.5$  shorter (the ellipticity terms being taken into account) and those in North American ones about  $20^\circ$  about  $3^s$  longer. In the Japanese deep shocks there was an unexplained variation between different earthquakes in the times of  $S$ , with a mean square value of about  $1^s.3$ , in addition to any attributable to errors of focal depth; this was not shared by  $SKS$ . A uniform and consistent standard is necessary for the study of such variations; the tables represent average times, so that no change is possible in the basic phases without making the agreement with observation worse for at least some earthquakes.

*P* and *S* appear to have loops in their time-curves about  $20^\circ$ . The upper parts of the loops have not been observed directly, but have been somewhat tentatively reconstructed from observations of deep-focus earthquakes. The first arrivals are given in the main *P* and *S* tables, the distances where the two earlier branches intersect being indicated by the letters *d* and *r*. The upper branches are given in separate tables. Focal depths are given as fractions of the adopted radius of the lower layer, and refer to the depth below the top of this layer or the base of the continental layers, supposed to be 33 km. below the outer surface. For *P* and *S* the times are tabulated fully; for other phases the effect of depth is given by allowances to be subtracted from the times for a surface focus. For core phases other than *PKP*, *SKS*, *PcP* and *ScS*, the allowances for depth may be taken as equal to those for these phases at distances where  $dt/d\Delta$  is the same. Thus if we want the time of *SKKS* at  $150^\circ$  for depth  $0.06R$ , we notice that  $dt/d\Delta$  is  $5^s.5/1^\circ$ , which is matched by *SKS* at  $94^\circ$ ; the depth allowance is then  $89^s$ , and the calculated time of *SKKS* will be  $30^m 18^s - 1^m 29^s = 28^m 49^s$ . For *PKS* the depth allowances will be as for *PcP* with the same  $dt/d\Delta$ , but for *SKP* they will be as for *ScS*. To avoid this complication it is suggested that the times for a surface focus should be used as the standard unless a definite estimate of focal depth is obtainable, so that *PS* and *SP*, *PKS* and *SKP* and so on can be treated alike.

*S* up to about  $25^\circ$  is not satisfactorily readable in normal earthquakes, but is very clear in deep ones; the times are based on the latter. In most normal earthquakes *S* seems to be small at these distances, though it can be sometimes recognized by the change of direction of the movement. The nature of the large movements scattered over  $30^s$  or so that are often reported as *S* in these conditions is not yet clear, but they are not *S*; and the *S-P* interval at these distances should not be used to estimate the distance if this is required within  $3^\circ$ . At greater distances *S* is satisfactory except that many earthquakes appear to be multiple, and observers often read the *P* of the first shock and the *S* of the second. This complication has sometimes led to the attribution of "high focus" to normal earthquakes.

Times of basic phases and a few others are given to  $0^s.1$ ; the uncertainties of the total times are larger, but often under  $1^s$ , and differencing is easier if the times are given to  $0^s.1$ . Phases often read but not very satisfactorily, sometimes on account of indistinct beginnings, are given to  $1^s$  at intervals of  $1^\circ$ . Other phases that have occasionally been read or may be read in the future are given to  $1^s$  at wider intervals.

The tables of *K*, *KIK* and *I* represent times within the core itself and the inner core; they are inferred from the basic observed phases and used in the calculation of others. Figs. 1, 2 and 3 show diagrammatically the forms of the time-curves for various core phases. *K*, *SKS* and *SKKS* are of the form shown in fig. 1, with a single loop. *PKP* resembles fig. 2, the cusp at B being an additional feature; while *PcPPKP* and *PcSPKP* resemble fig. 3, which differs from fig. 2 in the fact that the DF branch passes below the cusp at B. The DE branch of *PKP* corresponds to what was until recently considered to be diffracted movement within the shadow

**B**

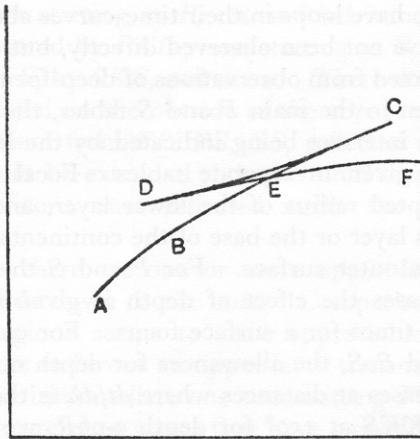


FIG. 1.

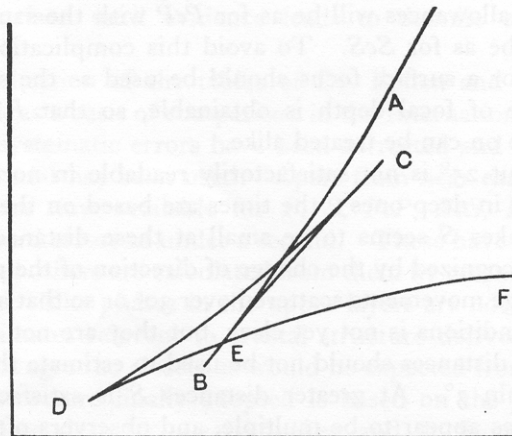


FIG. 2.

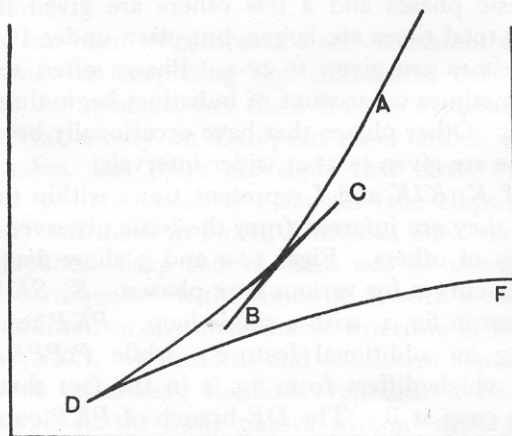


FIG. 3.

zone, but recent work has shown that the nature of the movement is very different from what diffraction would produce, and in these tables the hypothesis of an inner core, introduced by Lehmann and developed by Gutenberg and Richter, has been used. The distribution of velocities corresponding to these times is shown in fig. 4, and the times of the phases, observed or calculated, are shown graphically for a surface focus

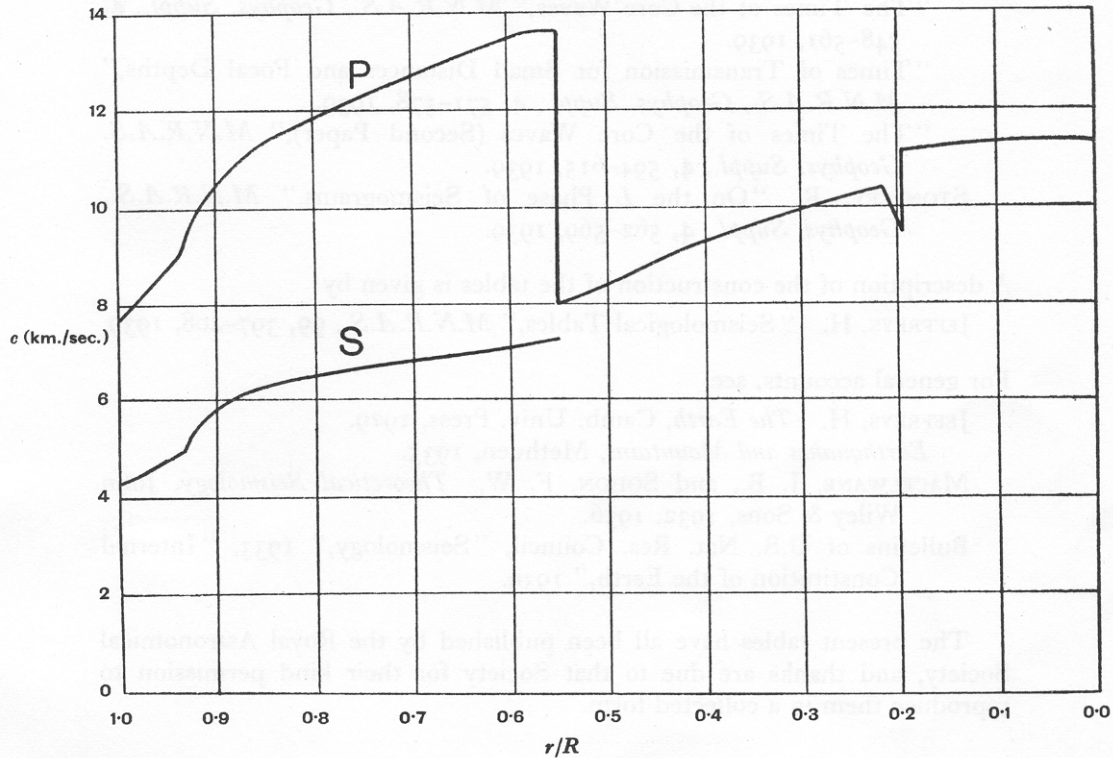


FIG. 4.

in fig. 5. The curves LQ and LR corresponding to the beginnings of the surface waves of Love and Rayleigh types are based on an analysis by Stoneley.

To obtain the highest accuracy geocentric distances should be used. Geocentric direction cosines of the observing stations, compiled by Dr. L. J. Comrie, have been published by the British Association Seismological Committee, which has also published a table due to Bullen of the corrections needed to convert geographic to geocentric distances. Particulars of the method are given in these pamphlets, with references to other literature. Later references, including the construction of the present tables, are as follows:—

BULLEN, K. E. "Theoretical Travel Times of the Phases *PP*, *PPP*, *PS*, *PPS*, *SS*, *PSS* and *SSS*," *M.N.R.A.S., Geophys. Suppl.*, 4, 583-593, 1939.

- JEFFREYS, H. "Some Japanese Deep-focus Earthquakes," *M.N.R.A.S., Geophys. Suppl.*, 4, 424-460, 1939.
- "The Times of *P*, *S* and *SKS*, and the Velocities of *P* and *S*," *M.N.R.A.S., Geophys. Suppl.*, 4, 498-533, 1939.
- "The Times of *PcP* and *ScS*," *M.N.R.A.S., Geophys. Suppl.*, 4, 537-547, 1939.
- "The Times of the Core Waves," *M.N.R.A.S., Geophys. Suppl.*, 4, 548-561, 1939.
- "Times of Transmission for Small Distances and Focal Depths," *M.N.R.A.S., Geophys. Suppl.*, 4, 571-578, 1939.
- "The Times of the Core Waves (Second Paper)," *M.N.R.A.S. Geophys. Suppl.*, 4, 594-615, 1939.
- STONELEY, R. "On the *L* Phase of Seismograms," *M.N.R.A.S., Geophys. Suppl.*, 4, 562-569, 1939.

A description of the construction of the tables is given by

- JEFFREYS, H. "Seismological Tables," *M.N.R.A.S.*, 99, 397-408, 1939.

For general accounts, see

- JEFFREYS, H. *The Earth*, Camb. Univ. Press, 1929.  
*Earthquakes and Mountains*, Methuen, 1935.
- MACELWANE, J. B., and SOHON, F. W. *Theoretical Seismology*, John Wiley & Sons, 1932, 1936.
- Bulletins of U.S. Nat. Res. Council, "Seismology," 1933, "Internal Constitution of the Earth," 1939.

The present tables have all been published by the Royal Astronomical Society, and thanks are due to that Society for their kind permission to reproduce them in a collected form.

TABLES

TABLE I  
 1957-58  
 1958-59  
 1959-60  
 1960-61  
 1961-62  
 1962-63  
 1963-64  
 1964-65  
 1965-66  
 1966-67  
 1967-68  
 1968-69  
 1969-70  
 1970-71  
 1971-72  
 1972-73  
 1973-74  
 1974-75  
 1975-76  
 1976-77  
 1977-78  
 1978-79  
 1979-80  
 1980-81  
 1981-82  
 1982-83  
 1983-84  
 1984-85  
 1985-86  
 1986-87  
 1987-88  
 1988-89  
 1989-90  
 1990-91  
 1991-92  
 1992-93  
 1993-94  
 1994-95  
 1995-96  
 1996-97  
 1997-98  
 1998-99  
 1999-00  
 2000-01  
 2001-02  
 2002-03  
 2003-04  
 2004-05  
 2005-06  
 2006-07  
 2007-08  
 2008-09  
 2009-10  
 2010-11  
 2011-12  
 2012-13  
 2013-14  
 2014-15  
 2015-16  
 2016-17  
 2017-18  
 2018-19  
 2019-20  
 2020-21  
 2021-22  
 2022-23  
 2023-24  
 2024-25  
 2025-26  
 2026-27  
 2027-28  
 2028-29  
 2029-30

C

TIMES OF P

Δ	Depth <i>h</i> =													
	Surface	33		97		161		225		289		353		
		0.00		0.01		0.02		0.03		0.04		0.05		
o	m	s	m	s	m	s	m	s	m	s	m	s	m	s
0.0		(6.8)		5.4		13.5		21.4		29.1		36.6		43.9
0.5		14.0	72	10.5	72	15.6	21	22.6	12	29.9	8	37.2	19	44.4
1.0		21.1	71	17.7	71	20.4	63	25.8	32	32.3	24	39.1	32	45.9
1.5		28.2	72	24.8	72	26.7	62	30.6	48	36.0	37	42.3	35	48.4
2.0		35.4	72	32.0	71	32.9	69	36.0	54	40.6	46	45.8	35	51.6
2.5		42.6	71	39.1	72	39.8	69	42.1	63	45.7	56	50.3	49	55.4
3.0		49.7	71	46.3	71	46.7	69	48.4	64	51.3	58	55.2	52	59.7
3.5		56.8	71	53.4	71	53.6	68	54.8	65	57.1	61	1 00.4	56	1 04.4
4.0		1 03.9	71	1 00.5	71	1 00.4	68	1 01.3	65	1 03.2	62	1 06.0	57	1 09.4
4.5		1 11.0	71	1 07.6	71	1 07.2	69	1 07.8	66	1 09.4	62	1 11.7	58	1 14.7
5.0		1 18.1	71	1 14.7	70	1 14.1	68	1 14.4	66	1 15.6	64	1 17.5	60	1 20.1
5.5		1 25.2	70	1 21.7	70	1 20.9	68	1 21.0	66	1 22.0	63	1 23.5	60	1 25.7
6.0		1 32.2	71	1 28.7	71	1 27.7	69	1 27.6	67	1 28.3	64	1 29.5	61	1 31.4
6.5		1 39.3	70	1 35.8	70	1 34.6	70	1 34.3	67	1 34.7	64	1 35.6	62	1 37.2
7.0		1 46.3	70	1 42.8	70	1 41.6	68	1 41.0	67	1 41.1	64	1 41.8	62	1 43.1
7.5		1 53.3	70	1 49.8	69	1 48.4	68	1 47.7	66	1 47.5	65	1 48.0	62	1 49.0
8.0		2 00.3	70	1 56.7	70	1 55.2	68	1 54.3	66	1 54.0	65	1 54.2	62	1 54.9
8.5		2 07.3	69	2 03.7	69	2 02.0	67	2 00.9	66	2 00.5	64	2 00.4	62	2 00.8
9.0		2 14.2	69	2 10.6	69	2 08.7	68	2 07.5	66	2 06.9	64	2 06.6	62	2 06.8
9.5		2 21.1	69	2 17.5	69	2 15.5	67	2 14.1	65	2 13.3	64	2 12.8	62	2 12.8
10.0		2 28.0	137	2 24.4	137	2 22.2	134	2 20.6	131	2 19.7	128	2 19.0	124	2 18.8
11.0		2 41.7	136	2 38.1	135	2 35.6	133	2 33.7	130	2 32.5	126	2 31.4	124	2 30.8
12.0		2 55.3	134	2 51.6	134	2 48.9	132	2 46.7	129	2 45.1	125	2 43.8	122	2 42.8
13.0		3 08.7	132	3 05.0	131	3 02.1	129	2 59.6	127	2 57.6	124	2 56.0	121	d2 54.7
14.0		3 21.9	131	3 18.1	131	3 15.0	129	3 12.3	126	3 10.0	123	3 08.1	120	r3 06.3
15.0		3 35.0	130	3 31.2	129	3 27.9	126	3 24.9	124	3 22.3	121	d3 20.1	112	3 17.0
16.0		3 48.0	127	3 44.1	126	3 40.5	124	3 37.3	122	d3 34.4	116	r3 31.3	106	3 27.6
17.0		4 00.7	125	3 56.7	125	3 52.9	123	d3 49.5	116	r3 46.0	105	3 41.9	103	3 38.0
18.0		4 13.2	123	4 09.2	123	d4 05.2	113	r4 01.1	105	3 56.5	102	3 52.2	101	3 48.1
19.0		d4 25.5	115	d4 21.5	110	r4 16.5	106	4 11.6	103	4 06.7	102	4 02.3	99	3 58.1
20.0		r4 37.0	104	r4 32.5	104	4 27.1	102	4 21.9	100	4 16.9	99	4 12.2	98	4 07.9
21.0		4 47.4	101	4 42.9	100	4 37.3	99	4 31.9	98	4 26.8	97	4 22.0	97	4 17.6
22.0		4 57.5	99	4 52.9	99	4 47.2	97	4 41.7	97	4 36.5	97	4 31.7	95	4 27.2
23.0		5 07.4	97	5 02.8	97	4 56.9	96	4 51.4	96	4 46.2	94	4 41.2	93	4 36.5
24.0		5 17.1	97	5 12.5	97	5 06.5	97	5 01.0	94	4 55.6	93	4 50.5	91	4 45.7
25.0		5 26.8	94	5 22.2	94	5 16.2	93	5 10.4	93	5 04.9	92	4 59.6	91	4 54.7
26.0		5 36.2	92	5 31.6	92	5 25.5	92	5 19.7	91	5 14.1	91	5 08.7	91	5 03.8
27.0		5 45.4	91	5 40.8	91	5 34.7	91	5 28.8	91	5 23.2	90	5 17.8	90	5 12.8
28.0		5 54.5	90	5 49.9	89	5 43.8	89	5 37.9	89	5 32.2	89	5 26.8	88	5 21.7
29.0		6 03.5	90	5 58.8	89	5 52.7	89	5 46.8	89	5 41.1	88	5 35.6	88	5 30.5
30.0		6 12.5		6 07.7		6 01.6		5 55.7		5 49.9		5 44.4		5 39.2

TIMES OF P

Δ	Depth <i>h</i> =						
	417	481	545	609	673		
	0.06	0.07	0.08	0.09	0.10	0.11	0.12
°	m s	m s	m s	m s	m s	m s	m s
0.0	51.1	58.0	1 04.5	1 10.8	1 16.8	1 22.8	1 28.8
0.5	51.5 <sup>4</sup>	58.3 <sup>3</sup>	1 04.8 <sup>3</sup>	1 11.0 <sup>2</sup>	1 17.0 <sup>2</sup>	1 23.0 <sup>2</sup>	1 29.0 <sup>2</sup>
1.0	52.7 <sup>12</sup>	59.3 <sup>10</sup>	1 05.7 <sup>9</sup>	1 11.8 <sup>8</sup>	1 17.7 <sup>7</sup>	1 23.6 <sup>6</sup>	1 29.5 <sup>5</sup>
1.5	54.8 <sup>21</sup>	1 01.0 <sup>17</sup>	1 07.2 <sup>15</sup>	1 13.1 <sup>13</sup>	1 18.8 <sup>11</sup>	1 24.6 <sup>10</sup>	1 30.3 <sup>8</sup>
2.0	57.6 <sup>28</sup>	1 03.4 <sup>24</sup>	1 09.2 <sup>20</sup>	1 14.8 <sup>17</sup>	1 20.3 <sup>15</sup>	1 25.9 <sup>13</sup>	1 31.5 <sup>12</sup>
		33 <sup>29</sup>		23 <sup>26</sup>	20 <sup>23</sup>	18 <sup>20</sup>	15 <sup>18</sup>
2.5	1 00.9 <sup>37</sup>	1 06.3 <sup>34</sup>	1 11.8 <sup>30</sup>	1 17.1 <sup>27</sup>	1 22.3 <sup>24</sup>	1 27.7 <sup>21</sup>	1 33.0 <sup>19</sup>
3.0	1 04.6 <sup>43</sup>	1 09.7 <sup>37</sup>	1 14.8 <sup>33</sup>	1 19.8 <sup>30</sup>	1 24.7 <sup>28</sup>	1 29.8 <sup>25</sup>	1 34.9 <sup>23</sup>
3.5	1 08.9 <sup>45</sup>	1 13.4 <sup>41</sup>	1 18.1 <sup>36</sup>	1 22.8 <sup>34</sup>	1 27.5 <sup>31</sup>	1 32.3 <sup>28</sup>	1 37.2 <sup>25</sup>
4.0	1 13.4 <sup>48</sup>	1 17.5 <sup>44</sup>	1 21.7 <sup>40</sup>	1 26.2 <sup>35</sup>	1 30.6 <sup>31</sup>	1 35.1 <sup>28</sup>	1 39.7 <sup>25</sup>
4.5	1 18.2 <sup>51</sup>	1 21.9 <sup>46</sup>	1 25.7 <sup>42</sup>	1 29.7 <sup>38</sup>	1 33.7 <sup>36</sup>	1 38.3 <sup>32</sup>	1 42.4 <sup>27</sup>
		51 <sup>46</sup>		42 <sup>38</sup>	36 <sup>36</sup>	31 <sup>31</sup>	30 <sup>27</sup>
5.0	1 23.3 <sup>51</sup>	1 26.5 <sup>48</sup>	1 29.9 <sup>44</sup>	1 33.5 <sup>41</sup>	1 37.3 <sup>36</sup>	1 41.4 <sup>34</sup>	1 45.4 <sup>32</sup>
5.5	1 28.4 <sup>53</sup>	1 31.3 <sup>50</sup>	1 34.3 <sup>46</sup>	1 37.6 <sup>42</sup>	1 40.9 <sup>39</sup>	1 44.8 <sup>34</sup>	1 48.6 <sup>33</sup>
6.0	1 33.7 <sup>55</sup>	1 36.3 <sup>51</sup>	1 38.9 <sup>47</sup>	1 41.8 <sup>43</sup>	1 44.8 <sup>41</sup>	1 48.2 <sup>38</sup>	1 51.9 <sup>34</sup>
6.5	1 39.2 <sup>56</sup>	1 41.4 <sup>51</sup>	1 43.6 <sup>48</sup>	1 46.1 <sup>45</sup>	1 48.9 <sup>42</sup>	1 52.0 <sup>39</sup>	1 55.3 <sup>36</sup>
7.0	1 44.8 <sup>56</sup>	1 46.5 <sup>53</sup>	1 48.4 <sup>49</sup>	1 50.6 <sup>46</sup>	1 53.1 <sup>43</sup>	1 55.9 <sup>40</sup>	1 58.9 <sup>37</sup>
		56 <sup>53</sup>		46 <sup>46</sup>	43 <sup>43</sup>	40 <sup>40</sup>	37 <sup>37</sup>
7.5	1 50.4 <sup>57</sup>	1 51.8 <sup>53</sup>	1 53.3 <sup>50</sup>	1 55.2 <sup>46</sup>	1 57.4 <sup>43</sup>	1 59.9 <sup>41</sup>	2 02.6 <sup>39</sup>
8.0	1 56.1 <sup>57</sup>	1 57.1 <sup>54</sup>	1 58.3 <sup>50</sup>	1 59.8 <sup>47</sup>	2 01.7 <sup>45</sup>	2 04.0 <sup>42</sup>	2 06.5 <sup>40</sup>
8.5	2 01.8 <sup>57</sup>	2 02.5 <sup>54</sup>	2 03.3 <sup>51</sup>	2 04.5 <sup>48</sup>	2 06.2 <sup>45</sup>	2 08.2 <sup>43</sup>	2 10.5 <sup>40</sup>
9.0	2 07.5 <sup>57</sup>	2 07.9 <sup>54</sup>	2 08.4 <sup>51</sup>	2 09.3 <sup>48</sup>	2 10.7 <sup>45</sup>	2 12.5 <sup>43</sup>	2 14.5 <sup>40</sup>
9.5	2 13.2 <sup>58</sup>	2 13.3 <sup>53</sup>	2 13.5 <sup>51</sup>	2 14.1 <sup>48</sup>	2 15.3 <sup>46</sup>	2 16.8 <sup>43</sup>	2 18.6 <sup>41</sup>
		58 <sup>53</sup>		51 <sup>48</sup>	46 <sup>46</sup>	44 <sup>44</sup>	41 <sup>41</sup>
10.0	2 19.0 <sup>116</sup>	2 18.6 <sup>107</sup>	2 18.6 <sup>102</sup>	2 18.9 <sup>98</sup>	2 19.9 <sup>92</sup>	2 21.2 <sup>88</sup>	2 22.7 <sup>85</sup>
11.0	2 30.6 <sup>112</sup>	2 29.3 <sup>106</sup>	2 28.8 <sup>101</sup>	2 28.7 <sup>99</sup>	2 29.1 <sup>95</sup>	2 30.0 <sup>90</sup>	2 31.2 <sup>86</sup>
12.0	2 41.8 <sup>111</sup>	2 39.9 <sup>106</sup>	2 38.9 <sup>102</sup>	2 38.6 <sup>99</sup>	2 38.6 <sup>95</sup>	2 39.0 <sup>91</sup>	2 39.8 <sup>87</sup>
13.0	2 52.9 <sup>107</sup>	2 50.5 <sup>104</sup>	2 49.1 <sup>101</sup>	2 48.5 <sup>97</sup>	2 48.1 <sup>95</sup>	2 48.1 <sup>91</sup>	2 48.5 <sup>88</sup>
14.0	3 03.6 <sup>104</sup>	3 00.9 <sup>102</sup>	2 59.2 <sup>100</sup>	2 58.2 <sup>97</sup>	2 57.6 <sup>95</sup>	2 57.2 <sup>92</sup>	2 57.3 <sup>89</sup>
		104 <sup>102</sup>		97 <sup>97</sup>	95 <sup>95</sup>	92 <sup>92</sup>	89 <sup>89</sup>
15.0	3 14.0 <sup>101</sup>	3 11.1 <sup>101</sup>	3 09.2 <sup>98</sup>	3 07.9 <sup>96</sup>	3 07.1 <sup>93</sup>	3 06.4 <sup>91</sup>	3 06.2 <sup>89</sup>
16.0	3 24.1 <sup>101</sup>	3 21.2 <sup>100</sup>	3 19.0 <sup>97</sup>	3 17.5 <sup>94</sup>	3 16.4 <sup>91</sup>	3 15.5 <sup>90</sup>	3 15.1 <sup>89</sup>
17.0	3 34.2 <sup>101</sup>	3 31.2 <sup>99</sup>	3 28.7 <sup>97</sup>	3 26.9 <sup>94</sup>	3 25.5 <sup>92</sup>	3 24.5 <sup>90</sup>	3 24.0 <sup>88</sup>
18.0	3 44.3 <sup>98</sup>	3 41.1 <sup>97</sup>	3 38.4 <sup>95</sup>	3 36.3 <sup>93</sup>	3 34.7 <sup>91</sup>	3 33.5 <sup>90</sup>	3 32.8 <sup>88</sup>
19.0	3 54.1 <sup>97</sup>	3 50.8 <sup>95</sup>	3 47.9 <sup>94</sup>	3 45.6 <sup>92</sup>	3 43.8 <sup>90</sup>	3 42.5 <sup>88</sup>	3 41.6 <sup>87</sup>
		97 <sup>95</sup>		92 <sup>92</sup>	90 <sup>90</sup>	88 <sup>88</sup>	87 <sup>87</sup>
20.0	4 03.8 <sup>96</sup>	4 00.3 <sup>94</sup>	3 57.3 <sup>92</sup>	3 54.8 <sup>91</sup>	3 52.8 <sup>90</sup>	3 51.3 <sup>89</sup>	3 50.3 <sup>87</sup>
21.0	4 13.4 <sup>95</sup>	4 09.7 <sup>93</sup>	4 06.5 <sup>92</sup>	4 03.9 <sup>91</sup>	4 01.8 <sup>90</sup>	4 00.2 <sup>88</sup>	3 59.0 <sup>87</sup>
22.0	4 22.9 <sup>91</sup>	4 19.0 <sup>91</sup>	4 15.7 <sup>90</sup>	4 13.0 <sup>89</sup>	4 10.8 <sup>88</sup>	4 09.0 <sup>87</sup>	4 07.7 <sup>86</sup>
23.0	4 32.0 <sup>91</sup>	4 28.1 <sup>90</sup>	4 24.7 <sup>90</sup>	4 21.9 <sup>89</sup>	4 19.6 <sup>88</sup>	4 17.7 <sup>87</sup>	4 16.3 <sup>86</sup>
24.0	4 41.1 <sup>90</sup>	4 37.1 <sup>90</sup>	4 33.7 <sup>89</sup>	4 30.8 <sup>88</sup>	4 28.4 <sup>87</sup>	4 26.4 <sup>86</sup>	4 24.9 <sup>85</sup>
		90 <sup>90</sup>		88 <sup>88</sup>	87 <sup>87</sup>	86 <sup>86</sup>	85 <sup>85</sup>
25.0	4 50.1 <sup>90</sup>	4 46.1 <sup>89</sup>	4 42.6 <sup>88</sup>	4 39.6 <sup>88</sup>	4 37.1 <sup>87</sup>	4 35.0 <sup>86</sup>	4 33.4 <sup>85</sup>
26.0	4 59.1 <sup>89</sup>	4 55.0 <sup>89</sup>	4 51.4 <sup>88</sup>	4 48.4 <sup>87</sup>	4 45.8 <sup>86</sup>	4 43.6 <sup>85</sup>	4 41.9 <sup>84</sup>
27.0	5 08.0 <sup>88</sup>	5 03.9 <sup>87</sup>	5 00.2 <sup>88</sup>	4 57.1 <sup>86</sup>	4 54.4 <sup>85</sup>	4 52.1 <sup>85</sup>	4 50.3 <sup>84</sup>
28.0	5 16.8 <sup>87</sup>	5 12.6 <sup>88</sup>	5 09.0 <sup>86</sup>	5 05.7 <sup>86</sup>	5 02.9 <sup>85</sup>	5 00.6 <sup>84</sup>	4 58.7 <sup>84</sup>
29.0	5 25.5 <sup>87</sup>	5 21.4 <sup>86</sup>	5 17.6 <sup>86</sup>	5 14.3 <sup>85</sup>	5 11.4 <sup>85</sup>	5 09.0 <sup>84</sup>	5 07.1 <sup>83</sup>
		87 <sup>86</sup>		85 <sup>85</sup>	85 <sup>85</sup>	84 <sup>84</sup>	83 <sup>83</sup>
30.0	5 34.2	5 30.0	5 26.2	5 22.8	5 19.9	5 17.4	5 15.4

TIMES OF P—continued

Δ	Depth <i>h</i> = 225																				
	Surface		0-00		0-01		0-02		0-03		0-04		0-05								
°	m	s	m	s	m	s	m	s	m	s	m	s	m	s							
30	6	12.5	88	6	07.7	89	6	01.6	88	5	55.7	88	5	49.9	87	5	44.4	87	5	39.2	86
31	6	21.3	88	6	16.6	88	6	10.4	87	6	04.5	87	5	58.6	87	5	53.1	86	5	47.8	86
32	6	30.1	88	6	25.4	87	6	19.1	87	6	13.2	86	6	07.3	86	6	01.7	86	5	56.4	85
33	6	38.8	87	6	34.1	86	6	27.8	86	6	21.8	85	6	15.9	85	6	10.3	85	6	04.9	85
34	6	47.5	86	6	42.7	86	6	36.4	85	6	30.3	85	6	24.4	85	6	18.8	84	6	13.4	84
35	6	56.1	85	6	51.3	85	6	44.9	85	6	38.8	84	6	32.9	84	6	27.2	84	6	21.8	84
36	7	04.6	84	6	59.8	84	6	53.4	84	6	47.2	84	6	41.3	84	6	35.6	84	6	30.2	83
37	7	13.0	84	7	08.2	84	7	01.8	83	6	55.6	84	6	49.7	83	6	44.0	83	6	38.5	83
38	7	21.4	84	7	16.6	83	7	10.1	83	7	04.0	83	6	58.0	83	6	52.3	83	6	46.8	82
39	7	29.8	83	7	24.9	83	7	18.4	83	7	12.3	82	7	06.3	82	7	00.5	82	6	55.0	82
40	7	38.1	82	7	33.2	83	7	26.7	82	7	20.5	82	7	14.5	82	7	08.7	82	7	03.2	81
41	7	46.3	82	7	41.5	82	7	34.9	82	7	28.7	82	7	22.7	81	7	16.9	81	7	11.3	81
42	7	54.5	82	7	49.7	82	7	43.1	82	7	36.9	81	7	30.8	81	7	25.0	80	7	19.4	80
43	8	02.7	81	7	57.9	81	7	51.3	81	7	45.0	80	7	38.9	80	7	33.0	80	7	27.4	80
44	8	10.8	81	8	06.0	80	7	59.4	80	7	53.0	80	7	46.9	79	7	41.0	79	7	35.4	79
45	8	18.9	79	8	14.0	80	8	07.4	79	8	01.0	79	7	54.8	79	7	48.9	78	7	43.3	78
46	8	26.8	79	8	22.0	78	8	15.3	79	8	08.9	79	8	02.7	79	7	56.7	78	7	51.1	77
47	8	34.7	79	8	29.8	78	8	23.2	79	8	16.7	78	8	10.4	78	8	04.5	77	7	58.8	77
48	8	42.6	79	8	37.7	77	8	31.0	77	8	24.5	77	8	18.2	76	8	12.2	76	8	06.5	76
49	8	50.3	77	8	45.4	77	8	38.7	77	8	32.2	76	8	25.8	76	8	19.8	75	8	14.1	75
50	8	58.0	76	8	53.1	76	8	46.4	76	8	39.8	76	8	33.4	75	8	27.3	74	8	21.6	74
51	9	05.6	76	9	00.7	75	8	54.0	75	8	47.4	75	8	40.9	74	8	34.7	74	8	29.0	74
52	9	13.2	75	9	08.2	75	9	01.5	75	8	54.9	74	8	48.3	74	8	42.1	73	8	36.4	73
53	9	20.7	73	9	15.7	74	9	09.0	73	9	02.3	73	8	55.7	73	8	49.4	72	8	43.7	72
54	9	28.0	74	9	23.1	73	9	16.3	73	9	09.6	73	9	03.0	72	8	56.6	72	8	50.9	71
55	9	35.4	72	9	30.4	72	9	23.6	72	9	16.9	72	9	10.2	71	9	03.8	71	8	58.0	71
56	9	42.6	72	9	37.6	72	9	30.8	71	9	24.1	70	9	17.3	71	9	10.9	70	9	05.1	69
57	9	49.8	70	9	44.8	70	9	37.9	70	9	31.1	70	9	24.4	70	9	17.9	70	9	12.0	69
58	9	56.8	70	9	51.8	70	9	44.9	69	9	38.1	70	9	31.4	69	9	24.9	69	9	18.9	69
59	10	03.8	69	9	58.8	69	9	51.8	69	9	45.1	68	9	38.3	68	9	31.8	68	9	25.8	67
60	10	10.7	68	10	05.7	68	9	58.7	68	9	51.9	68	9	45.1	67	9	38.6	67	9	32.5	66
61	10	17.5	68	10	12.5	67	10	05.5	67	9	58.7	67	9	51.8	67	9	45.3	66	9	39.1	66
62	10	24.3	66	10	19.2	67	10	12.2	67	10	05.4	66	9	58.5	66	9	51.9	65	9	45.7	65
63	10	30.9	66	10	25.9	65	10	18.9	65	10	12.0	65	10	05.1	65	9	58.4	65	9	52.2	64
64	10	37.5	65	10	32.4	65	10	25.4	65	10	18.5	65	10	11.6	64	10	04.9	64	9	58.6	64
65	10	44.0	64	10	38.9	64	10	31.9	64	10	25.0	64	10	18.0	64	10	11.3	63	10	05.0	63
66	10	50.4	64	10	45.3	63	10	38.3	63	10	31.4	63	10	24.4	63	10	17.6	63	10	11.3	63
67	10	56.8	63	10	51.6	63	10	44.6	62	10	37.7	62	10	30.7	62	10	23.9	62	10	17.6	61
68	11	03.1	62	10	57.9	62	10	50.8	62	10	43.9	61	10	36.9	61	10	30.1	61	10	23.7	61
69	11	09.3	61	11	04.1	61	10	57.0	61	10	50.0	61	10	43.0	61	10	36.2	61	10	29.8	61
70	11	15.4		11	10.2		11	03.1		10	56.1		10	49.1		10	42.3		10	35.9	

TIMES OF P—continued

Δ	Depth <i>h</i> =						
	0.06	0.07	0.08	0.09	0.10	0.11	0.12
30	m s	m s	m s	m s	m s	m s	m s
31	5 34.2 86	5 30.0 86	5 26.2 85	5 22.8 85	5 19.9 84	5 17.4 83	5 15.4 83
32	5 42.8 86	5 38.6 85	5 34.7 85	5 31.3 84	5 28.3 84	5 25.7 84	5 23.7 82
33	5 51.4 85	5 47.1 84	5 43.2 84	5 39.7 84	5 36.7 83	5 34.1 82	5 31.9 82
34	5 59.9 85	5 55.5 84	5 51.6 84	5 48.1 83	5 45.0 83	5 42.3 82	5 40.1 81
35	6 08.4 84	6 03.9 84	6 00.0 83	5 56.4 83	5 53.3 82	5 50.5 82	5 48.2 81
36	6 16.8 84	6 12.3 83	6 08.3 83	6 04.7 82	6 01.5 82	5 58.7 81	5 56.3 81
37	6 25.2 83	6 20.6 83	6 16.6 82	6 12.9 82	6 09.7 82	6 06.8 81	6 04.4 80
38	6 33.5 82	6 28.9 82	6 24.8 81	6 21.1 82	6 17.9 81	6 14.9 81	6 12.4 80
39	6 41.7 82	6 37.1 82	6 32.9 81	6 29.3 81	6 26.0 80	6 23.0 80	6 20.4 79
40	6 49.9 82	6 45.3 81	6 41.0 81	6 37.4 80	6 34.0 80	6 31.0 79	6 28.3 78
41	6 58.1 81	6 53.4 81	6 49.1 80	6 45.4 80	6 42.0 79	6 38.9 78	6 36.1 77
42	7 06.2 80	7 01.5 80	6 57.1 80	6 53.4 79	6 49.9 79	6 46.7 78	6 43.8 77
43	7 14.2 80	7 09.5 79	7 05.1 79	7 01.3 78	6 57.8 77	6 54.5 77	6 51.5 76
44	7 22.2 79	7 17.4 79	7 13.0 78	7 09.1 78	7 05.5 78	7 02.2 76	6 59.1 76
45	7 30.1 79	7 25.3 78	7 20.8 78	7 16.9 77	7 13.3 76	7 09.8 76	7 06.7 75
46	7 38.0 78	7 33.1 77	7 28.6 77	7 24.6 76	7 20.9 76	7 17.4 75	7 14.2 75
47	7 45.8 77	7 40.8 77	7 36.3 76	7 32.2 76	7 28.5 75	7 24.9 75	7 21.7 74
48	7 53.5 76	7 48.5 76	7 43.9 76	7 39.8 75	7 36.0 74	7 32.4 74	7 29.1 73
49	8 01.1 76	7 56.1 75	7 51.5 75	7 47.3 75	7 43.4 74	7 39.8 73	7 36.4 73
50	8 08.7 75	8 03.6 75	7 59.0 74	7 54.8 73	7 50.8 73	7 47.1 73	7 43.7 72
51	8 16.2 74	8 11.1 74	8 06.4 73	8 02.1 73	7 58.1 72	7 54.4 72	7 50.9 71
52	8 23.6 74	8 18.5 73	8 13.7 73	8 09.4 71	8 05.3 71	8 01.6 70	7 58.0 70
53	8 31.0 73	8 25.8 72	8 21.0 71	8 16.5 71	8 12.4 71	8 08.6 70	8 05.0 69
54	8 38.3 72	8 33.0 71	8 28.1 71	8 23.6 70	8 19.5 70	8 15.6 70	8 11.9 69
55	8 45.5 71	8 40.1 71	8 35.2 70	8 30.6 70	8 26.5 69	8 22.6 68	8 18.8 68
56	8 52.6 70	8 47.2 70	8 42.2 69	8 37.6 69	8 33.4 68	8 29.4 68	8 25.6 67
57	8 59.6 69	8 54.2 68	8 49.1 69	8 44.5 68	8 40.2 68	8 36.2 67	8 32.3 67
58	9 06.5 68	9 01.0 68	8 56.0 68	8 51.3 68	8 47.0 67	8 42.9 66	8 39.0 66
59	9 13.3 67	9 07.8 67	9 02.8 67	8 58.1 67	8 53.7 66	8 49.5 66	8 45.6 65
60	9 20.0 67	9 14.5 67	9 09.5 66	9 04.8 66	9 00.3 66	8 56.1 65	8 52.1 65
61	9 26.7 66	9 21.2 66	9 16.1 66	9 11.4 65	9 06.9 65	9 02.6 64	8 58.6 64
62	9 33.3 66	9 27.8 66	9 22.7 65	9 17.9 65	9 13.4 64	9 09.0 64	9 05.0 64
63	9 39.9 65	9 34.4 65	9 29.2 64	9 24.4 64	9 19.8 64	9 15.4 64	9 11.4 62
64	9 46.4 64	9 40.9 64	9 35.6 64	9 30.8 63	9 26.2 63	9 21.8 62	9 17.6 62
65	9 52.8 64	9 47.3 63	9 42.0 63	9 37.1 63	9 32.5 62	9 28.0 62	9 23.9 61
66	9 59.2 63	9 53.6 62	9 48.3 62	9 43.4 62	9 38.7 62	9 34.2 61	9 30.0 61
67	10 05.5 62	9 59.8 62	9 54.5 62	9 49.6 61	9 44.9 60	9 40.3 61	9 36.1 60
68	10 11.7 61	10 06.0 61	10 00.7 61	9 55.7 60	9 50.9 61	9 46.4 60	9 42.1 59
69	10 17.8 61	10 12.1 60	10 06.8 60	10 01.7 60	9 57.0 59	9 52.4 59	9 48.0 59
70	10 23.9 60	10 18.1 60	10 12.8 59	10 07.7 59	10 02.9 59	9 58.3 59	9 53.9 58
70	10 29.9	10 24.1	10 18.7	10 13.6	10 08.8	10 04.2	9 59.7

D

## TIMES OF P—continued

Δ	Depth $h =$																							
	Surface	0.00	0.01	0.02	0.03	0.04	0.05																	
	33 km		97 km		161		295																	
o	m	s	m	s	m	s	m	s																
70	11	15.4	61	11	10.2	61	11	03.1	60	10	56.1	60	10	49.1	60	10	42.3	60	10	35.9	60			
71	11	21.5	60	11	16.3	59	11	09.1	60	11	02.1	59	11	01.1	60	10	55.1	60	10	48.3	60	10	41.9	59
72	11	27.5	59	11	22.2	58	11	15.1	58	11	08.0	59	11	01.1	59	10	54.3	59	10	47.8	59	10	47.8	59
73	11	33.4	58	11	28.2	58	11	20.9	58	11	13.9	59	11	07.0	58	11	00.2	59	10	53.7	58	10	53.7	58
74	11	39.2	58	11	34.0	58	11	26.8	59	11	19.7	57	11	12.8	57	11	06.0	58	10	59.5	57	10	59.5	57
75	11	45.0	57	11	39.8	57	11	32.5	57	11	25.4	56	11	18.5	56	11	11.7	56	11	05.2	56	11	05.2	56
76	11	50.7	56	11	45.5	57	11	38.2	56	11	31.0	56	11	24.1	55	11	17.3	55	11	10.8	55	11	10.8	55
77	11	56.3	55	11	51.2	55	11	43.8	55	11	36.6	55	11	29.6	55	11	22.8	55	11	16.3	54	11	16.3	54
78	12	01.8	55	11	56.7	55	11	49.3	55	11	42.1	55	11	35.1	54	11	28.3	55	11	21.7	53	11	21.7	53
79	12	07.3	54	12	02.2	54	11	54.8	54	11	47.5	54	11	40.5	53	11	33.6	53	11	27.0	53	11	27.0	53
80	12	12.7	53	12	07.6	53	12	00.2	53	11	52.9	53	11	45.8	53	11	38.9	52	11	32.3	52	11	32.3	52
81	12	18.0	52	12	12.9	52	12	05.5	52	11	58.2	52	11	51.1	51	11	44.1	52	11	37.5	52	11	37.5	52
82	12	23.2	52	12	18.1	52	12	10.7	52	12	03.4	52	11	56.2	51	11	49.3	52	11	42.7	50	11	42.7	50
83	12	28.4	51	12	23.2	51	12	15.8	51	12	08.5	51	12	01.4	50	11	54.4	51	11	47.7	51	11	47.7	51
84	12	33.5	50	12	28.3	50	12	20.8	50	12	13.5	50	12	06.4	50	11	59.4	50	11	52.8	49	11	52.8	49
85	12	38.5	49	12	33.3	49	12	25.8	49	12	18.5	49	12	11.4	48	12	04.4	49	11	57.7	48	11	57.7	48
86	12	43.5	48	12	38.2	48	12	30.7	48	12	23.4	48	12	16.3	48	12	09.3	49	12	02.5	48	12	02.5	48
87	12	48.4	48	12	43.1	48	12	35.6	48	12	28.2	48	12	21.1	47	12	14.1	48	12	07.3	48	12	07.3	48
88	12	53.2	48	12	47.9	48	12	40.4	47	12	33.0	47	12	25.8	47	12	18.8	47	12	12.1	46	12	12.1	46
89	12	58.0	47	12	52.7	47	12	45.1	47	12	37.7	47	12	30.5	47	12	23.5	47	12	16.7	47	12	16.7	47
90	13	02.7	46	12	57.4	47	12	49.8	47	12	42.4	47	12	35.2	46	12	28.2	46	12	21.4	46	12	21.4	46
91	13	07.3	46	13	02.1	46	12	54.5	46	12	47.1	46	12	39.8	46	12	32.8	46	12	26.0	46	12	26.0	46
92	13	11.9	46	13	06.7	46	12	59.1	46	12	51.7	46	12	44.5	46	12	37.5	47	12	30.7	47	12	30.7	47
93	13	16.5	46	13	11.3	45	13	03.7	45	12	56.3	45	12	49.1	45	12	42.1	45	12	35.3	45	12	35.3	45
94	13	21.1	46	13	15.8	46	13	08.2	46	13	00.8	46	12	53.6	46	12	46.6	46	12	39.8	46	12	39.8	46
95	13	25.7	46	13	20.4	45	13	12.8	45	13	05.4	45	12	58.2	45	12	51.2	45	12	44.4	46	12	44.4	46
96	13	30.3	45	13	24.9	46	13	17.3	46	13	09.9	46	13	02.7	46	12	55.7	46	12	49.0	45	12	49.0	45
97	13	34.8	45	13	29.5	45	13	21.9	45	13	14.5	45	13	07.3	45	13	00.3	45	12	53.5	45	12	53.5	45
98	13	39.3	45	13	34.0	45	13	26.4	45	13	19.0	46	13	11.8	46	13	04.8	46	12	58.0	46	12	58.0	46
99	13	43.8	46	13	38.5	46	13	31.0	45	13	23.6	45	13	16.4	45	13	09.4	45	13	02.6	45	13	02.6	45
100	13	48.4	45	13	43.1	45	13	35.5	45	13	28.1	45	13	20.9	45	13	13.9	45	13	07.1	44	13	07.1	44
101	13	52.9	44	13	47.6	45	13	40.0	44	13	32.6	44	13	25.4	44	13	18.4	45	13	11.5	44	13	11.5	44
102	13	57.4	44	13	52.1	44	13	44.4	44	13	37.0	44	13	29.8	44	13	22.8	44	13	15.9	44	13	15.9	44
103	14	01.8	44	13	56.5	44	13	48.8	44	13	41.4	44	13	34.2	44	13	27.2	44	13	20.3	44	13	20.3	44
104	14	06.2	44	14	00.9	44	13	53.2	44	13	45.8	44	13	38.6	44	13	31.6	44						
105	14	10.6		14	05.3																			

TIMES OF P—continued

Δ	Depth <i>h</i> =																			
	417		545		609		673		737		801		865							
	0.06		0.07		0.08		0.09		0.10		0.11		0.12							
°	m	s	m	s	m	s	m	s	m	s	m	s	m	s						
70	10	29.9	10	24.1	10	18.7	10	13.6	10	08.8	10	04.2	9	59.7						
71	10	35.8	59	10	30.0	59	10	24.6	59	10	19.4	58	10	14.6	58	10	09.0	57	10	05.4
72	10	41.7	59	10	35.8	58	10	30.4	58	10	25.2	57	10	20.3	57	10	15.7	57	10	11.1
73	10	47.5	58	10	41.6	58	10	36.1	57	10	30.9	57	10	26.0	56	10	21.3	55	10	16.6
74	10	53.2	57	10	47.3	57	10	41.7	56	10	36.5	56	10	31.6	55	10	26.8	55	10	22.2
75	10	58.8	56	10	52.9	55	10	47.3	55	10	42.1	55	10	37.1	54	10	32.3	54	10	27.6
76	11	04.4	55	10	58.4	55	10	52.8	54	10	47.6	54	10	42.6	53	10	37.7	54	10	33.0
77	11	09.9	54	11	03.9	54	10	58.2	54	10	53.0	53	10	47.9	54	10	43.1	52	10	38.3
78	11	15.3	53	11	09.3	53	11	03.6	53	10	58.3	53	10	53.3	52	10	48.3	53	10	43.5
79	11	20.6	53	11	14.6	52	11	08.9	52	11	03.6	52	10	58.5	52	10	53.6	51	10	48.7
80	11	25.9	52	11	19.8	52	11	14.1	51	11	08.8	51	10	58.7	51	10	53.8	50	10	53.8
81	11	31.1	51	11	25.0	51	11	19.3	51	11	13.9	51	11	08.8	50	11	03.8	50	10	58.8
82	11	36.2	51	11	30.1	50	11	24.3	50	11	19.0	50	11	13.9	49	11	08.8	49	11	03.8
83	11	41.3	50	11	35.1	50	11	29.4	49	11	24.0	49	11	18.8	49	11	13.7	49	11	08.7
84	11	46.3	49	11	40.1	49	11	34.3	49	11	28.9	49	11	23.8	48	11	18.6	48	11	13.6
85	11	51.2	48	11	45.0	48	11	39.2	48	11	33.8	48	11	28.6	47	11	23.4	47	11	18.4
86	11	56.0	48	11	49.8	48	11	44.0	48	11	38.6	48	11	33.3	47	11	28.1	47	11	23.1
87	12	00.8	47	11	54.6	47	11	48.7	47	11	43.3	47	11	38.0	47	11	32.8	47	11	27.8
88	12	05.5	47	11	59.3	47	11	53.4	47	11	48.0	47	11	42.7	46	11	37.5	46	11	32.4
89	12	10.2	46	12	04.0	46	11	58.1	46	11	52.7	46	11	47.3	46	11	42.1	46	11	37.0
90	12	14.8	46	12	08.6	46	12	02.7	46	11	57.3	46	11	51.9	46	11	46.7	46	11	41.6
91	12	19.4	47	12	13.2	46	12	07.3	46	12	01.9	45	11	56.5	46	11	51.3	46	11	46.2
92	12	24.1	46	12	17.8	46	12	11.9	46	12	06.4	46	12	01.1	46	11	55.9	46	11	50.8
93	12	28.7	45	12	22.4	46	12	16.5	46	12	11.0	45	12	05.7	46	12	00.5	46	11	55.3
94	12	33.2	46	12	27.0	45	12	21.1	45	12	15.5	45	12	10.3	45	12	05.1	45	11	59.9
95	12	37.8	46	12	31.5	45	12	25.6	45	12	20.0	45	12	14.8	45	12	09.6	45	12	04.4
96	12	42.4	45	12	36.0	46	12	30.1	46	12	24.5	45	12	19.3	45	12	14.1	45	12	08.9
97	12	46.9	46	12	40.6	45	12	34.7	45	12	29.0	45	12	23.8	45	12	18.6	45	12	13.5
98	12	51.5	45	12	45.1	45	12	39.2	45	12	33.5	45	12	28.3	45	12	23.1	45	12	18.0
99	12	56.0	44	12	49.6	45	12	43.7	45	12	38.0	46	12	32.8	45	12	27.6	45	12	22.5
100	13	00.4	44	12	54.1	44	12	48.2	44	12	42.6	44	12	37.3	44	12	32.1	44	12	27.0
101	13	04.8	44	12	58.5	44	12	52.6	44	12	47.0	44	12	41.7	44	12	36.5	44	12	31.4
102	13	09.2	44	13	02.9	44	12	57.0	44	12	51.4	44	12	46.1	44	12	40.9	44	12	35.8
103	13	13.6	44	13	07.3	44	13	01.4												

TIMES OF S

Δ	Depth <i>h</i> =						
	Surface	33	97	161	225		
	0-00	0-01	0-02	0-03	0-04	0-05	
o	m s	m s	m s	m s	m s	m s	m s
0.0	(10.7) <sup>127</sup>	9.2 <sup>89</sup>	23.6 <sup>39</sup>	37.7 <sup>23</sup>	51.5 <sup>15</sup>	1 05.1 <sup>12</sup>	1 18.3 <sup>9</sup>
0.5	(23.4) <sup>127</sup>	(18.1) <sup>127</sup>	27.5 <sup>83</sup>	40.0 <sup>57</sup>	53.0 <sup>44</sup>	1 06.3 <sup>34</sup>	1 19.2 <sup>27</sup>
1.0	36.1 <sup>127</sup>	30.8 <sup>127</sup>	35.8 <sup>108</sup>	45.7 <sup>84</sup>	57.4 <sup>65</sup>	1 09.7 <sup>51</sup>	1 21.9 <sup>44</sup>
1.5	48.8 <sup>127</sup>	43.5 <sup>126</sup>	46.6 <sup>106</sup>	54.1 <sup>97</sup>	63.9 <sup>80</sup>	1 14.8 <sup>67</sup>	1 26.3 <sup>57</sup>
2.0	1 01.5 <sup>127</sup>	56.1 <sup>127</sup>	57.2 <sup>123</sup>	1 03.8 <sup>106</sup>	1 11.9 <sup>92</sup>	1 21.5 <sup>80</sup>	1 32.0 <sup>67</sup>
2.5	1 14.2 <sup>127</sup>	1 08.8 <sup>127</sup>	1 09.5 <sup>123</sup>	1 14.4 <sup>111</sup>	1 21.1 <sup>100</sup>	1 29.5 <sup>87</sup>	1 38.7 <sup>78</sup>
3.0	1 26.9 <sup>127</sup>	1 21.5 <sup>127</sup>	1 21.8 <sup>123</sup>	1 25.5 <sup>114</sup>	1 31.1 <sup>103</sup>	1 38.2 <sup>94</sup>	1 46.5 <sup>84</sup>
3.5	1 39.6 <sup>126</sup>	1 34.2 <sup>127</sup>	1 34.1 <sup>123</sup>	1 36.9 <sup>116</sup>	1 41.4 <sup>108</sup>	1 47.6 <sup>99</sup>	1 54.9 <sup>90</sup>
4.0	1 52.2 <sup>127</sup>	1 46.9 <sup>126</sup>	1 46.4 <sup>123</sup>	1 48.5 <sup>116</sup>	1 52.2 <sup>110</sup>	1 57.5 <sup>103</sup>	2 03.9 <sup>94</sup>
4.5	2 04.9 <sup>126</sup>	1 59.5 <sup>126</sup>	1 58.7 <sup>124</sup>	2 00.1 <sup>118</sup>	2 03.2 <sup>112</sup>	2 07.8 <sup>104</sup>	2 13.3 <sup>97</sup>
5.0	2 17.5 <sup>126</sup>	2 12.1 <sup>126</sup>	2 11.1 <sup>123</sup>	2 11.9 <sup>119</sup>	2 14.4 <sup>113</sup>	2 18.2 <sup>107</sup>	2 23.0 <sup>100</sup>
5.5	2 30.1 <sup>125</sup>	2 24.7 <sup>125</sup>	2 23.4 <sup>123</sup>	2 23.8 <sup>119</sup>	2 25.7 <sup>114</sup>	2 28.9 <sup>108</sup>	2 33.0 <sup>102</sup>
6.0	2 42.6 <sup>125</sup>	2 37.2 <sup>125</sup>	2 35.7 <sup>123</sup>	2 35.7 <sup>119</sup>	2 37.1 <sup>115</sup>	2 39.7 <sup>110</sup>	2 43.2 <sup>104</sup>
6.5	2 55.1 <sup>125</sup>	2 49.7 <sup>124</sup>	2 48.0 <sup>122</sup>	2 47.6 <sup>120</sup>	2 48.6 <sup>115</sup>	2 50.7 <sup>110</sup>	2 53.6 <sup>105</sup>
7.0	3 07.6 <sup>125</sup>	3 02.1 <sup>125</sup>	3 00.2 <sup>123</sup>	2 59.6 <sup>120</sup>	3 00.1 <sup>115</sup>	3 01.7 <sup>111</sup>	3 04.1 <sup>106</sup>
7.5	3 20.1 <sup>125</sup>	3 14.6 <sup>124</sup>	3 12.5 <sup>122</sup>	3 11.6 <sup>119</sup>	3 11.6 <sup>116</sup>	3 12.8 <sup>111</sup>	3 14.7 <sup>107</sup>
8.0	3 32.6 <sup>125</sup>	3 27.0 <sup>125</sup>	3 24.7 <sup>122</sup>	3 23.5 <sup>119</sup>	3 23.2 <sup>115</sup>	3 23.9 <sup>111</sup>	3 25.4 <sup>107</sup>
8.5	3 45.1 <sup>124</sup>	3 39.5 <sup>124</sup>	3 36.9 <sup>122</sup>	3 35.4 <sup>118</sup>	3 34.7 <sup>115</sup>	3 35.0 <sup>112</sup>	3 36.1 <sup>108</sup>
9.0	3 57.5 <sup>124</sup>	3 51.9 <sup>124</sup>	3 49.1 <sup>121</sup>	3 47.2 <sup>118</sup>	3 46.2 <sup>115</sup>	3 46.2 <sup>112</sup>	3 46.9 <sup>108</sup>
9.5	4 09.9 <sup>123</sup>	4 04.3 <sup>123</sup>	4 01.2 <sup>120</sup>	3 59.0 <sup>118</sup>	3 57.7 <sup>115</sup>	3 57.4 <sup>112</sup>	3 57.7 <sup>109</sup>
10.0	4 22.2 <sup>245</sup>	4 16.6 <sup>244</sup>	4 13.2 <sup>240</sup>	4 10.8 <sup>235</sup>	4 09.2 <sup>231</sup>	4 08.6 <sup>224</sup>	4 08.6 <sup>216</sup>
11.0	4 46.7 <sup>244</sup>	4 41.0 <sup>243</sup>	4 37.2 <sup>239</sup>	4 34.3 <sup>234</sup>	4 32.3 <sup>229</sup>	4 31.0 <sup>223</sup>	4 30.2 <sup>216</sup>
12.0	5 11.1 <sup>242</sup>	5 05.3 <sup>241</sup>	5 01.1 <sup>237</sup>	4 57.7 <sup>233</sup>	4 55.2 <sup>227</sup>	4 53.3 <sup>221</sup>	4 51.8 <sup>216</sup>
13.0	5 35.3 <sup>239</sup>	5 29.4 <sup>239</sup>	5 24.8 <sup>235</sup>	5 21.0 <sup>230</sup>	5 17.9 <sup>224</sup>	5 15.4 <sup>219</sup>	5 13.4 <sup>216</sup>
14.0	5 59.2 <sup>237</sup>	5 53.3 <sup>236</sup>	5 48.3 <sup>235</sup>	5 44.0 <sup>228</sup>	5 40.3 <sup>223</sup>	5 37.3 <sup>218</sup>	d5 35.0 <sup>202</sup>
15.0	6 22.9 <sup>235</sup>	6 16.9 <sup>233</sup>	6 11.8 <sup>228</sup>	6 06.8 <sup>226</sup>	6 02.6 <sup>222</sup>	5 59.1 <sup>215</sup>	r5 55.2 <sup>193</sup>
16.0	6 46.4 <sup>231</sup>	6 40.2 <sup>231</sup>	6 34.6 <sup>227</sup>	6 29.4 <sup>223</sup>	6 24.8 <sup>217</sup>	d6 20.6 <sup>196</sup>	6 14.5 <sup>190</sup>
17.0	7 09.5 <sup>228</sup>	7 03.3 <sup>227</sup>	6 57.3 <sup>221</sup>	6 51.7 <sup>219</sup>	d6 46.5 <sup>202</sup>	r6 40.2 <sup>191</sup>	6 33.5 <sup>188</sup>
18.0	7 32.3 <sup>226</sup>	7 26.0 <sup>225</sup>	7 19.4 <sup>220</sup>	d7 13.6 <sup>204</sup>	r7 06.7 <sup>191</sup>	6 59.3 <sup>187</sup>	6 52.3 <sup>183</sup>
19.0	7 54.9 <sup>222</sup>	7 48.5 <sup>221</sup>	d7 41.4 <sup>202</sup>	r7 34.0 <sup>187</sup>	7 25.8 <sup>185</sup>	7 18.0 <sup>181</sup>	7 10.6 <sup>177</sup>
20.0	d8 17.1 <sup>203</sup>	d8 10.6 <sup>194</sup>	r8 01.6 <sup>189</sup>	7 52.7 <sup>186</sup>	7 44.3 <sup>180</sup>	7 36.1 <sup>176</sup>	7 28.3 <sup>172</sup>
21.0	r8 37.4 <sup>188</sup>	r8 30.0 <sup>187</sup>	8 20.5 <sup>182</sup>	8 11.3 <sup>178</sup>	8 02.3 <sup>175</sup>	7 53.7 <sup>172</sup>	7 45.5 <sup>170</sup>
22.0	8 56.2 <sup>182</sup>	8 48.7 <sup>181</sup>	8 38.7 <sup>176</sup>	8 29.1 <sup>172</sup>	8 19.8 <sup>170</sup>	8 10.9 <sup>169</sup>	8 02.5 <sup>166</sup>
23.0	9 14.4 <sup>175</sup>	9 06.8 <sup>175</sup>	8 56.3 <sup>172</sup>	8 46.3 <sup>169</sup>	8 36.8 <sup>168</sup>	8 27.8 <sup>166</sup>	8 19.1 <sup>165</sup>
24.0	9 31.9 <sup>170</sup>	9 24.3 <sup>170</sup>	9 13.5 <sup>168</sup>	9 03.2 <sup>168</sup>	8 53.6 <sup>165</sup>	8 44.4 <sup>163</sup>	8 35.6 <sup>162</sup>
25.0	9 48.9 <sup>167</sup>	9 41.3 <sup>165</sup>	9 30.3 <sup>166</sup>	9 20.0 <sup>165</sup>	9 10.1 <sup>162</sup>	9 00.7 <sup>161</sup>	8 51.8 <sup>160</sup>
26.0	10 05.6 <sup>165</sup>	9 57.8 <sup>164</sup>	9 46.9 <sup>163</sup>	9 36.5 <sup>162</sup>	9 26.3 <sup>162</sup>	9 16.8 <sup>160</sup>	9 07.8 <sup>159</sup>
27.0	10 22.1 <sup>161</sup>	10 14.2 <sup>161</sup>	10 03.2 <sup>162</sup>	9 52.7 <sup>161</sup>	9 42.5 <sup>160</sup>	9 32.8 <sup>159</sup>	9 23.7 <sup>158</sup>
28.0	10 38.2 <sup>161</sup>	10 30.3 <sup>160</sup>	10 19.4 <sup>159</sup>	10 08.8 <sup>159</sup>	9 58.5 <sup>159</sup>	9 48.7 <sup>158</sup>	9 39.5 <sup>157</sup>
29.0	10 54.3 <sup>159</sup>	10 46.3 <sup>159</sup>	10 35.3 <sup>158</sup>	10 24.7 <sup>157</sup>	10 14.4 <sup>157</sup>	10 04.5 <sup>157</sup>	9 55.2 <sup>157</sup>
30.0	11 10.2	11 02.2	10 51.1	10 40.4	10 30.1	10 20.2	10 10.9

TIMES OF S

Δ	Depth <i>h</i> =																			
	0.06		0.07		0.08		0.09		0.10		0.11		0.12							
0	m	s	m	s	m	s	m	s	m	s	m	s	m	s						
0.0	1	31.2	8	1	43.6	7	1	55.5	5	2	06.9	5	2	17.9	4	2	28.6	4	2	39.0
0.5	1	32.0	22	1	44.3	20	1	56.0	16	2	07.4	15	2	18.3	12	2	29.0	12	2	39.4
1.0	1	34.2	37	1	46.3	31	1	57.6	27	2	08.9	23	2	19.6	21	2	30.2	19	2	40.4
1.5	1	37.9	49	1	49.4	42	2	00.3	38	2	11.2	32	2	21.7	29	2	32.1	25	2	42.1
2.0	1	42.8	59	1	53.6	52	2	04.1	46	2	14.4	40	2	24.6	36	2	34.6	32	2	44.4
2.5	1	48.7	68	1	58.8	60	2	08.7	53	2	18.4	48	2	28.2	42	2	37.8	38	2	47.3
3.0	1	55.5	75	2	04.8	67	2	14.0	60	2	23.2	54	2	32.4	48	2	41.6	44	2	50.7
3.5	2	03.0	81	2	11.5	73	2	20.0	66	2	28.6	60	2	37.2	54	2	46.0	49	2	54.6
4.0	2	11.1	86	2	18.8	78	2	26.6	70	2	34.6	64	2	42.6	58	2	50.9	53	2	59.1
4.5	2	19.7	89	2	26.6	83	2	33.6	76	2	41.0	68	2	48.4	64	2	56.2	58	3	04.1
5.0	2	28.6	92	2	34.9	86	2	41.2	79	2	47.8	73	2	54.8	65	3	02.0	61	3	09.4
5.5	2	37.8	96	2	43.5	89	2	49.1	83	2	55.1	76	3	01.3	70	3	08.1	65	3	15.0
6.0	2	47.4	100	2	52.4	92	2	57.4	85	3	02.7	79	3	08.3	73	3	14.6	63	3	20.9
6.5	2	57.4	101	3	01.6	93	3	05.9	87	3	10.6	81	3	15.6	75	3	20.9	73	3	27.0
7.0	3	07.5	101	3	10.9	95	3	14.6	89	3	18.7	84	3	23.1	77	3	28.2	72	3	33.4
7.5	3	17.6	101	3	20.4	96	3	23.5	90	3	27.1	85	3	30.8	80	3	35.4	74	3	40.0
8.0	3	27.7	103	3	30.0	97	3	32.5	91	3	35.6	86	3	38.8	81	3	42.8	76	3	46.9
8.5	3	38.0	103	3	39.7	97	3	41.6	92	3	44.2	87	3	46.9	83	3	50.4	77	3	54.0
9.0	3	48.3	104	3	49.4	98	3	50.8	93	3	52.9	88	3	55.2	83	3	58.1	78	4	01.4
9.5	3	58.7	104	3	59.2	98	4	00.1	93	4	01.7	88	4	03.5	84	4	05.9	79	4	08.9
10.0	4	09.1	209	4	09.0	197	4	09.4	187	4	10.5	178	4	11.9	170	4	13.8	162	4	16.5
11.0	4	30.0	209	4	28.7	196	4	28.1	187	4	28.3	177	4	28.9	170	4	30.0	164	4	31.9
12.0	4	50.9	201	4	48.3	193	4	46.8	184	4	46.0	177	4	45.9	171	4	46.4	164	4	47.5
13.0	5	11.0	198	5	07.6	191	5	05.2	184	5	03.7	178	5	03.0	171	5	02.8	165	5	03.3
14.0	5	30.8	193	5	26.7	189	5	23.6	183	5	21.5	176	5	20.1	169	5	19.3	164	5	19.2
15.0	5	50.1	189	5	45.6	184	5	41.9	179	5	39.1	173	5	37.0	167	5	35.7	162	5	35.1
16.0	6	09.0	186	6	04.0	181	5	59.8	176	5	56.4	171	5	53.7	167	5	51.9	163	5	51.0
17.0	6	27.6	182	6	22.1	176	6	17.4	171	6	13.5	168	6	10.4	165	6	08.2	162	6	06.9
18.0	6	45.8	177	6	39.7	173	6	34.5	170	6	30.3	167	6	26.9	163	6	24.4	160	6	22.7
19.0	7	03.5	173	6	57.0	170	6	51.5	167	6	47.0	165	6	43.2	163	6	40.4	159	6	38.5
20.0	7	20.8	170	7	14.0	168	7	08.2	166	7	03.5	162	6	59.4	162	6	56.3	159	6	54.1
21.0	7	37.8	167	7	30.8	165	7	24.8	163	7	19.7	162	7	15.6	159	7	12.2	158	7	09.7
22.0	7	54.5	165	7	47.3	163	7	41.1	161	7	35.9	159	7	31.5	157	7	28.0	156	7	25.3
23.0	8	11.0	162	8	03.6	161	7	57.2	160	7	51.8	158	7	47.2	157	7	43.6	155	7	40.8
24.0	8	27.2	161	8	19.7	160	8	13.2	158	8	07.6	157	8	02.9	156	7	59.1	156	7	56.3
25.0	8	43.3	160	8	35.7	159	8	29.0	158	8	23.3	157	8	18.5	156	8	14.7	155	8	11.8
26.0	8	59.3	158	8	51.6	157	8	44.8	156	8	39.0	155	8	34.1	155	8	30.2	154	8	27.2
27.0	9	15.1	157	9	07.3	156	9	00.4	156	8	54.5	156	8	49.6	155	8	45.6	154	8	42.5
28.0	9	30.8	156	9	22.9	156	9	16.0	155	9	10.1	154	9	05.1	154	9	01.0	153	8	57.8
29.0	9	46.4	156	9	38.5	155	9	31.5	155	9	25.5	155	9	20.5	154	9	16.3	153	9	12.9
30.0	10	02.0		9	54.0		9	47.0		9	41.0		9	35.9		9	31.6		9	28.0

E

TIMES OF S—continued

Δ	Depth <i>h</i> =						
	Surface	33 0-00	97 0-01	161 0-02	225 0-03	289 0-04	353 0-05
°	m s	m s	m s	m s	m s	m s	m s
30	11 10.2 158	11 02.2 157	10 51.1 157	10 40.4 157	10 30.1 157	10 20.2 156	10 10.9 156
31	11 26.0 156	11 17.9 157	11 06.8 157	10 56.1 156	10 45.8 155	10 35.8 155	10 26.5 155
32	11 41.6 156	11 33.6 156	11 22.5 155	11 11.7 156	11 01.3 155	10 51.3 155	10 42.0 154
33	11 57.2 155	11 49.2 155	11 38.0 155	11 27.7 154	11 16.8 155	11 06.8 154	10 57.4 153
34	12 12.7 155	12 04.7 155	11 53.5 154	11 42.7 154	11 32.3 153	11 22.2 153	11 12.7 153
35	12 28.2 155	12 20.2 154	12 08.9 154	11 58.1 153	11 47.6 153	11 37.5 152	11 28.0 152
36	12 43.7 153	12 35.6 154	12 24.3 152	12 13.4 152	12 02.9 152	11 52.7 152	11 43.2 150
37	12 59.0 153	12 51.0 152	12 39.5 152	12 28.6 152	12 18.1 150	12 07.9 150	11 58.2 150
38	13 14.3 151	13 06.2 152	12 54.7 151	12 43.8 150	12 33.1 150	12 22.9 150	12 13.2 148
39	13 29.4 151	13 21.4 150	13 09.8 150	12 58.8 149	12 48.1 149	12 37.9 148	12 28.0 148
40	13 44.5 149	13 36.4 149	13 24.8 148	13 13.7 148	13 03.0 147	12 52.7 147	12 42.8 146
41	13 59.4 148	13 51.3 148	13 39.6 148	13 28.5 146	13 17.7 146	13 07.4 145	12 57.4 145
42	14 14.2 147	14 06.1 146	13 54.4 146	13 43.1 146	13 32.3 145	13 21.9 145	13 11.9 144
43	14 28.9 145	14 20.7 146	14 09.0 145	13 57.7 145	13 46.8 144	13 36.4 144	13 26.3 143
44	14 43.4 145	14 35.3 144	14 23.5 144	14 12.2 143	14 01.2 143	13 50.8 142	13 40.6 142
45	14 57.9 143	14 49.7 143	14 37.9 143	14 26.5 142	14 15.5 142	14 05.0 142	13 54.8 141
46	15 12.2 143	15 04.0 142	14 52.2 142	14 40.7 142	14 29.7 141	14 19.2 140	14 08.9 140
47	15 26.5 141	15 18.2 142	15 06.4 140	14 54.9 140	14 43.8 141	14 33.2 140	14 22.9 140
48	15 40.6 141	15 32.4 140	15 20.4 140	15 08.9 140	14 57.9 139	14 47.2 138	14 36.9 138
49	15 54.7 139	15 46.4 139	15 34.4 139	15 22.9 138	15 11.8 138	15 01.0 138	14 50.7 137
50	16 08.6 138	16 00.3 138	15 48.3 138	15 36.7 138	15 25.6 137	15 14.8 137	15 04.4 136
51	16 22.4 138	16 14.1 138	16 02.1 137	15 50.5 136	15 39.3 136	15 28.5 135	15 18.0 135
52	16 36.2 136	16 27.9 136	16 15.8 136	16 04.1 136	15 52.9 135	15 42.0 135	15 31.5 135
53	16 49.8 136	16 41.5 136	16 29.4 135	16 17.7 134	16 06.4 134	15 55.5 133	15 45.0 133
54	17 03.4 134	16 55.1 134	16 42.9 134	16 31.1 134	16 19.8 133	16 08.8 133	15 58.3 132
55	17 16.8 134	17 08.5 134	16 56.3 133	16 44.5 133	16 33.1 132	16 22.1 132	16 11.5 131
56	17 30.2 132	17 21.9 132	17 09.6 132	16 57.8 131	16 46.3 132	16 35.3 131	16 24.6 131
57	17 43.4 132	17 35.1 131	17 22.8 131	17 10.9 131	16 59.5 130	16 48.4 130	16 37.7 129
58	17 56.6 131	17 48.2 131	17 35.9 130	17 24.0 130	17 12.5 130	17 01.4 129	16 50.6 129
59	18 09.7 129	18 01.3 129	17 48.9 129	17 37.0 128	17 25.5 128	17 14.3 128	17 03.5 127
60	18 22.6 128	18 14.2 128	18 01.8 128	17 49.8 127	17 38.3 127	17 27.1 126	17 16.2 126
61	18 35.4 127	18 27.0 127	18 14.6 126	18 02.5 126	17 51.0 125	17 39.7 125	17 28.8 125
62	18 48.1 125	18 39.7 125	18 27.2 126	18 15.1 125	18 03.5 125	17 52.2 124	17 41.3 123
63	19 00.7 125	18 52.2 125	18 39.8 125	18 27.6 124	18 16.0 123	18 04.6 123	17 53.6 123
64	19 13.2 123	19 04.7 123	18 52.2 123	18 40.0 123	18 28.3 122	18 16.9 122	18 05.9 121
65	19 25.5 123	19 17.0 122	19 04.5 122	18 52.3 122	18 40.5 121	18 29.1 121	18 18.0 121
66	19 37.8 121	19 29.2 121	19 16.7 121	19 04.5 120	18 52.6 121	18 41.2 120	18 30.1 119
67	19 49.9 120	19 41.3 120	19 28.8 120	19 16.5 119	19 04.7 119	18 53.2 118	18 42.0 118
68	20 01.9 119	19 53.3 119	19 40.8 119	19 28.4 118	19 16.6 117	19 05.0 118	18 53.8 117
69	20 13.8 118	20 05.2 118	19 52.7 117	19 40.2 117	19 28.3 117	19 16.8 116	19 05.5 116
70	20 25.6	20 17.0	20 04.4	19 51.9	19 40.0	19 28.4	19 17.1

TIMES OF S—continued

Δ	Depth <i>h</i> =						
	417 0-06	481 0-07	546 0-08	609 0-09	673 0-10	0-11	0-12
°	m s	m s	m s	m s	m s	m s	m s
30	10 02.0 155	9 54.0 155	9 47.0 155	9 41.0 154	9 35.9 152	9 31.6 151	9 28.0 150
31	10 17.5 155	10 09.5 154	10 02.5 153	9 56.4 152	9 51.1 152	9 46.7 150	9 43.0 149
32	10 33.0 154	10 24.9 154	10 17.8 154	10 11.6 152	10 06.3 151	10 01.7 150	9 57.9 148
33	10 48.4 153	10 40.3 153	10 33.2 152	10 26.8 151	10 21.4 149	10 16.7 148	10 12.7 147
34	11 03.7 152	10 55.6 152	10 48.4 151	10 41.9 150	10 36.3 149	10 31.5 147	10 27.4 146
35	11 18.9 151	11 10.8 150	11 03.5 149	10 56.9 149	10 51.2 147	10 46.2 146	10 42.0 145
36	11 34.0 150	11 25.8 150	11 18.4 149	11 11.8 147	11 05.9 147	11 00.8 146	10 56.5 144
37	11 49.0 149	11 40.8 148	11 33.3 147	11 26.5 146	11 20.6 145	11 15.4 144	11 10.9 143
38	12 03.9 148	11 55.6 147	11 48.0 146	11 41.1 146	11 35.1 145	11 29.8 144	11 25.2 142
39	12 18.7 147	12 10.3 146	12 02.6 145	11 55.7 144	11 49.6 143	11 44.2 142	11 39.4 141
40	12 33.4 146	12 24.9 145	12 17.1 144	12 10.1 143	12 03.9 142	11 58.4 141	11 53.5 141
41	12 48.0 144	12 39.4 143	12 31.5 143	12 24.4 142	12 18.1 142	12 12.5 141	12 07.6 139
42	13 02.4 143	12 53.7 143	12 45.8 142	12 38.6 141	12 32.3 140	12 26.6 140	12 21.5 139
43	13 16.7 143	13 08.0 141	13 00.0 141	12 52.7 141	12 46.3 139	12 40.6 138	12 35.4 138
44	13 31.0 141	13 22.1 141	13 14.1 140	13 06.8 139	13 00.2 139	12 54.4 138	12 49.2 137
45	13 45.1 140	13 36.2 140	13 28.1 139	13 20.7 139	13 14.1 138	13 08.2 137	13 02.9 136
46	13 59.1 140	13 50.2 139	13 42.0 139	13 34.6 138	13 27.9 137	13 21.9 136	13 16.5 135
47	14 13.1 138	14 04.1 138	13 55.9 137	13 48.4 137	13 41.6 136	13 35.5 135	13 30.0 134
48	14 26.9 137	14 17.9 137	14 09.6 136	14 02.1 136	13 55.2 136	13 49.0 135	13 43.4 134
49	14 40.6 137	14 31.6 136	14 23.2 136	14 15.7 135	14 08.8 134	14 02.5 133	13 56.8 132
50	14 54.3 136	14 45.2 135	14 36.8 135	14 29.2 134	14 22.2 133	14 15.8 132	14 10.0 132
51	15 07.9 135	14 58.7 135	14 50.3 134	14 42.6 133	14 35.5 132	14 29.0 132	14 23.2 130
52	15 21.4 134	15 12.2 133	15 03.7 132	14 55.9 132	14 48.7 132	14 42.2 130	14 36.2 130
53	15 34.8 133	15 25.5 133	15 16.9 132	15 09.1 131	15 01.9 130	14 55.2 130	14 49.2 128
54	15 48.1 132	15 38.8 131	15 30.1 131	15 22.2 130	15 14.9 129	15 08.2 128	15 02.0 128
55	16 01.3 131	15 51.9 130	15 43.2 130	15 35.2 129	15 27.8 128	15 21.0 127	15 14.8 126
56	16 14.4 130	16 04.9 130	15 56.2 128	15 48.1 128	15 40.6 128	15 33.7 127	15 27.4 126
57	16 27.4 129	16 17.9 128	16 09.0 128	16 00.9 127	15 53.4 126	15 46.4 125	15 40.0 124
58	16 40.3 127	16 30.7 127	16 21.8 127	16 13.6 126	16 06.0 126	15 58.9 125	15 52.4 123
59	16 53.0 127	16 43.4 126	16 34.5 125	16 26.2 125	16 18.6 124	16 11.4 123	16 04.7 122
60	17 05.7 125	16 56.0 125	16 47.0 124	16 38.7 124	16 31.0 123	16 23.7 122	16 16.9 121
61	17 18.2 125	17 08.5 124	16 59.4 123	16 51.1 122	16 43.3 122	16 35.9 121	16 29.0 121
62	17 30.7 123	17 20.9 122	17 11.7 122	17 03.3 122	16 55.5 120	16 48.0 120	16 41.1 119
63	17 43.0 122	17 33.1 122	17 23.9 121	17 15.5 120	17 07.5 120	17 00.0 119	16 53.0 118
64	17 55.2 121	17 45.3 120	17 36.0 120	17 27.5 119	17 19.5 118	17 11.9 118	17 04.8 117
65	18 07.3 120	17 57.3 119	17 48.0 119	17 39.4 118	17 31.3 117	17 23.7 116	17 16.5 116
66	18 19.3 119	18 09.2 119	17 59.9 117	17 51.2 117	17 43.0 116	17 35.3 116	17 28.1 114
67	18 31.2 117	18 21.1 117	18 11.6 117	18 02.9 117	17 54.6 115	17 46.9 114	17 39.5 114
68	18 42.9 117	18 32.8 117	18 23.3 117	18 14.4 115	18 06.1 115	17 58.3 114	17 50.9 112
69	18 54.6 115	18 44.3 115	18 34.8 115	18 25.9 113	18 17.5 113	18 09.6 112	18 02.1 111
70	19 06.1	18 55.8	18 46.2	18 37.2	18 28.8	18 20.8	18 13.2

TIMES OF S—continued

Δ	33		97		Depth h = 161		215		289		363			
	Surface		0-00	0-01	0-02	0-03	0-04	0-05						
°	m	s	m	s	m	s	m	s	m	s	m	s		
70	20	25.6	20	17.0	20	04.4	19	51.9	19	40.0	19	28.4	19	17.1
71	20	37.3	20	28.6	20	15.9	20	03.4	19	51.5	19	39.9	19	28.5
72	20	48.8	20	40.2	20	27.4	20	14.8	20	02.9	19	51.2	19	39.8
73	21	00.2	20	51.6	20	38.7	20	26.1	20	14.1	20	02.4	19	51.0
74	21	11.4	21	02.8	20	49.8	20	37.3	20	25.2	20	13.4	20	02.0
75	21	22.6	21	14.0	21	00.9	20	48.3	20	36.2	20	24.4	20	12.9
76	21	33.6	21	25.0	21	11.9	20	59.3	20	47.1	20	35.3	20	23.7
77	21	44.5	21	35.9	21	22.8	21	10.1	20	57.9	20	46.0	20	34.4
78	21	55.3	21	46.7	21	33.5	21	20.8	21	08.5	20	56.6	20	45.0
79	22	06.0	21	57.3	21	44.2	21	31.4	21	19.1	21	07.1	20	55.5
80	22	16.5	22	07.8	21	54.7	21	41.9	21	29.5	21	17.5	21	05.8
81	22	26.9	22	18.2	22	05.1	21	52.2	21	39.8	21	27.7	21	16.0
82	22	37.2	22	28.5	22	15.3	22	02.4	21	49.9	21	37.8	21	26.0
83	22	47.4	22	38.6	22	25.4	22	12.5	22	00.0	21	47.8	21	36.0
84	22	57.4	22	48.6	22	35.4	22	22.4	22	09.9	21	57.6	21	45.7
85	23	07.3	22	58.5	22	45.2	22	32.2	22	19.6	22	07.3	21	55.4
86	23	17.0	23	08.2	22	54.9	22	41.8	22	29.2	22	16.8	22	04.9
87	23	26.6	23	17.8	23	04.4	22	51.3	22	38.6	22	26.3	22	14.3
88	23	36.0	23	27.2	23	13.8	23	00.7	22	48.0	22	35.5	22	23.5
89	23	45.3	23	36.5	23	23.1	23	09.9	22	57.1	22	44.7	22	32.6
90	23	54.5	23	45.7	23	32.2	23	19.0	23	06.2	22	53.7	22	41.6
91	24	03.4	23	54.6	23	41.1	23	27.9	23	15.1	23	02.5	22	50.4
92	24	12.3	24	03.4	23	49.9	23	36.7	23	23.8	23	11.3	22	59.1
93	24	21.0	24	12.2	23	58.6	23	45.4	23	32.5	23	19.9	23	07.8
94	24	29.7	24	20.8	24	07.2	23	54.0	23	41.1	23	28.5	23	16.3
95	24	38.2	24	29.3	24	15.7	24	02.5	23	49.6	23	37.0	23	24.8
96	24	46.7	24	37.8	24	24.2	24	11.0	23	58.1	23	45.5	23	33.3
97	24	55.2	24	46.3	24	32.7	24	19.5	24	06.6	23	53.9	23	41.7
98	25	03.6	24	54.7	24	41.1	24	27.9	24	15.0	24	02.4	23	50.2
99	25	12.0	25	03.1	24	49.5	24	36.2	24	23.3	24	10.7	23	58.5
100	25	20.4	25	11.5	24	57.9	24	44.6	24	31.7	24	19.1	24	06.9
101	25	28.8	25	19.9	25	06.3	24	53.0	24	40.1	24	27.4	24	15.3
102	25	37.1	25	28.2	25	14.6	25	01.3	24	48.4	24	35.8	24	23.6
103	25	45.5	25	36.6	25	23.0	25	09.7	24	56.8	24	44.1	24	31.9
104	25	53.8	25	44.9	25	31.3	25	18.0	25	05.1	24	52.4	24	40.2
105	26	02.1	25	53.2	25	39.6	25	26.3	25	13.3	25	00.7	24	48.5
106	26	10.4	26	01.5	25	47.8	25	34.6	25	21.7	25	09.0		
107	26	18.7	26	09.8	25	56.2								

TIMES OF S—continued

Δ	Depth <i>h</i> =						
	417	481	545	609	673		
	0.06	0.07	0.08	0.09	0.10	0.11	0.12
°	m s	m s	m s	m s	m s	m s	m s
70	19 06.1	18 55.8	18 46.2	18 37.2	18 28.8	18 20.8	18 13.2
71	19 17.5 <sup>114</sup>	19 07.1 <sup>113</sup>	18 57.5 <sup>113</sup>	18 48.4 <sup>112</sup>	18 40.0 <sup>112</sup>	18 31.9 <sup>111</sup>	18 24.2 <sup>110</sup>
72	19 28.7 <sup>112</sup>	19 18.3 <sup>111</sup>	19 08.6 <sup>111</sup>	18 59.5 <sup>110</sup>	18 51.1 <sup>109</sup>	18 42.9 <sup>108</sup>	18 35.1 <sup>108</sup>
73	19 39.8 <sup>111</sup>	19 29.4 <sup>110</sup>	19 19.6 <sup>109</sup>	19 10.5 <sup>109</sup>	19 02.0 <sup>109</sup>	18 53.7 <sup>108</sup>	18 45.9 <sup>106</sup>
74	19 50.8 <sup>110</sup>	19 40.4 <sup>108</sup>	19 30.5 <sup>108</sup>	19 21.4 <sup>108</sup>	19 12.9 <sup>107</sup>	19 04.5 <sup>106</sup>	18 56.5 <sup>106</sup>
75	20 01.7 <sup>108</sup>	19 51.2 <sup>107</sup>	19 41.3 <sup>107</sup>	19 32.2 <sup>107</sup>	19 23.6 <sup>106</sup>	19 15.1 <sup>105</sup>	19 07.1 <sup>105</sup>
76	20 12.5 <sup>106</sup>	20 01.9 <sup>107</sup>	19 52.0 <sup>106</sup>	19 42.9 <sup>105</sup>	19 34.2 <sup>104</sup>	19 25.6 <sup>105</sup>	19 17.6 <sup>103</sup>
77	20 23.1 <sup>106</sup>	20 12.6 <sup>105</sup>	20 02.6 <sup>104</sup>	19 53.4 <sup>104</sup>	19 44.6 <sup>103</sup>	19 36.1 <sup>103</sup>	19 27.9 <sup>103</sup>
78	20 33.7 <sup>104</sup>	20 23.1 <sup>103</sup>	20 13.0 <sup>104</sup>	20 03.8 <sup>103</sup>	19 54.9 <sup>102</sup>	19 46.4 <sup>102</sup>	19 38.2 <sup>101</sup>
79	20 44.1 <sup>103</sup>	20 33.4 <sup>103</sup>	20 23.4 <sup>102</sup>	20 14.1 <sup>101</sup>	20 05.1 <sup>101</sup>	19 56.6 <sup>100</sup>	19 48.3 <sup>100</sup>
80	20 54.4 <sup>102</sup>	20 43.7 <sup>101</sup>	20 33.6 <sup>101</sup>	20 24.2 <sup>100</sup>	20 15.2 <sup>99</sup>	20 06.6 <sup>99</sup>	19 58.3 <sup>98</sup>
81	21 04.6 <sup>100</sup>	20 53.8 <sup>100</sup>	20 43.7 <sup>99</sup>	20 34.2 <sup>98</sup>	20 25.1 <sup>99</sup>	20 16.5 <sup>99</sup>	20 08.1 <sup>98</sup>
82	21 14.6 <sup>100</sup>	21 03.8 <sup>99</sup>	20 53.6 <sup>98</sup>	20 44.0 <sup>98</sup>	20 35.0 <sup>96</sup>	20 26.2 <sup>97</sup>	20 17.9 <sup>95</sup>
83	21 24.6 <sup>98</sup>	21 13.7 <sup>97</sup>	21 03.4 <sup>97</sup>	20 53.8 <sup>95</sup>	20 44.6 <sup>96</sup>	20 35.9 <sup>94</sup>	20 27.4 <sup>95</sup>
84	21 34.4 <sup>96</sup>	21 23.4 <sup>96</sup>	21 13.1 <sup>95</sup>	21 03.3 <sup>95</sup>	20 54.2 <sup>94</sup>	20 45.3 <sup>94</sup>	20 36.9 <sup>93</sup>
85	21 44.0 <sup>95</sup>	21 33.0 <sup>94</sup>	21 22.6 <sup>94</sup>	21 12.8 <sup>93</sup>	21 03.6 <sup>92</sup>	20 54.7 <sup>92</sup>	20 46.2 <sup>91</sup>
86	21 53.5 <sup>93</sup>	21 42.4 <sup>93</sup>	21 32.0 <sup>92</sup>	21 22.1 <sup>92</sup>	21 12.8 <sup>91</sup>	21 03.9 <sup>91</sup>	20 55.3 <sup>91</sup>
87	22 02.8 <sup>92</sup>	21 51.7 <sup>92</sup>	21 41.2 <sup>91</sup>	21 31.3 <sup>91</sup>	21 21.9 <sup>90</sup>	21 13.0 <sup>89</sup>	21 04.4 <sup>89</sup>
88	22 12.0 <sup>91</sup>	22 00.9 <sup>90</sup>	21 50.3 <sup>90</sup>	21 40.4 <sup>89</sup>	21 30.9 <sup>89</sup>	21 21.9 <sup>89</sup>	21 13.3 <sup>88</sup>
89	22 21.1 <sup>89</sup>	22 09.9 <sup>89</sup>	21 59.3 <sup>89</sup>	21 49.3 <sup>89</sup>	21 39.8 <sup>88</sup>	21 30.8 <sup>87</sup>	21 22.1 <sup>87</sup>
90	22 30.0 <sup>88</sup>	22 18.8 <sup>88</sup>	22 08.2 <sup>87</sup>	21 58.2 <sup>87</sup>	21 48.6 <sup>87</sup>	21 39.5 <sup>86</sup>	21 30.8 <sup>86</sup>
91	22 38.8 <sup>87</sup>	22 27.6 <sup>86</sup>	22 16.9 <sup>87</sup>	22 06.9 <sup>86</sup>	21 57.3 <sup>86</sup>	21 48.1 <sup>86</sup>	21 39.4 <sup>85</sup>
92	22 47.5 <sup>86</sup>	22 36.2 <sup>86</sup>	22 25.6 <sup>86</sup>	22 15.5 <sup>86</sup>	22 05.9 <sup>85</sup>	21 56.7 <sup>85</sup>	21 47.9 <sup>85</sup>
93	22 56.1 <sup>85</sup>	22 44.8 <sup>85</sup>	22 34.2 <sup>85</sup>	22 24.1 <sup>85</sup>	22 14.4 <sup>85</sup>	22 05.2 <sup>84</sup>	21 56.4 <sup>84</sup>
94	23 04.6 <sup>85</sup>	22 53.3 <sup>85</sup>	22 42.7 <sup>84</sup>	22 32.6 <sup>84</sup>	22 22.9 <sup>84</sup>	22 13.6 <sup>84</sup>	22 04.8 <sup>84</sup>
95	23 13.1 <sup>85</sup>	23 01.8 <sup>85</sup>	22 51.1 <sup>84</sup>	22 41.0 <sup>84</sup>	22 31.3 <sup>84</sup>	22 22.0 <sup>84</sup>	22 13.2 <sup>84</sup>
96	23 21.6 <sup>84</sup>	23 10.3 <sup>84</sup>	22 59.5 <sup>84</sup>	22 49.4 <sup>84</sup>	22 39.7 <sup>84</sup>	22 30.4 <sup>83</sup>	22 21.6 <sup>83</sup>
97	23 30.0 <sup>84</sup>	23 18.7 <sup>84</sup>	23 07.9 <sup>84</sup>	22 57.8 <sup>83</sup>	22 48.1 <sup>83</sup>	22 38.7 <sup>84</sup>	22 29.9 <sup>84</sup>
98	23 38.4 <sup>84</sup>	23 27.1 <sup>84</sup>	23 16.3 <sup>84</sup>	23 06.1 <sup>84</sup>	22 56.4 <sup>84</sup>	22 47.1 <sup>84</sup>	22 38.3 <sup>84</sup>
99	23 46.8 <sup>83</sup>	23 35.5 <sup>84</sup>	23 24.7 <sup>83</sup>	23 14.5 <sup>84</sup>	23 04.8 <sup>84</sup>	22 55.5 <sup>84</sup>	22 46.7 <sup>84</sup>
100	23 55.1 <sup>83</sup>	23 43.9 <sup>83</sup>	23 33.0 <sup>84</sup>	23 22.9 <sup>83</sup>	23 13.2 <sup>83</sup>	23 03.9 <sup>83</sup>	22 55.1 <sup>83</sup>
101	24 03.4 <sup>84</sup>	23 52.2 <sup>83</sup>	23 41.4 <sup>83</sup>	23 31.2 <sup>83</sup>	23 21.5 <sup>83</sup>	23 12.2 <sup>83</sup>	23 03.4 <sup>83</sup>
102	24 11.8 <sup>83</sup>	24 00.5 <sup>83</sup>	23 49.7 <sup>83</sup>	23 39.5 <sup>83</sup>	23 29.8 <sup>83</sup>	23 20.5 <sup>83</sup>	23 11.7 <sup>83</sup>
103	24 20.1 <sup>83</sup>	24 08.8 <sup>83</sup>	23 58.0 <sup>83</sup>	23 47.8 <sup>83</sup>	23 38.1 <sup>83</sup>	23 28.8 <sup>83</sup>	23 20.0 <sup>83</sup>
104	24 28.4 <sup>83</sup>	24 17.1 <sup>83</sup>	24 06.3 <sup>83</sup>	23 56.1 <sup>83</sup>	23 46.4 <sup>83</sup>		
105	24 36.7	24 25.4	24 14.6				

F

*P Upper Branches*

Surface	0.00	0.01	0.02	0.03	0.04	0.05
<i>Pd</i>	<i>Pd</i>	<i>Pd</i>	<i>Pd</i>	<i>Pd</i>	<i>Pd</i>	<i>Pd</i>
° m s	° m s	° m s	° m s	° m s	° m s	° m s
20 4 37.6	4 33.5	19 4 16.9	18 4 1.6	16 3 34.4	14 3 8.1	14 3 6.5
21 49.6	45.4	20 29.2	19 13.6	17 46.5	15 20.1	15 18.2
21.5 55.4	51.2	20.5 35.1	<i>Pu</i>	18 58.3	16 32.1	<i>Pu</i>
<i>Pu</i>	<i>Pu</i>	<i>Pu</i>	19 4 13.9	<i>Pu</i>	17 43.7	15 3 18.5
21.5 4 55.7	4 51.5	20 4 29.5	18 2.4	18 3 58.6	<i>Pu</i>	14 6.7
21 49.9	45.7	19 18.0	17 3 50.8	17 47.1	17 3 43.9	
20 38.4	34.2	18 6.4	<i>Pr</i>	16 35.5	16 32.4	
19 26.8	22.6	17.5 0.6	17 3 50.3	<i>Pr</i>	15 20.7	
18.5 21.0	16.7	<i>Pr</i>	18 4 1.1	17 3 46.0		
<i>Pr</i>	<i>Pr</i>	18 4 5.9				
19 4 26.3	19 4 21.9					

*S Upper Branches*

Surface	0.00	0.01	0.02	0.03	0.04
<i>Sd</i>	<i>Sd</i>	<i>Sd</i>	<i>Sd</i>	<i>Sd</i>	<i>Sd</i>
° m s	° m s	° m s	° m s	° m s	° m s
21 8 38.8	8 32.2	20 8 2.8	19 7 35.1	18 7 7.9	17 6 41.8
22 9 0.0	53.2		20 56.3		<i>Su</i>
22.4 8.4	9 1.8	<i>Su</i>	<i>Su</i>	<i>Sr</i>	16 6 21.1
<i>Su</i>	<i>Su</i>	20 8 3.0	20 7 56.4	17 6 47.3	<i>Sr</i>
22 9 0.0	8 53.0	19 7 42.3	19 35.5		16 6 20.8
21 8 39.2	32.1	18 21.8	18 14.9		17 6 40.2
20 18.6	11.4		<i>Sr</i>		
19.6 10.4	3.2	<i>Sr</i>	18 7 14.6		
<i>Sr</i>	<i>Sr</i>	19 7 42.4			
20 8 18.2	10.8				
21 37.4	30.0				

## Times of Transmission at Short Epicentral Distances for Different Focal Depths

$\Delta \backslash h/R$	P										
	0.00	0.002	.004	.006	.008	.010	.012	.014	.016	.018	.020
0.0	5.4	7.0	8.6	10.3	11.9	13.5	15.1	16.7	18.2	19.8	21.4
0.1	5.7	7.2	8.8	10.4	12.0	13.6	15.2	16.8	18.3	19.9	21.4
0.2	6.6	7.8	9.2	10.7	12.2	13.8	15.4	16.9	18.5	20.1	21.6
0.3	7.7	8.8	10.0	11.4	12.8	14.2	15.8	17.2	18.7	20.3	21.8
0.4	9.1	9.8	10.9	12.1	13.4	14.8	16.3	17.7	19.2	20.6	22.1
0.5	10.5	11.0	11.9	13.0	14.2	15.6	16.9	18.3	19.7	21.1	22.6
0.6	11.9	12.3	13.0	14.1	15.2	16.4	17.6	18.9	20.3	21.7	23.1
0.7	13.4	13.6	14.2	15.1	16.2	17.3	18.4	19.6	21.0	22.4	23.7
0.8	14.8	15.0	15.5	16.3	17.3	18.3	19.4	20.5	21.7	23.1	24.3
0.9	16.2	16.4	16.8	17.5	18.3	19.3	20.4	21.5	22.5	23.8	25.0
1.0	17.7	17.8	18.2	18.8	19.5	20.4	21.4	22.5	23.5	24.7	25.8
1.1	19.1	19.2	19.6	20.1	20.7	21.6	22.5	23.5	24.5	25.6	26.7
1.2	20.5	20.6	20.9	21.4	22.0	22.9	23.7	24.6	25.5	26.6	27.6
1.3	21.9	22.1	22.4	22.8	23.3	24.1	24.8	25.7	26.6	27.6	28.6
1.4	23.4	23.5	23.8	24.2	24.7	25.4	26.1	26.8	27.7	28.6	29.6
1.5	24.8	25.0	25.3	25.7	26.1	26.7	27.3	28.0	28.8	29.7	30.6

$\Delta \backslash h/R$	S										
	0.00	0.002	.004	.006	.008	.010	.012	.014	.016	.018	.020
0.0	9.2	12.1	15.0	17.8	20.7	23.6	26.4	29.2	32.1	34.9	37.7
0.1	9.8	12.4	15.3	18.0	20.9	23.8	26.5	29.3	32.2	35.0	37.8
0.2	11.2	13.3	16.0	18.7	21.4	24.2	27.0	29.7	32.6	35.3	38.1
0.3	13.2	14.9	17.3	19.8	22.4	25.0	27.6	30.3	33.1	35.8	38.5
0.4	15.5	16.7	18.9	21.1	23.5	26.0	28.5	31.1	33.8	36.5	39.2
0.5	18.0	18.8	20.6	22.6	24.9	27.2	29.6	32.1	34.7	37.3	40.0
0.6	20.6	21.2	22.6	24.4	26.4	28.6	30.9	33.3	35.8	38.3	40.9
0.7	23.1	23.6	24.8	26.4	28.2	30.2	32.3	34.6	37.0	39.4	41.9
0.8	25.7	26.0	27.0	28.4	30.1	31.8	33.9	36.0	38.3	40.6	43.1
0.9	28.2	28.5	29.4	30.5	32.1	33.7	35.7	37.6	39.8	42.0	44.3
1.0	30.8	31.0	31.7	32.8	34.2	35.7	37.5	39.3	41.4	43.5	45.7
1.1	33.3	33.5	34.1	35.0	36.3	37.8	39.4	41.1	43.1	45.1	47.2
1.2	35.9	36.0	36.5	37.4	38.5	39.9	41.5	43.0	44.9	46.8	48.8
1.3	38.4	38.6	39.0	39.7	40.8	42.1	43.5	45.0	46.8	48.6	50.5
1.4	41.0	41.1	41.5	42.2	43.2	44.4	45.7	47.1	48.7	50.5	52.3
1.5	43.5	43.7	44.1	44.7	45.6	46.6	47.8	49.2	50.7	52.4	54.1

$\Delta^\circ$	$h/R$													
	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12	
19	8	17	25											
20	9	19	27											
21	9	20	30	39										
22	9	20	31	41	50									
23	9	21	32	42	51									
24	9	21	32	42	52	61								
25	9	21	32	43	53	62	70							
28	9	22	33	45	55	65	74	81						
29	10	22	33	45	56	65	75	82						
30	10	22	34	45	56	66	75	83	90					
34	10	22	34	46	57	67	77	86	93	100				
35	10	22	34	46	58	68	78	86	94	100				
37	10	22	35	47	58	69	78	87	95	102	107			
40	10	23	35	47	58	69	80	89	97	104	110			
45	10	23	36	48	60	71	81	91	99	107	114	119	124	
50	10	23	36	49	61	72	83	93	102	110	118	124	130	
55	10	24	37	50	63	74	85	96	105	114	122	129	136	
60	10	24	38	51	64	76	88	98	108	117	126	134	141	
65	10	24	38	52	65	78	89	100	111	120	129	138	146	
70	10	25	39	53	66	79	91	102	113	123	132	141	150	
75	10	25	39	53	66	80	92	104	115	125	135	144	153	
80	10	25	40	54	67	81	94	105	117	127	137	147	156	
85	10	26	40	54	68	82	95	107	118	129	139	149	159	
90	10	26	41	55	69	82	96	108	120	131	141	152	162	
95	11	26	41	55	69	83	96	108	120	131	142	152	162	
100	11	26	41	55	69	83	96	108	120	131	142	153	163	

$\Delta^\circ$	$sS - S$													
	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12	
19	13d													
20	13d													
21	13d	32d												
22	14d	36d	51d											
23	15r	36r	55r	70d										
24	15	37	57	74r	91									
25	15	37	57	76	94	109								
26	16	37	58	78	96	112	126							
27	16	38	59	78	97	114	130							
28	16	38	59	79	98	116	132							
29	16	38	59	80	99	117	134	148						
30	16	38	60	80	100	118	135	150	162					
35	16	38	60	81	101	120	138	154	168	180	190			
40	16	39	61	83	103	122	141	158	172	185	196	206		
45	16	40	63	84	105	125	145	162	178	191	203	213	222	
50	17	41	64	86	107	128	148	166	182	196	210	221	231	
55	17	41	65	87	109	130	150	169	186	201	215	228	239	
60	17	42	66	89	111	132	153	172	190	206	220	234	246	
65	17	42	66	90	113	134	156	176	194	211	226	240	254	
70	17	43	67	91	114	137	158	179	198	215	231	246	261	
75	17	43	68	93	116	139	161	182	202	220	236	252	268	
80	18	44	69	94	118	141	164	185	205	223	241	258	274	
85	18	44	70	95	120	143	166	187	208	227	246	263	280	
90	18	45	71	96	121	145	169	191	212	231	250	268	286	
95	18	45	72	97	122	146	170	193	214	234	253	271	289	
100	18	45	72	98	123	147	171	194	215	235	254	272	290	

NEAR EARTHQUAKE PHASES.

Times of Transmission for a Surface Focus

$\Delta$	$P_g$	$P^*$	$P_n$	$S_g$	$S^*$	$S_n$
0.0	0.0	0 (2.8)	0 (6.8)	0.0	0 (3.9)	0 (10.7)
0.2	4.0			6.6	2.6	3.2
0.4	8.0	(9.6)		13.2	5.2	
0.6	12.0	13.1		19.8	21.7	
0.8	16.0	16.5	18.3	26.4	27.7	31.0
1.0	20.0	19.9	21.1	33.0	33.6	36.1
1.2	23.9	23.3	23.9	39.6	39.5	41.2
1.4	27.9	26.7	26.8	46.3	45.5	46.3
1.6	31.9	30.2	29.6	52.9	51.4	51.3
1.8	35.9	33.6	32.5	59.5	57.4	56.4
2.0	39.9	37.0	35.4	1 6.1	1 3.3	1 1.5
2.2	43.9	40.4	38.3	12.7	9.2	6.6
2.4	47.9	43.8	41.2	19.3	15.2	11.7
2.6	51.9	47.3	44.0	25.9	21.1	16.7
2.8	55.9	50.7	46.9	32.5	27.1	21.8
3.0	59.8	54.1	49.7	39.1	33.0	26.9
3.2	1 3.8	57.5	52.5	45.7	38.9	32.0
3.4	7.8	1 0.9	55.4	52.3	44.9	37.1
3.6	11.8	4.4	58.2	58.9	50.8	42.1
3.8	15.8	7.8	1 1.1	2 5.6	56.8	47.2
4.0	19.8	11.2	3.9	12.2	2 2.7	52.2
4.2	23.8	14.6	6.7	18.8	8.6	57.3
4.4	27.8	18.0	9.6	25.4	14.6	2 2.4
4.6	31.8	21.5	12.4	32.0	20.5	7.4
4.8	35.8	24.9	15.3	38.6	26.5	12.5
5.0	39.8	28.3	18.1	45.2	32.4	17.5
5.2	43.7	31.7	20.9	51.8	38.3	22.5
5.4	47.7	35.1	23.8	58.4	44.3	27.6
5.6	51.7	38.6	26.6	3 5.0	50.2	32.6
5.8	55.7	42.0	29.4	11.6	56.2	37.6
6.0	59.7	45.4	32.2	18.2	3 2.1	42.6
6.2	2 3.7	48.8	35.0	24.8	8.0	47.6
6.4	7.7	52.2	37.9	31.5	14.0	52.6
6.6	11.7	55.7	40.7	38.1	19.9	57.6
6.8	15.7	59.1	43.5	44.7	25.9	3 2.6
7.0	19.6	2 2.5	46.3	51.3	31.8	7.6
7.2	23.6	5.9	49.1	57.9	37.7	12.6
7.4	27.6	9.3	51.9	4 4.5	43.7	17.6
7.6	31.6	12.8	54.7	11.1	49.6	22.6
7.8	35.6	16.2	57.5	17.7	55.6	27.6
8.0	39.6	19.6	2 0.3	24.3	4 1.5	32.6
8.2				30.9	7.4	37.6
8.4				37.5	13.4	42.6
8.6				44.1	19.3	47.6
8.8				50.8	25.3	52.5
9.0				57.4	31.2	57.5
9.2				5 4.0	37.1	4 2.5
9.4				10.6	43.1	7.4
9.6				17.2	49.0	12.4
9.8				23.8	55.0	17.3
10.0				30.4	5 0.9	22.2

*Corrections for Focus at the Base of the Upper Layer*

$\Delta$	$P_g$	$S_g$
0	+2.7	+4.5
0.1	+1.4	+2.3
0.2	+0.8	+1.4
0.3	+0.6	+1.0
0.4	+0.4	+0.7
0.5	+0.4	+0.6
0.6	+0.3	+0.5
0.8	+0.2	+0.4
1.0	+0.2	+0.3
1.2	+0.1	+0.2
1.4	+0.1	+0.2

$\Delta$	$P$	$S$
1	-1.9	-2.8
10	-2.0	-3.0
20	-2.2	-3.4
30	-2.4	-3.9
40	-2.5	-4.0
50	-2.5	-4.0
60	-2.5	-4.1
70	-2.5	-4.1
80	-2.6	-4.2
90	-2.6	-4.2
100	-2.6	-4.3
100 (SKS)		-4.4
180 (PKP)	-2.7	
180 (SKS)		4.5

*Corrections for Focus at the Base of the Intermediate Layer*

$\Delta$	$P^*$	$S^*$
0.0	5.5	9.2
0.1	5.8	9.7
0.2	6.6	11.1
0.3	7.6	13.0
0.4	9.0	15.3
0.5	10.5	18.0
0.6	12.1	20.8
0.7	13.7	23.6
0.8	15.4	26.4

SURFACE REFLEXIONS

Travel-times of the Phases PP, PPP, PS (or SP), PPS (or SPP or PSP), SS, SSP (or PSS or SPS) and SSS. Surface Focus

Δ	PP		PPP		PS	PPS	SS		SSP	SSS	
	m	s	m	s			m	s		m	s
0	14		20				21			32	
1	28	143	35	143			47	254		58	254
2	42	143	49	143			1 12	254		1 23	254
3	57	143	1 3	143			38	254		48	254
4	1 11	143	18	143			2 3	254		2 14	254
5	25		32				28			39	
6	39	143	46	143			54	254		3 5	254
7	54	142	2 1	143			3 19	253		30	254
8	2 8	142	15	143			45	253		55	254
9	22	142	29	142			4 10	252		4 21	254
10	36	142	43	142			35	251		46	
11	50	141	58	142			5 0	251		5 11	253
12	3 5	141	3 12	142			25	250		37	253
13	19	140	26	142			50	250		6 2	253
14	33	140	40	142			6 15	250		27	252
15	47	140	54	142			40	250		53	251
16	4 1	139	4 9	141			7 5	249		7 18	251
17	15	139	23	141			30	249		43	251
18	28	138	37	141			55	248		8 8	250
19	42	138	51	141			8 20	247		33	250
20	56	137	5 5	140			45	246		58	250
21	5 10	137	19	140			9 9	245		9 23	250
22	23	136	33	140			34	244		48	250
23	37	135	47	140			58	243		10 13	250
24	51	134	6 1	139			10 22	242		38	249
25	6 4	134	15	139			47	241		11 3	249
26	17	133	29	139			11 11	240		28	249
27	31	132	43	138			35	239		53	248
28	44	131	56	138			59	238		12 17	247
29	57	131	7 10	138			12 22	236		42	247
30	7 10	130	24	137			46	235		13 7	246
31	23	129	38	137			13 9	234		31	245
32	36	128	51	137			33	232		56	245
33	49	127	8 5	136			56	230		14 20	244
34	8 1	125	19	136			14 19	229		45	244
35	14	125	32	135			42	227		15 9	243
36	26	124	46	134			15 5	227		33	242
37	39	122	59	134			27	225		58	242
38	51	121	9 13	134			50	223		16 22	241
39	9 3	109	26	133			16 12	221		46	240

SURFACE REFLEXIONS—continued

Δ	PP		PPP		PS		PPS		SS		SSP		SSS	
	m	s	m	s	m	s	m	s	m	s			m	s
40	9	14	9	39	(13	53)	(14	0)	16	34			17	10
41		24		53						213				239
42		35	10	6						56			34	239
43		45		19						17	15		58	238
44		55		32	14	50	14	57		34			18	22
				131		143		143		52			45	237
45	10	5	45		15	5	15	12	18					236
46		15		58		19		26		11			19	9
47		25	11	11		33		40		46				235
48		34		24		48		54		19	4		32	234
49		44		37	16	2	16	9	19	4	171		20	19
				127		142		143		21	169		42	233
50		54	49		16			23						231
51	11	3	12	2	30			37		38			21	6
52		12		15		45		52		55			29	230
53		22		27		59		17	6	20	11		51	229
54		31		40	17	13	17	6		28			22	228
				124		141		142		44			37	227
55		40	52		27			34		21	0		23	0
56		49	13	4	41			48		16			22	226
57		58		17		55		18	3	33			45	225
58	12	7		29	18	9	18	9		49			24	7
59		16		40		23		31		22	5		29	222
				106		138		141			159			221
60		25	51		37			45		20				217
61		34	14	2	50			59		36			25	13
62		43		12		18		19	13	52			33	200
63		51		22	19	4	19	13		27			52	192
64	13	0		32	32			41		23	8		26	190
				101		136		140		23	156			188
65		9	43		45			55		39				186
66		18		53		59		20	9	54			30	186
67		26	15	3	20	12	20	23		24	10		49	183
68		35		12		26		37		25			27	7
69		44		22		39		51		41			25	182
				98		133		138		41	155		43	180
70		52	32		52			21	5	56				177
71	14	1		42	21	5	21	18		25	12		28	1
72		9		51		19		32		27			18	175
73		18	16	1		32		46		43			36	173
74		26		11		45		22	0	58			53	172
				96		131		136		58	153		29	170
75		35	20		58			13		26	13			169
76		43		30	22	11		27		29	152		27	168
77		51		39		23		40		44	152		44	167
78	15	0		49		36		54		59	151		30	0
79		8		58		49		23	7	27	14		17	166
				92		126		134			150		33	165
80		16	17	7	23	1		21		29				164
81		25		16		14		34		44	150		50	163
82		33		25		26		47		59	149		31	6
83		41		34		39		24	1	28	148		22	163
84		49		44		51		14		28	148		39	162
				90		123		132			147		55	161
														161

SURFACE REFLEXIONS—continued

Δ	PP		PPP		PS		PPS		SS		SSP		SSS	
	m	s	m	s	m	s	m	s	m	s	m	s	m	s
85	15	57	17	53	24	3	24	27	28	43			32	11
86	16	5	18	2		16		40	58				27	161
87		14		11		28		54	12				43	160
88		22		20		40		25	27				59	159
89		30		29		52		20	41				33	159
90		38		37	25	3		33	56			30	3	159
91		46		46		15		46	17			17	143	47
92		54		55		27		59	24			31	143	2
93	17	2	19	4		38		26	39			46	143	18
94		10		13		49		24	53			31	0	34
95		17		22	26	0		37	31			14	143	49
96		25		30		11		50	21			28	142	5
97		33		39		22		27	35			43	142	20
98		41		48		32		15	49			57	142	36
99		48		57		43		27	32			32	11	52
100		56	20	5		53		40	17			25	141	7
101	18	4		14	27	4		52	31			39	141	23
102		11		23		14		28	45			53	141	38
103		19		31		25		17	59			33	8	54
104		26		40		35		29	33			22	140	9
105		34		48		45		41	26			36	140	25
106		41		57		55		53	40			50	140	40
107		49	21	5	28	5		29	53			34	4	56
108		56		14		15		17	34			18	139	38
109	19	4		22		24		29	20			31	138	26
110		11		31		34		41	34			45	138	42
111		18		39		44		53	47			59	138	57
112		25		47		53		30	35			35	13	39
113		33		56	29	3		16	14			27	137	28
114		40	22	4		12		27	27			40	137	43
115		47		13		22		37	40			54	137	58
116		54		21		31		48	53			36	8	40
117	20	1		30		40		59	36			21	136	28
118		8		38		49		31	19			35	136	43
119		15		46		58		20	32			49	135	58
120		21		54	30	7		30	45			37	2	41
121		28	23	3		16		41	58			16	134	28
122		35		11		25		51	37			29	134	43
123		42		19		34		32	24			42	134	58
124		49		27		42		12	36			56	133	42
125		55		35		51		22	49			38	9	28
126	21	2		44	31	0		32	38			22	132	43
127		8		52		9		42	14			36	132	57
128		15	24	0		17		52	26			49	132	43
129		22		8		26		33	39			39	2	27

## SURFACE REFLEXIONS—continued

Δ	PP		PPP		PS		PPS		SS		SSP		SSS	
	m	s	m	s	m	s	m	s	m	s	m	s	m	s
130	21	28 65	24	16 81	31	34 85	33	12 98	38	51 123	39	15 131	43	41 145
131		35 64	24	81	43	85		22 98	39	3 122	28	131	56	145
132		41 64	32	81	51	85		32 97		16 122	41	130	44	10 145
133		47 63	41	81	32	0 84		42 97		28 121	54	130		25 145
134		54 63	49	80		8 84		51 97		40 120	40	7 130		39 144
135	22	0 63	57	80		17 84	34	1 96		52 120	20	129	54	144
136		6 62	25	79	25	84		11 96	40	4 119	33	128	45	8 143
137		12 62	13	79	33	84		20 95		16 119	46	128	22	143
138		19 62	20	79	42	84		30 94		28 118	59	127		37 143
139		25 61	28	79	50	84		39 94		39 118	41	12 127		51 143
140		31 61	36	79	59	84		48 93		51 117	24	127	46	5 142
141		37 60	44	79	33	7 83		58 92	41	3 116	37	126		19 142
142		43 60	52	79	15	83	35	7 92		15 116	50	126		34 141
143		49 60	26	0 78	24	83		16 92		26 115	42	2 125		48 141
144		55 59	8	78	32	83		25 91		38 114	15	125	47	2 141
145	23	1 59	16	77	40	83		34 90		49 113	27	125		16 141
146		7 59	23	77	49	83		44 90	42	0 113	40	124		30 140
147		13 58	31	77	57			53 90		12 112	52	123		44 140
148		19 58	39	77			36	2 90		23 112	43	4 123		58 139
149		24 57	46	77				11 90		34 111	17	123	48	12 139
150		30 57	54	76				20 89		45 111	29	122		26 138
151		36 57	27	2 76				28 89		56 110	41	122		40 138
152		41 56	9	76				37 88	43	7 109	53	121		53 138
153		47 56	17	76				46 88		18 109	44	5 121	49	7 138
154		53 56	24	76				55 88		29 108	17	120		21 138
155		58	32	76										
156	24	4 55	40	75			37	4 88		40 108	29	120		35 137
157		9 54	47	75				13 87		51 107	41	119		49 137
158		15 54	55	74				21 87	44	1 106	53	119	50	2 136
159		20 54	28	2 74				30 87		12 106	45	5 119		16 136
								39 87		23 105	17	119		29 136
160		25 53	9	74				47 87		33 104	29	118		43 136
161		31 53	17	74				56 87		43 104	41	117		57 135
162		36 53	24	73			38	5 86		54 104	53	116	51	10 135
163		41 52	32	73				13 86	45	4 103	46	4 113		24 134
164		47 52	39	73				22 85		15 102	15	113		37 134
165		52 51	46	73				30 85		25 101	27	112		50 134
166		57 51	53	72				39 85		35 100	38	112	52	4 134
167	25	2 51	29	1 72				47 85		45 100	49	112		17 133
168		7 51	8	72				56 85		55 99	47	0 111		31 133
169		12 50	15	72			39	4 84	46	5 98	11	111		44 132
170		17 50	22	71				13 84		15 98	23	110		57 132
171		22 49	29	71				21 84		24 97	34	109	53	10 132
172		27 49	36	70				30 84		34 96	44	109		23 132
173		32 49	43	70				38 84		44 95	55	108		37 132
174		37 49	50	70				46 84		53 95	48	6 108		50 131

SURFACE REFLEXIONS—continued

Δ	PP		PPP		PS	PPS		SS		SSP		SSS	
	m	s	m	s		m	s	m	s	m	s	m	s
175	25	42	29	57		39	55	47	3	48	17	54	3
176		47	30	4		40	3		12	28	107	16	131
177		51		11			12		21	38	107	29	130
178		56		18			84		31	49	106	42	130
179	26	i	25	69		28	84	40	91	49	0	55	129
180		5	32	68		37	83	49	90	10	104	55	8
181	10	46	39	68		45	83	58	89	20	104	21	128
182	15	46	46	68		53	83	48	7	31	104	33	128
183	19	46	53	68		41	2	16	88	41	103	46	127
184	24	46	59	68		10	83	25	88	52	103	59	127
185	28	46	31	6		18	83	33	87	50	2	56	12
186	33	46		13		27	83	42	87	12	102	24	126
187	38	46	20	66		35	83	51	86	22	101	37	126
188	42	46	26	66		43		59	86	32	100	50	126
189	47	46	33	66				49	8	42	100	57	2
190	51	46	39	66				16	85	52	99	15	125
191	56	46	46	66				25	85	51	2	27	124
192	27	1	53	65				33	85	12	98	40	124
193	5	45	59	65				42	85	22	98	52	123
194	10	45	32	6				50	84	32	98	58	4
195	14	45	12	64				59	84	41	97	17	123
196	19	45	18	64				50	7	51	97	29	122
197	23	45	25	64				16	84	52	1	41	122
198	28	45	31	64				24	84	10	96	53	122
199	32	45	38	64				32	84	20	95	59	6
200	37	45	44	64				41	84	29	94	18	121
201	41	45	50	63				49	84	39	94	30	120
202	46	45	57	63				58	84	48	93	42	120
203	50	45	33	3				51	6	58	93	54	120
204	55	44		9				14	83	53	7	60	6
205	59	44	16	62				23	83	16	92	18	119
206	28	4	22	62				31	83	25	91	30	119
207	8	44	28	61				39	83	34	91	41	118
208	12	44	34	61				48	83	43	91	53	118
209	17	44	40	61				56	83	52	90	61	5
210	21		46	61				52	4	54	1	17	118
211			52	61				13	83	10	89	29	117
212			58	61				21	83	19	89	40	116
213			34	5				29	83	28	88	52	116
214			11	60				37	83	37	88	62	4
215			17	60						46	88	15	114
216			23	59						55	88	26	114
217			28	59						55	3	38	114
218			34	59						12	87	49	113
219			40	58						21	87	63	1
220			46							30		12	

$\Delta$ \ h	Depth Allowances. PP												
	33 .00	97 .01	161 .02	225 .03	289 .04	353 .05	417 .06	481 .07	545 .08	609 .09	673 .10	.11	.12
10	3	3											
20	4	5	6	7									
30	4	7	10	12	13	14	13	14	14				
32	4	7	10	13	14	16	17	19	20				
34	4	8	11	14	15	18	21	24	25	25			
36	4	8	11	14	18	22	25	28	30	31			
38	4	8	12	17	22	26	29	32	34	36	36		
40	4	10	15	20	24	28	32	35	38	39	40	40	
45	5	10	16	21	26	30	34	38	41	43	45	46	46
50	5	10	16	22	27	32	36	40	43	46	48	50	51
60	5	11	17	23	28	33	38	42	46	49	52	54	55
70	5	11	17	23	29	34	39	44	48	51	54	57	59
80	5	11	18	24	29	35	40	45	49	53	56	59	61
90	5	12	18	24	30	36	41	46	50	54	57	61	64
100	5	12	18	25	31	36	42	47	51	55	59	63	66
110	5	12	19	25	32	37	43	48	53	57	61	65	69
120	5	12	19	26	32	38	44	49	54	59	63	67	71
130	5	12	19	26	33	39	45	50	56	60	65	69	74
140	5	12	19	26	33	40	46	51	57	62	66	71	75
150	5	13	20	27	33	40	46	52	58	63	68	72	77
160	5	13	20	27	34	40	47	53	59	64	69	74	79
170	5	13	20	27	34	41	47	54	59	65	70	75	80
180	5	13	20	28	35	41	48	54	60	65	71	76	81

$\Delta$ \ h	Depth Allowances. PPP												
	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12
10	3												
20	4	4											
30	4	5	6										
40	4	7	9	9	9								
50	4	8	11	13	15	15	15	17					
52	4	8	11	14	16	17	18	21	21				
54	4	8	11	14	16	19	22	25	26				
56	4	8	12	15	19	23	26	29	30	31			
58	4	9	14	18	22	26	30	33	34	35			
60	4	10	15	20	24	28	32	35	37	38	39		
70	5	10	16	21	26	30	35	38	41	43	45	47	
80	5	11	17	22	28	32	37	41	44	47	49	51	52
90	5	11	17	23	28	33	38	42	46	49	51	53	55
100	5	11	17	23	29	34	39	43	47	50	53	55	57
120	5	11	17	24	29	35	40	44	49	52	55	58	61
140	5	11	18	24	30	36	41	46	50	54	58	61	64
160	5	12	18	25	31	37	42	47	52	56	60	64	68
180	5	12	19	26	32	38	44	49	54	59	63	67	71
200	5	12	19	26	33	39	45	51	56	61	65	70	75
220	5	12	19	26	33	40	46	52	57	62	67	72	77

Depth Allowances. PS and SP

(a) PS

$\frac{h}{\Delta}$	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12
50	3	3											
60	3	5	6										
70	4	7	9	10	10								
80	4	8	11	14	15	16	17						
85	4	8	11	15	17	19	21	22					
90	4	9	12	16	21	23	26	28	30				
95	4	9	14	19	23	26	30	32	34	34			
100	5	10	15	20	24	28	32	35	37	38	39		
105	5	10	16	21	25	30	34	37	40	42	43	44	44
110	5	11	16	21	26	31	36	39	42	45	47	48	49
120	5	11	17	22	28	33	38	42	46	49	51	54	55
130	5	11	17	23	29	34	39	44	47	51	54	57	58
140	5	11	17	23	29	35	40	44	48	52	55	58	59

(b) SP

$\frac{h}{\Delta}$	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12
40	8	20	31	42	53	63	73	81	89	96	102	108	113
50	8	20	31	42	53	63	73	82	90	97	103	109	114
60	8	20	32	43	54	64	74	83	92	99	106	112	118
70	8	21	32	44	55	66	76	85	94	102	109	116	122
80	8	21	33	45	56	67	77	87	96	105	112	120	127
85	9	21	33	45	57	68	78	88	98	106	114	122	129
90	9	21	34	46	57	68	79	89	99	108	116	124	133
95	9	22	34	47	58	70	81	92	102	111	119	128	136
100	9	22	34	47	59	70	82	93	103	112	121	129	139
105	9	22	35	47	60	71	83	94	104	113	122	131	140
110	9	22	35	48	60	72	83	94	105	114	124	133	141
120	9	22	35	48	61	73	84	95	106	116	126	135	143
130	9	22	36	49	61	73	85	96	107	117	127	136	145
140	9	23	36	49	61	73	85	97	107	118	127	137	145

## Depth Allowances. PPS, PSP and SPP

## (a) PPS or PSP

$\frac{h}{\Delta}$	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12
60	3	3											
70	4	5											
80	4	6	8	8									
90	4	7	10	11	12								
100	4	8	11	14	16	17	18	(17)					
110	4	9	12	18	21	24	27	29	28				
120	4	10	15	20	24	28	31	34	36	37			
130	5	10	16	21	26	30	34	38	40	42	44	44	
140	5	11	16	22	27	32	36	40	43	46	49	50	51
160	5	11	17	23	28	34	38	43	47	50	53	55	57
180	5	11	17	23	29	35	40	44	48	52	55	(58)	(60)

## (b) SPP

$\frac{h}{\Delta}$	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12
40	8	20	31	42	53	63	73	81	89	96	102	108	113
50	8	20	31	42	53	63	73	81	89	97	103	109	113
60	8	20	32	43	53	63	73	82	90	98	104	110	115
70	8	20	32	43	54	64	74	83	92	99	106	112	117
80	8	21	32	43	54	65	75	84	93	101	108	115	120
90	8	21	32	44	55	66	77	86	95	103	111	118	124
100	8	21	33	45	56	67	78	88	97	105	113	121	127
110	9	22	34	46	58	69	80	91	101	110	118	126	134
120	9	22	34	47	59	69	82	92	103	112	121	129	137
140	9	22	35	48	60	72	84	95	105	115	124	133	142
160	9	22	36	49	61	73	85	96	107	117	126	135	144
180	9	22	36	49	61	73	85	97	107	118	127	137	145

Depth Allowances. SS

$\frac{h}{\Delta}$	52	97	161	225			477	481	545	604	673		
$\Delta$	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12
10	5	6											
20	6	9	10	(10)									
30	6	11	15	18	20	20	18	19	18				
32	6	12	16	20	22	24	24	26	27	25			
34	6	12	17	21	25	27	30	34	36	36	35		
36	6	13	18	23	27	32	37	42	45	46	47		
38	6	13	19	25	32	39	45	50	53	56	58	58	
40	6	14	23	31	39	46	52	58	62	66	68	69	
42.5	7	17	26	34	43	50	57	64	69	73	76	78	78
45	8	18	26	35	45	53	61	68	74	78	83	84	85
50	8	19	29	39	48	56	65	72	78	84	88	91	93
60	8	19	30	40	50	59	68	76	83	89	94	97	100
70	8	19	30	40	51	60	69	77	84	91	96	100	104
80	8	20	31	41	52	61	71	79	87	93	99	105	109
90	8	20	31	42	53	63	72	81	89	96	103	108	113
100	8	20	32	43	54	64	74	83	91	99	106	112	117
110	8	20	32	44	55	65	75	85	93	101	108	115	121
120	8	21	33	44	55	66	77	86	95	103	111	118	124
130	8	21	33	45	56	67	78	88	97	106	114	121	128
140	9	21	34	46	57	68	79	90	99	108	116	124	131
150	9	21	34	47	58	69	81	91	101	110	119	127	135
160	9	22	35	47	59	71	82	93	103	112	121	129	138
170	9	22	35	48	60	72	83	94	104	114	123	132	140
180	9	22	35	48	61	73	84	96	106	116	126	135	143

Depth Allowances. PSS, SSP and SPS

(a) PSS

$\frac{h}{\Delta}$	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12
100	3	3											
110	4	5											
120	4	6	7										
130	4	7	9	10									
140	4	7	10	13	14								
150	4	8	11	15	17	18	19						
160	4	8	12	16	19	22	24	26					
170	4	9	14	18	22	26	28	31	31				
180	4	10	15	20	24	28	31	34	36	37			
200	5	10	16	22	27	31	36	40	43	46	48	49	
220	5	11	17	23	28	34	39	43	47	50	53	55	57

## (b) SSP or SPS

$\frac{h}{\Delta}$	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12
90	8	20	31	42	53	63	72	81	88	96	103	108	113
100	8	20	32	43	53	63	73	82	90	97	104	110	115
110	8	20	32	43	54	64	74	83	91	99	106	112	117
120	8	20	32	43	54	65	75	84	93	101	108	114	120
130	8	21	33	44	55	66	76	85	94	102	110	116	122
140	8	21	33	44	56	67	77	87	96	104	112	119	125
150	8	21	33	45	56	68	78	88	97	106	114	121	128
160	9	21	33	45	57	68	79	89	99	108	116	124	131
170	9	21	34	46	58	69	81	91	101	110	119	127	135
180	9	22	35	47	59	71	82	93	103	112	121	129	138
200	9	22	35	48	60	72	84	95	105	115	124	133	142
220	9	22	36	48	61	73	85	96	107	117	126	136	144

## Depth Allowances. SSS

$\frac{h}{\Delta}$	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12
10	5												
20	5	6											
30	6	8	9										
40	6	10	13	14									
50	6	12	17	20	22	23		20					
52	6	12	17	21	24	25		27	27				
54	6	12	18	22	25	28	30	34	35				
56	6	13	18	23	27	31	37	42	43	43			
58	6	13	19	25	31	38	43	48	51	52	52		
60	7	15	22	30	37	44	50	55	59	61	62		
62	7	17	25	33	41	48	55	60	64	67	69		
64	7	17	26	34	42	50	57	63	67	71	73	73	
66	8	17	27	36	44	52	59	65	70	74	77	78	
68	8	18	27	36	45	53	60	67	73	78	80	82	
70	8	18	28	37	46	54	62	69	75	81	83	85	86
80	8	19	29	39	49	58	66	74	80	85	90	93	95
90	8	19	30	40	50	59	68	76	83	88	93	97	100
100	8	19	30	40	50	60	69	77	84	90	95	99	102
120	8	20	31	41	52	61	71	79	86	93	99	104	108
140	8	20	32	43	53	63	73	82	90	97	104	109	114
160	8	20	32	43	54	65	75	84	92	100	107	113	119
180	8	21	33	44	55	66	77	86	95	103	111	118	124
200	9	21	33	45	57	68	78	88	98	106	114	122	129
220	9	21	34	46	58	69	80	91	100	109	118	126	133

CORE REFLEXIONS

*PcP. Surface Focus*

$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s
0	8	34.3	26	9	5.2	51	10	22.0	76	12	3.4
1		34.3	27		7.5	52		25.7	77		7.7
2		34.5	28		9.9	53		29.4	78		12.0
3		34.7	29		12.4	54		33.2	79		16.3
4		35.0	30		14.9	55		37.0	80		20.6
5		35.4	31		17.5	56		40.9	81		24.9
6		35.9	32		20.2	57		44.8	82		29.3
7		36.6	33		22.9	58		48.7	83		33.6
8		37.3	34		25.7	59		52.6	84		37.9
9		38.1	35		28.6	60		56.6	85		42.3
10		39.0	36		31.5	61	11	0.6	86		46.7
11		40.0	37		34.5	62		4.6	87		51.0
12		41.1	38		37.6	63		8.7	88		55.4
13		42.3	39		40.7	64		12.8	89		59.8
14		43.5	40		43.9	65		16.9	90	13	4.2
15		44.9	41		47.1	66		21.0	91		8.6
16		46.4	42		50.4	67		25.2	92		13.0
17		47.9	43		53.7	68		29.4	93		17.4
18		49.5	44		57.1	69		33.6	94		21.9
19		51.2	45	10	0.5	70		37.8	95		26.3
20		53.0	46		4.0	71		42.0	96		30.7
21		54.9	47		7.5	72		46.3	97		35.2
22		56.8	48		11.1	73		50.5	98		39.6
23		58.8	49		14.7	74		54.8	99		44.1
24	9	0.9	50		18.3	75		59.1	100		48.5
25		3.0									

*ScS. Surface Focus*

$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s
0	15	35.7	26	16	33.0	51	18	54.6	76	22	3.1
1		35.8	27		37.3	52	19	1.5	77		11.1
2		36.1	28		41.7	53		8.4	78		19.2
3		36.5	29		46.3	54		15.4	79		27.4
4		37.1	30		51.0	55		22.5	80		35.5
5		37.9	31		55.8	56		29.6	81		43.7
6		38.9	32	17	0.8	57		36.8	82		51.9
7		40.1	33		5.9	58		44.1	83	23	0.1
8		41.4	34		11.1	59		51.4	84		8.3
9		42.9	35		16.4	60		58.8	85		16.5
10		44.6	36		21.8	61	20	6.2	86		24.7
11		46.5	37		27.4	62		13.7	87		33.0
12		48.5	38		33.0	63		21.2	88		41.3
13		50.7	39		38.8	64		28.8	89		49.5
14		53.0	40		44.6	65		36.4	90		57.8
15		55.5	41		50.5	66		44.1	91	24	6.1
16		58.2	42		56.5	67		51.8	92		14.3
17	16	1.0	43	18	2.6	68		59.6	93		22.6
18		3.9	44		8.8	69	21	7.4	94		30.9
19		7.0	45		15.1	70		15.2	95		39.2
20		10.3	46		21.5	71		23.1	96		47.5
21		13.7	47		28.0	72		31.0	97		55.8
22		17.3	48		34.5	73		39.0	98	25	4.1
23		21.0	49		41.1	74		47.0	99		12.4
24		24.9	50		47.8	75		55.0	100		20.7
25		28.9									

$\Delta \backslash h$	Depth Allowances. PcP												
	33 .00	97 .01	161 .02	225 .03	.04	.05	.06	.07	.08	.09	.10	.11	.12
0	-5.4	-13.5	-21.4	-29.1	-36.6	-43.9	-51.1	-58.0	-64.5	-70.8	-76.8	-82.8	-88.8
10	-5.4	-13.4	-21.3	-29.0	-36.5	-43.8	-50.9	-57.8	-64.3	-70.5	-76.5	-82.5	-88.5
20	-5.4	-13.4	-21.2	-28.8	-36.2	-43.5	-50.6	-57.4	-63.8	-69.9	-75.8	-81.6	-87.4
30	-5.3	-13.3	-21.0	-28.6	-35.9	-43.0	-50.0	-56.7	-63.1	-69.1	-74.8	-80.5	-86.2
40	-5.3	-13.2	-20.9	-28.4	-35.6	-42.6	-49.5	-56.1	-62.4	-68.3	-73.9	-79.5	-84.9
50	-5.3	-13.1	-20.7	-28.1	-35.2	-42.2	-49.0	-55.5	-61.7	-67.4	-72.9	-78.2	-83.3
60	-5.3	-13.1	-20.6	-27.9	-35.0	-41.9	-48.6	-55.0	-61.1	-66.8	-72.3	-77.6	-82.8
70	-5.3	-13.0	-20.5	-27.7	-34.8	-41.6	-48.3	-54.7	-60.7	-66.3	-71.7	-77.0	-82.2
80	-5.3	-13.0	-20.5	-27.7	-34.8	-41.6	-48.3	-54.6	-60.5	-66.1	-71.5	-76.8	-81.9

$\Delta \backslash h$	Depth Allowances. ScS												
	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12
0	-9.2	-23.6	-37.7	-51.5	-65.1	-78.3	-91.2	-103.6	-115.5	-126.9	-137.9	-148.6	-159.0
10	-9.2	-23.5	-37.6	-51.4	-64.9	-78.1	-90.9	-103.2	-115.1	-126.4	-137.4	-148.1	-158.4
20	-9.2	-23.4	-37.4	-51.1	-64.5	-77.6	-90.3	-102.6	-114.3	-125.4	-136.2	-146.7	-156.9
30	-9.1	-23.3	-37.1	-50.7	-63.9	-76.8	-89.4	-101.2	-112.7	-123.7	-134.4	-144.7	-154.6
40	-9.1	-23.1	-36.8	-50.2	-63.3	-76.0	-88.3	-100.1	-111.4	-122.3	-132.7	-142.8	-152.4
50	-9.1	-23.0	-36.5	-49.7	-62.6	-75.1	-87.3	-99.0	-110.1	-120.7	-130.9	-140.7	-150.1
60	-9.0	-22.8	-36.3	-49.4	-62.2	-74.6	-86.7	-98.2	-109.1	-119.5	-129.5	-139.1	-148.3
70	-9.0	-22.6	-36.0	-49.1	-61.8	-74.1	-85.9	-97.4	-108.3	-118.6	-128.4	-137.8	-146.8
80	-9.0	-22.6	-35.9	-48.9	-61.5	-73.7	-85.5	-96.9	-107.7	-117.8	-127.5	-136.8	-145.7

PcS = ScP. Surface Focus

Δ	m s		Δ	m s		Partition of Distance		
	m	s		m	s	Δ	Δ (as P)	Δ (as S)
0	12	5.0	36	13	17.8	0	0	0
1		5.1	37		21.5	5	3	2
2		5.2	38		25.2	10	6	4
3		5.5	39		29.0	15	10	5
4		6.0	40		32.9	20	14	6
5		6.5	41		36.8	25	17	8
6		7.2	42		40.8	30	20	10
7		8.0	43		44.8	35	24	11
8		9.0	44		48.8	40	28	12
9		10.0	45		52.9	45	32	13
10		11.2	46		57.0	50	37	13
11		12.5	47	14	1.2	55	42	13
12		13.9	48		5.4	60	46	14
13		15.4	49		9.6	65	51	14
14		17.1	50		13.8	70	56	14
15		18.8	51		18.1			
16		20.6	52		22.4			
17		22.6	53		26.7			
18		24.7	54		31.0			
19		26.8	55		35.4			
20		29.1	56		39.8			
21		31.5	57		44.2			
22		33.9	58		48.6			
23		36.5	59		53.0			
24		39.1	60		57.4			
25		41.9	61	15	1.9			
26		44.8	62		6.3			
27		47.7	63		10.7			
28		50.8	64		15.2			
29		53.9	65		19.6			
30		57.1	66		24.1			
31	13	0.4	67		28.5			
32		3.7	68		32.9			
33		7.2	69		37.3			
34		10.7	70		41.7			
35		14.2						

ScSP

Δ	m	s	Δ	m	s
140	32	59	113	29	18
130	31	36	114		24
120	30	14	115		29
115	29	34	120		54
112		12	125	30	17
112		12	130		39

## WAVES TRANSMITTED THROUGH THE CORE

*Surface Focus*

## PKP

$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s
180A	22	10.6	151	20	4.4	123	18	58.5	152	19	50.4
179		6.2	150		0.2	124	19	0.5	153		51.8
178		1.8	149	19	56.1	125		2.4	154		53.2
177	21	57.4	148		52.0	126		4.3	155		54.5
176		52.9	147		48.1	127		6.2	156		55.8
175		48.5	146		44.2	128		8.2	157		57.2
174		44.1	145		40.4	129		10.1	158		58.5
173		39.6	144		36.8	130		12.0	159		59.7
172		35.2	143B		33.5	131		13.9	160	20	0.8
171		30.8				132		15.8	161		1.8
170		26.3	143B		33.5	133		17.7	162		2.8
169		21.9	144		36.5	134		19.5	163		3.8
168		17.5	145		39.3	135		21.4	164		4.8
167		13.1	146		41.8	136		23.2	165		5.8
166		8.8	147C		44.1	137		25.0	166		6.7
165		4.4				138		26.9	167		7.4
164		0.1	110D	18	33.2	139		28.7	168		8.0
163	20	55.7	111		35.2	140		30.5	169		8.6
162		51.4	112		37.1	141		32.3	170		9.2
161		47.0	113		39.1	142		34.0	171		9.8
160		42.7	114		41.1	143		35.7	172		10.4
159		38.4	115		43.0	144		37.4	173		10.9
158		34.1	116		45.0	145E		39.2	174		11.2
157		29.8	117		46.9	146		40.9	175		11.5
156		25.5	118		48.8	147		42.6	176		11.8
155		21.2	119		50.8	148		44.2	177		12.0
154		17.0	120		52.7	149		45.8	178		12.1
153		12.8	121		54.7	150		47.4	179		12.1
152		8.6	122		56.6	151		48.9	180F		12.2

*SKP* PKS

$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s
148A	23	55.0	104D	21	57.0	130	22	47.0	156	23	28.6
145		41.8	105		59.0	131		48.9	157		29.7
142		28.4	106	22	0.9	132		50.7	158		30.8
141		23.9	107		2.9	133		52.6	159		31.8
140		19.5	108		4.8	134		54.4	160		32.8
139		15.0	109		6.8	135		56.3	161		33.8
138		10.6	110		8.7	136		58.1	162		34.8
137		6.2	111		10.7	137		59.8	163		35.8
136		1.9	112		12.6	138	23	1.6	164		36.6
135	22	57.6	113		14.6	139E		3.3	165		37.3
134		53.2	114		16.5	140		5.0	166		37.9
133		48.9	115		18.4	141		6.7	167		38.6
132		44.6	116		20.4	142		8.3	168		39.2
131		40.4	117		22.3	143		10.0	169		39.8
130B		36.2	118		24.3	144		11.7	170		40.4
130B		36.2	119		26.2	145		13.3	171		41.0
131		39.9	120		28.1	146		14.9	172		41.4
132		43.4	121		30.1	147		16.4	173		41.7
133		46.6	122		32.0	148		17.9	174		42.0
134		49.7	123		34.0	149		19.3	175		42.3
135		52.7	124		35.9	150		20.8	176		42.5
136		55.6	125		37.7	151		22.2	177		42.7
137		58.3	126		39.6	152		23.5	178		42.8
138	23	0.9	127		41.5	153		24.8	179		42.9
139		3.4	128		43.4	154		26.1	180F		42.9
140C		5.7	129		45.2	155		27.4			

SKS

$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s
62A	20	13.7	101	24	31.9	104	25	32.7	143	26	43.9
63		21.2	102		36.7	105		34.6	144		45.4
64		28.7	103		41.4	106		36.6	145		46.9
65		36.2	104		46.0	107		38.5	146		48.3
66		43.7	105		50.5	108		40.5	147		49.7
67		51.1	106		55.0	109		42.4	148		51.1
68		58.6	107		59.4	110		44.3	149		52.5
69	21	6.0	108	25	3.7	111		46.3	150		53.8
70		13.4	109		8.0	112		48.2	151		55.1
71		20.8	110		12.2	113		50.2	152		56.3
72		28.2	111		16.3	114		52.1	153		57.5
73		35.5	112		20.3	115		54.0	154		58.6
74		42.9	113		24.3	116		56.0	155		59.7
75		50.2	114		28.2	117		57.9	156	27	0.7
76		57.5	115		32.0	118		59.9	157		1.7
77	22	4.8	116		35.7	119	26	1.8	158		2.7
78		12.0	117		39.4	120		3.6	159		3.7
79		19.1	118		43.0	121		5.5	160		4.7
80		26.3	119		46.5	122		7.3	161		5.6
81		33.4	120		50.0	123		9.2	162		6.4
82		40.4	121		53.3	124		11.1	163		7.1
83		47.3	122		56.6	125		13.0	164		7.8
84		54.1	123		59.8	126		14.8	165		8.5
85	23	0.8	124	26	2.9	127		16.7	166		9.2
86		7.5	125		5.9	128		18.5	167		9.8
87		14.1	126		8.9	129		20.3	168		10.4
88		20.5	127		11.8	130		22.1	169		11.0
89		26.7	128		14.6	131		23.9	170		11.5
90		32.8	129		17.3	132		25.7	171		11.9
91		38.7	130		19.9	133E		27.4	172		12.3
92		44.4	131		22.4	134		29.1	173		12.6
93		50.1	132		24.9	135		30.8	174		12.9
94		55.6	133C		27.3	136		32.5	175		13.1
95	24	1.1				137		34.2	176		13.3
96		6.5	99D	25	22.9	138		35.9	177		13.4
97		11.8	100		24.9	139		37.5	178		13.4
98		17.0	101		26.8	140		39.1	179		13.5
99		22.1	102		28.8	141		40.8	180F		13.5
100		27.0	103		30.7	142		42.4			

## PKKP

$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s
256A	30	15.1	234B	28	39.4	257	29	55.7	250	29	50
255		10.7	235		43.4	258		58.4	255		59
254		6.2	236		47.4	259	30	1.1	260	30	8
253		1.8	237		51.4	260		3.7	265		17
252	29	57.4	238		55.1	261		6.2	270		25
251		52.9	239		58.8	262		8.7	275		34
250		48.5	240	29	2.5	263		11.2	280		42
249		44.0	241		6.1	264		13.7	285		50
248		39.6	242		9.6	265		16.1	290		57
247		35.2	243		13.1	266		18.4	295	31	4
246		30.9	244		16.4	267C		20.7	300		11
245		26.5	245		19.7				305		17
244		22.2	246		23.0	198D	28	10	310		23
243		17.8	247		26.3	200		14	315		28
242		13.5	248		29.4	205		23	320		32
241		9.2	249		32.5	210		33	325		37
240		4.8	250		35.5	215		43	330		40
239		0.5	251		38.5	220		52	335		43
238	28	56.2	252		41.5	225	29	2	340		46
237		52.0	253		44.4	230		12	345		48
236		47.8	254		47.3	235		22	350		49
235		43.6	255		50.1	240		31	355		50
234B		39.4	256		52.9	245		40	360F		50

## PKKS

$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s
226A	32	8.3	221	31	43.4	241	32	51.7	192D	31	33
225		3.9	222		47.2	242		54.7	200		49
224	31	59.5	223		50.9	243		57.6	210	32	8
223		55.1	224		54.6	244	33	0.6	220		28
222		50.7	225		58.3	245		3.5	230		47
221		46.2	226	32	2.0	246		6.3	240	33	6
220		41.8	227		5.6	247		9.1	250		25
219		37.3	228		9.2	248		11.9	260		43
218		32.9	229		12.8	249		14.6	270	34	0
217		28.5	230		16.3	250		17.3	280		16
216		24.0	231		19.7	251		19.9	290		30
215		19.6	232		23.1	252		22.5	300		44
214B		15.2	233		26.4	253		25.1	310		55
214B		15.2	234		29.7	254		27.7	320	35	4
215		19.5	235		33.0	255		30.3	330		11
216		23.6	236		36.3	256		32.8	340		17
217		27.6	237		39.5	257		35.3	350		20
218		31.6	238		42.6	258		37.7	360F		21
219		35.6	239		45.7	259		40.0			
220		39.5	240		48.7	260C		42.3			

SKKS

$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s
85A	23	5	125	27	47	165	31	38	205	34	35
86		12	126		54	166		43	206		39
87		20	127	28	0	167		48	207		43
88		27	128		7	168		53	208		47
89		34	129		13	169		58	209		50
90		42	130		20	170	32	3	210		54
91		49	131		26	171		8	211		58
92		56	132		32	172		13	212	35	2
93	24	4	133		38	173		18	213		5
94		11	134		45	174		22	214		9
95		18	135		51	175		27	215		12
96		25	136		57	176		32	216		16
97		33	137	29	3	177		36	217		19
98		40	138		9	178		41	218		23
99		47	139		15	179		46	219		26
100		54	140		21	180		50	220		30
101	25	1	141		27	181		55	221		33
102		9	142		33	182		59	222		36
103		16	143		39	183	33	4	223		40
104		23	144		44	184		8	224		43
105		30	145		50	185		13	225		46
106		37	146		56	186		17	226		49
107		44	147	30	2	187		22	227		52
108		51	148		7	188		26	228		56
109		58	149		13	189		30	229		59
110	26	5	150		18	190		34	230	36	2
111		12	151		24	191		39	231		5
112		19	152		29	192		43	232		8
113		26	153		35	193		47	233		11
114		33	154		40	194		51	234		14
115		40	155		46	195		56	235		17
116		47	156		51	196	34	0	236		20
117		54	157		57	197		4	237		23
118	27	0	158	31	2	198		8	238		26
119		7	159		7	199		12	239		28
120		14	160		12	200		16	240		31
121		20	161		18	201		20	241		34
122		27	162		23	202		24	242		36
123		34	163		28	203		28	243C		39
124		41	164		33	204		32			

SKKS (DF)

$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s
187	34	59	230	36	23	275	37	42	320	38	36
190	35	5	235		32	280		49	325		39
195		15	240		41	285		57	330		43
200		25	245		50	290	38	4	335		45
205		34	250	37	0	295		10	340		48
210		44	255		9	300		16	345		50
215		54	260		17	305		21	350		51
220	36	4	265		26	310		27	355		51
225		13	270		34	315		32	360		52

## SKKKS (ABC)

$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s
90	23	43	165	32	33	235	39	15	305	44	16
95	24	20	170	33	6	240		39	310		34
100		57	175		38	245	40	3	315		52
105	25	33	180	34	9	250		27	320	45	9
110	26	10	185		39	255		50	325		26
115		46	190	35	9	260	41	13	330		42
120	27	22	195		38	265		35	335		58
125		58	200	36	7	270		57	340	46	13
130	28	34	205		36	275	42	18	345		28
135	29	9	210	37	3	280		39	350		42
140		44	215		30	285		59	355		56
145	30	19	220		57	290	43	19	360	47	9
150		53	225	38	24	295		39	365		21
155	31	27	230		50	300		58	370		34
160	32	0									

## PcPPKP

$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s
278A	35	50.3	180	29	8.0	142	27	49.5	162	28	26.9
275		37.0	179		5.1	143		51.4	163		28.6
270		14.8	178		2.2	144		53.4	164		30.3
265	34	52.6	177	28	59.5	145		55.3	165		32.0
260		30.5	176		56.8	146		57.3	166		33.7
255		8.5	175		54.2	147		59.2	167		35.3
250	33	46.7	174		51.7	148	28	1.1	168		36.8
245		25.0	173B		49.3	149		3.1	169		38.1
240		3.3	174C		51.6	150		5.0	170		39.4
235	32	41.8				151		7.0	171		40.6
230		20.3	132D	27	30.0	152		8.9	172		41.7
225	31	59.1	133		32.0	153		10.8	173		42.8
220		38.0	134		33.9	154		12.6	174		43.8
215		17.1	135		35.9	155		14.5	175		44.6
210	30	56.6	136		37.8	156		16.3	176		45.3
205		36.8	137		39.8	157		18.1	177		45.8
200		17.4	138		41.7	158		19.9	178		46.3
195	29	58.7	139		43.7	159		21.7	179		46.5
190		40.8	140		45.6	160		23.5	180F		46.5
185		23.8	141		47.6	161		25.2			

## PcSPKP

$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s
250A	37	52	210	34	57	170	32	21	150	31	40
245		30	205		35	166C		11	155		49
240		8	200		14				160		58
235	36	46	195	33	53	127D	30	56	165	32	6
230		24	190		33	130	31	2	170		12
225		2	185		13	135		11	175		16
220	35	40	180	32	55	140		21	180F		17
215		18	175		37	145		31			

*ScSPKP*

$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s
206A	38	43.5	179	36	45.8	127	34	31.4	154	35	22.0
205		39.1	178		41.6	128		33.4	155		23.7
204		34.6	177		37.4	129		35.3	156		25.4
203		30.2	176		33.2	130		37.3	157		27.1
202		25.8	175		29.1	131		39.2	158		28.7
201		21.3	174		25.0	132		41.1	159		30.3
200		16.8	173		20.9	133		43.1	160		31.8
199		12.4	172		16.9	134		45.0	161		33.3
198		8.0	171		13.0	135		47.0	162		34.7
197		3.6	170		9.1	136		48.9	163		36.0
196	37	59.2	169		5.2	137		50.8	164		37.3
195		54.8	168		1.4	138		52.8	165		38.6
194		50.4	167	35	57.7	139		54.7	166		39.7
193		46.1	166		54.1	140		56.7	167		40.7
192		41.7	165		50.5	141		58.6	168		41.7
191		37.4	164		47.1	142	35	0.5	169		42.7
190		33.0	163		43.7	143		2.4	170		43.7
189		28.7	162		40.5	144		4.2	171		44.5
188		24.3	161		37.5	145		6.1	172		45.2
187		20.0	160BC		34.8	146		7.9	173		45.8
186		15.7				147		9.7	174		46.4
185		11.4	121D	34	19.7	148		11.5	175		46.9
184		7.1	122		21.7	149		13.3	176		47.3
183		2.8	123		23.6	150		15.1	177		47.6
182	36	58.5	124		25.6	151		16.9	178		47.8
181		54.3	125		27.5	152		18.6	179		47.9
180		50.0	126		29.5	153		20.3	180		47.9

*SKSP*

$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s
115	29	34	140	32	37	165	35	18	190	37	30
120	30	12	145	33	12	170		47	195		53
125		49	150		45	175	36	14	200	38	16
130	31	26	155	34	17	180		40	205		39
135	32	2	160		48	185	37	6			

*PKPPKP*

$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s
286B	39	7	255	38	14	310	39	49
288		13	260		24	315		56
290		19	265		34	320	40	1
			270		43	325		7
220D	37	6	275		52	330		12
225		16	280	39	1	335		15
230		26	285		10	340		18
235		36	290		18	345		21
240		45	295		27	350		23
245		55	300		35	355		24
250	38	5	305		42	360F		24

PKPPKS

$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s
276B	42	20	215D	40	32	265	42	8	315	43	28
277		23	220		42	270		18	320		34
278		26	225		52	275		27	325		39
279		29	230	41	2	280		36	330		43
280		32	235		11	285		44	335		47
281		35	240		21	290		52	340		50
282		38	245		31	295	43	1	345		52
283		40	250		40	300		8	350		54
284		43	255		50	305		15	355		55
285		45	260		59	310		22	360F		55

$\approx$  PKB

PKP. Depth Allowances

(To be subtracted from times for surface focus)

$\Delta$	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12
142	5.3	13.2	20.9	28.4	35.6	42.6	49.5	56.1	62.4	68.4	74.1	79.8	85.3
145	5.3	13.2	21.0	28.5	35.9	43.1	50.1	56.8	63.2	69.3	75.2	81.0	86.7
150	5.4	13.4	21.3	28.9	36.4	43.7	50.8	57.6	64.1	70.2	76.2	82.2	88.1
160	5.4	13.4	21.3	29.0	36.5	43.8	50.9	57.8	64.3	70.4	76.4	82.4	88.4
170	5.4	13.5	21.4	29.1	36.6	43.9	51.1	58.0	64.5	70.7	76.7	82.7	88.7
180	5.4	13.5	21.4	29.1	36.6	43.9	51.1	58.0	64.5	70.8	76.8	82.8	88.8

PKP<sub>2</sub> = PKP (AB)

160	5.3	12.9	20.4	27.7	34.8	41.7	48.3	54.8	60.8	66.3	71.5	76.6	81.7
-----	-----	------	------	------	------	------	------	------	------	------	------	------	------

$\approx$  SKP

SKS. Depth Allowances

(To be subtracted from times for surface focus)

$\Delta$	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12
70	9.0	22.7	36.1	49.3	62.2	74.7	86.7	98.1	109.1	119.6	129.7	139.4	148.6
80	9.0	22.8	36.3	49.6	62.5	75.0	87.1	98.7	109.9	120.5	130.7	140.5	150.0
85	9.0	22.9	36.5	49.8	62.7	75.3	87.5	99.1	110.3	121.0	131.3	141.2	150.7
90	9.1	23.0	36.7	50.1	63.2	75.9	88.1	99.9	111.3	122.0	132.6	142.6	152.2
95	9.1	23.1	36.8	50.4	63.6	76.4	88.8	100.7	112.1	123.0	133.7	143.9	153.7
100	9.1	23.1	37.0	50.5	63.8	76.7	89.3	101.2	112.6	123.7	134.5	144.9	154.8
105	9.1	23.2	37.1	50.7	64.0	77.0	89.6	101.6	113.1	124.2	135.0	145.4	155.4
110	9.1	23.3	37.2	50.9	64.2	77.2	89.8	101.9	113.5	124.7	135.5	145.9	156.0
115	9.2	23.4	37.4	51.1	64.5	77.5	90.1	102.2	113.9	125.2	136.0	146.5	156.6
120	9.2	23.5	37.5	51.2	64.6	77.6	90.3	102.5	114.2	125.5	136.4	146.9	157.1
125	9.2	23.5	37.5	51.2	64.6	77.7	90.5	102.7	114.4	125.7	136.6	147.2	157.5
130	9.2	23.5	37.6	51.3	64.7	77.9	90.7	102.9	114.7	126.0	136.9	147.5	157.8
135	9.2	23.5	37.6	51.4	64.9	78.1	90.9	103.1	115.0	126.3	137.2	147.9	158.3
140	9.2	23.5	37.6	51.4	65.0	78.2	91.0	103.3	115.2	126.5	137.5	148.2	158.6
145	9.2	23.5	37.6	51.4	65.0	78.2	91.0	103.3	115.3	126.6	137.6	148.3	158.7
150	9.2	23.5	37.6	51.5	65.1	78.2	91.1	103.4	115.3	126.6	137.6	148.3	158.8
180	9.2	23.6	37.7	51.6	65.2	78.3	91.2	103.6	115.5	126.8	137.8	148.5	159.0

## TIMES WITHIN THE CORE

## K (ABE)

$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s
0	0	0.0	31	3	45.8	61	6	50.1	91	9	7.2
1		7.5	32		52.7	62		55.4	92		11.0
2		15.0	33		59.5	63	7	0.7	93		14.7
3		22.5	34	4	6.3	64		5.9	94		18.4
4		30.0	35		13.0	65		11.1	95		22.1
5		37.4	36		19.7	66		16.2	96		25.7
6		44.9	37		26.4	67		21.3	97		29.3
7		52.3	38		33.0	68		26.3	98		32.8
8		59.8	39		39.6	69		31.2	99		36.3
9	1	7.2	40		46.1	70		36.1	100		39.7
10		14.6	41		52.6	71		40.9	101		43.0
11		22.0	42		59.0	72		45.7	102		46.3
12		29.4	43	5	5.4	73		50.4	103		49.6
13		36.8	44		11.7	74		55.1	104		52.8
14		44.1	45		17.9	75		59.7	105		55.9
15		51.5	46		24.1	76	8	4.3	106		59.0
16		58.8	47		30.2	77		8.8	107	10	2.0
17	2	6.1	48		36.3	78		13.3	108		5.0
18		13.4	49		42.3	79		17.7	109		7.9
19		20.7	50		48.2	80		22.1	110		10.8
20		27.9	51		54.1	81		26.4	111		13.6
21		35.1	52		59.9	82		30.7	112		16.4
22		42.3	53	6	5.7	83		35.0	113		19.1
23		49.5	54		11.4	84		39.2	114		21.8
24		56.7	55		17.1	85		43.3	115		24.4
25	3	3.8	56		22.7	86		47.4	116		26.9
26		10.9	57		28.3	87		51.4	117		29.4
27		18.0	58		33.8	88		55.4	118		31.9
28		25.0	59		39.3	89		59.4	119		34.3
29		32.0	60		44.7	90	9	3.3	120		36.6
30		38.9									

$KIK = K(DF)$ 

$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s
88	9	36.4	112	10	22.8	135	11	2.5	158	11	29.4
89		38.4	113		24.6	136		4.0	159		30.1
90		40.3	114		26.5	137		5.4	160		30.8
91		42.3	115		28.4	138		6.9	161		31.5
92		44.2	116		30.2	139		8.3	162		32.1
93		46.2	117		32.1	140		9.7	163		32.7
94		48.1	118		33.9	141		11.0	164		33.3
95		50.1	119		35.7	142		12.3	165		33.9
96		52.0	120		37.5	143		13.6	166		34.5
97		54.0	121		39.3	144		14.9	167		35.0
98		55.9	122		41.1	145		16.2	168		35.5
99		57.8	123		42.8	146		17.4	169		35.9
100		59.8	124		44.5	147		18.6	170		36.2
101	10	1.7	125		46.2	148		19.7	171		36.5
102		3.7	126		47.9	149		20.8	172		36.8
103		5.6	127		49.6	150		21.8	173		37.1
104		7.6	128		51.3	151		22.8	174		37.3
105		9.5	129		53.0	152		23.8	175		37.5
106		11.5	130		54.6	153		24.8	176		37.6
107		13.4	131		56.2	154		25.8	177		37.7
108		15.3	132		57.9	155		26.7	178		37.8
109		17.2	133		59.5	156		27.7	179		37.9
110		19.0	134	11	1.0	157		28.6	180		37.9
111		20.9									

## I

$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s	$\Delta$	m	s
0	0	0.0	50	1	34.6	95	2	44.4	140	3	29.0
5		9.8	55		43.3	100		50.8	145		32.0
10		19.5	60		51.8	105		56.8	150		34.7
15		29.2	65	2	0.1	110	3	2.5	155		37.0
20		38.9	70		8.2	115		7.8	160		38.8
25		48.5	75		16.0	120		12.8	165		40.3
30		58.0	80		23.5	125		17.4	170		41.3
35	1	7.3	85		30.8	130		21.6	175		41.9
40		16.6	90		37.8	135		25.5	180		42.1
45		25.7									

*sP-P*

$h/R$ $\Delta$	15 km.	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12
1	6	12	21											
5	6	12	24	35	45	54	61	68	73	78				
10	6	12	26	39	52	63	73	83	92	100	107	112	117	120
15	7	12	28	43	57	70	84	97	109	119	128	135	142	147
20	7	13	32	49	66	82	97	112	125	137	148	157	166	172
25	7	13	33	51	70	87	104	120	135	149	161	173	184	193
30	7	14	33	52	71	89	106	123	138	152	166	178	189	200
35	7	14	34	53	72	90	108	124	140	155	168	181	193	204
40	7	14	34	54	73	91	108	125	142	156	170	183	196	207
50	7	14	34	54	74	93	111	128	145	160	175	189	202	214
60	7	14	35	55	75	95	113	131	148	164	180	194	208	222
70	7	14	35	56	76	96	115	134	152	168	184	199	213	228
80	7	14	36	57	77	97	117	136	154	171	187	203	218	232
90	7	14	36	58	78	98	118	137	156	173	190	205	221	236
100	7	14	36	58	78	98	118	138	156	173	190	206	222	237

*sP Depth Allowances*

$h/R$ $\Delta$	15 km.	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12
1	4	8	20											
5	4	8	20	32	43	53	63	73	82	90				
10	4	8	20	32	43	54	64	74	83	91	98	104	110	114
15	4	8	21	33	44	55	66	76	85	93	101	107	113	118
20	4	9 <sup>r</sup>	22 <sup>r</sup>	34 <sup>r</sup>	46 <sup>d</sup>	57	68	79	88	98	106	113	120	125
25	4	9	22	35	48	60	72	83	94	104	114	123	132	140
30	4	9	22	36	48	61	73	84	96	106	116	125	134	143
35	4	9	22	36	49	61	73	85	96	107	117	126	136	144
40	4	9	22	36	49	61	74	85	97	107	118	127	136	145
50	4	9	23	36	49	62	74	86	98	109	119	129	138	147
60	4	9	23	36	50	63	75	87	99	110	120	131	140	150
70	4	9	23	37	50	63	76	88	100	111	122	132	142	152
80	4	9	23	37	50	64	76	89	101	112	123	134	144	154
90	4	9	23	37	51	64	77	90	102	113	124	135	145	155
100	4	9	23	37	51	64	77	90	102	113	124	135	145	155
<i>sP</i> begins at		1°	1°	2°	2°	3°	3°	4°	4°	5°	6°	7°	8°	9°
Overtakes <i>S</i> at		1°	1°·5	2°·3	3°·2	3°·9	4°·6	5°·5	6°·4	7°·4	8°·6	10°·1	12°·0	13°·8

*sPKP Depth Allowances*

$h/R$ $\Delta$	15 km.	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12
180 <i>A</i> *	4	9	24	38	51	64	77	90	102	113	124	135	146	156
150	4	9	24	38	51	64	77	90	102	114	125	136	146	156
143-4 <i>B</i>	4	9	24	38	52	65	78	91	103	114	126	137	147	157
110 <i>D</i>	4	9	24	38	52	65	78	91	103	115	126	137	148	158
140	4	9	24	38	52	65	78	91	103	115	126	137	148	159
180 <i>F</i>	4	9	24	38	52	65	78	91	104	116	127	138	149	159

*pPKP-PKP, sSKS-SKS*

These are twice the depth allowances for *PKP* and *SKS* respectively, within 1<sup>s</sup>.

*sPcP, sPKS Depth Allowances*

These may be taken to be the same as for *sPKP* at a distance where  $dt/d\Delta$  is the same.

33 97 PKP. Depth Allowances between 110° and 140° 673

$h/R$	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.12
	5.4	13.4	21.2	28.8	36.2	43.5	50.5	57.2	63.7	69.8	75.7	81.5	87.3

SKS-P

(For rapid determination of focal depth when  $pP$ ,  $sS$  are not available)

*PKP*  
*x2*

$h/R$	Surface	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.12
$\Delta$	m s s	s s	s s	s m s	m s s	s s	s s	s s	s s	s s	s s	s s	s s	s
85°	10 22	18	12	6	0	9 54	9 48	42	37	31	26	21	16	12
90°	30	26	20	14	8	10 1	9 56	50	44	39	34	28	24	19
95°	35	32	25	19	12	6 10	0 54	49	43	38	32	28	23	
100°	39	35	28	22	16	9	3	57	52	46	41	35	30	25

HEIGHT ABOVE MEAN SPHERE

$\phi$	$h$
0 00	+ 7
10 11	+ 6
16 12	+ 5
20 42	+ 4
24 29	+ 3
27 53	+ 2
31 00	+ 1
33 58	0
36 48	- 1
39 33	- 2
42 15	- 3
44 55	- 4
47 37	- 5
50 17	- 6
53 01	- 7
55 50	- 8
58 46	- 9
61 51	- 10
65 11	- 11
68 52	- 12
73 11	- 13
78 50	- 14
90 00	

In critical cases ascend.

TABLES OF  $f(\Delta)$

Correction =  $f(\Delta) (h + H)$

$P$	$S$	SKS
$\Delta$ $f(\Delta)$	$\Delta$ $f(\Delta)$	$\Delta$ $f(\Delta)$
9 s	9 s	79 s
13 0.01	10 0.01	83 0.11
22 0.02	13 0.02	106 0.12
41 0.03	16 0.03	116 0.13
63 0.04	22 0.04	124 0.14
72 0.05	32 0.05	140 0.15
83 0.06	44 0.06	
124 0.07	54 0.07	
140 0.08	66 0.08	
	71 0.09	
	76 0.10	
	82 0.11	
	103 0.12	
	123 0.13	
	140 0.14	

In critical cases ascend.

For PKP  $f(\Delta) = 0.09$