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PRAKLA-SEISMOS GMBH

Hannover, April 10th, 1973

721 034
721 011

Report
Campobasso 1972
Cercepiccola 1972
on a Seismic Reflection Survey
in Concession Areas
Campobasso and Cercepiccola

Clients:

AGIP Mineraria S.p.A.
Montecatini Edison S.p.A.

Authors:

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Dipl.-Geophys. A. Glocke
K. Jacob
Dipl.-Ing. R. Bading

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+) Two sets of photographically reduced seismogram sections were placed at disposal by the client for interpretation and are attached to two copies of the report

1. General

Commissioned by AGIP Mineraria S. p. A., Milan, and Montecatini Edison S. p. A., Milan, PRAKLA-SEISMOS GMBH, Hannover, carried out a seismic reflection survey in the Campobasso and Cercepiccola concession areas from April to October 1972.

The following report covers the execution of survey, the preparation of data, and an interpretation of a marker horizon. The report is entitled Campobasso 1972/ Cercepiccola 1972. The processing of data was performed by AGIP/Western and is, therefore, not covered by this report.

1.1. Location of Survey Area

The survey area is situated in southern Italy about 120 km northeast of Napels and near Campobasso, capital of the province Campobasso (Location Map: encl. 2 and 3). The area is part of the Apennine foothills E of the Napolitanian Mesozoic overthrusts.

The survey extended over the areas shown in the following sheets of the 1 : 25 000 topographical map:

F 162 II SW, Circello;
F 162 III NE, Vinchiaturo;
F 162 III SE, Morcone;
F 162 III SW, Cusano Mutri;
F 162 IV SE, Campobasso;
F 162 IV SW, Baranello;
F 173 IV NE, Guardia Sanframondi.

1.2. Purpose of Survey

The structure of the mesozoic limestone in the SW part of the concession area Cercepiccola was to be investigated by a wide-meshed grid of reconnaissance lines. Moreover, in the northern part of this concession, two lines (CEP-6 and -8) were planned to enable a seismic connection with previous surveys in concession area Campobasso. In the latter concession area the grid of existing lines was to be supplemented by lines MOL-28/28 bis.

1.3. Previous Surveys

Intensive seismic surveys had been performed earlier only in the NE part of concession Cercepiccola. The results of four lines of the most recent survey in 1969 (Ferrazzano: FER 1, 2, 3 and 4, carried out by O. G. S. and processed by PRAKLA-SEISMOS), were placed at disposal by the clients and included in the interpretation of the actual lines.

2. Execution of Survey

The main data on the execution of the survey are compiled below, partly in tabular form.

2.1. Duration of Survey

The survey was carried out from April 12th to June 14th and from August 28th to September 25th in the area Cercepiccola and from September 26th to October 10th in the area Campobasso.

2.2. Personnel and Equipment

Personnel

1	party chief	
1	geophysical engineer	
1	computer/administrator	
1	senior operator	
1	junior operator	
1	permit man	
2	shooters	
1	surveyor	
1	chief driller	
2	drillers	) occasionally more
26	helpers (including drivers)	)

Instruments and Devices

		Type	Manufacturer
1	seismic recording unit (MDC-12) 24 channels, digital	DFS III	Texas Instruments
1	dry-write oscillograph	OXBB-19	PRAKLA-SEISMOS
2000	geophones	SM-2, 10 Hz	Sensor
36	survey cables, 52 channels 90 m spacing	K 62 A	
4	cable extensions 200 m each		
1	trace switching device	Murabox	PRAKLA-SEISMOS
5	radio communication sets		
3	walkie-talkies		
2	shooting unitswith time-break and uphole-time transmit controller	ZBB	PRAKLA-SEISMOS
1	Blaster for synchronous firing	CK 22	PRAKLA-SEISMOS
1	weathering-survey unit	RS-4	SIE
2	theodolites	RDS	Wild

Vehicles

1 Survey truck, Mercedes-Benz Unimog D

2 Cable trucks, Mercedes-Benz Unimog S

2 Trucks, Landrover Diesel, for transport of explosives and for shooter

3 Landrover Station wagons, for personnel transport and surveyor

2 VW cars for party chief and permit man

Drilling outfit

1 drilling rig, type 3001 (M 301), Magirus-Saturn
2 drilling rigs, type 3012 (SU 125), 3-axeled Unimog D
2 drilling rigs, type 3012 (SE 125),)
1 drilling rig, type 3011 (M 301), Magirus-Saturn) only temporary
2 water trucks, Mercedes-Benz Unimog S)
3 water trucks, Mercedes-Benz Unimog D
1 gravel truck, Mercedes-Benz Unimog S
1 wrecking truck, Mercedes-Benz Unimog D

2.3. Working conditions

The terrain is hilly to mountainous;it is practically level in the 2 to 4 km wide valley of the Tàmmaro river.

Elevations encountered on the lines were between 385 m on line CEP-4 and 1220 m on line CEP-5.

Average elevation was 700 m a.s.l. The surface is covered mainly by loam and clay in the N and E, whereas marly limestone is predominant in the SW.

Under normal weather conditions the lines situated in the middle and northern parts of the area under survey could be fairly arrived at along roads and lanes. Lines CEP-1, -3 and -5, however, could be reached only with the aid of caterpillars. Parts of the lines had to be changed or even replaced by lines of deviating directions (see lines MOL-28 bis, CEP-5 bis), because the terrain could not be transversed by trucks and cars.

Weather was extremely unfavourable because of permanent rain which softened the ground and rendered the terrain unpassable. In altitudes of more than 1000 m the terrain remained covered with snow for several weeks. From the second half of May weather became somewhat more pleasant; on the whole, however, it remained much more unfavourable as was expected with regard to the season.

According to the surface cover drilling operations were normal or even easy in the northern and middle parts of the area (clay, shale and marl); drilling was partly rather difficult in the gravels of the Tàmmaro valley and in the limy formations southwest of it, and required considerable consumption of roller bits.

2.4. Field Techniques

2.4.1. Arrangement of Lines, Topographical Survey

A total of 11 lines were surveyed. The general directions of the lines were:

NW-SE	(Lines MOL-28, CEP-2, CEP-4),
NE-SW	(Lines CEP-1, CEP-3, CEP-5, CEP-7),
~W-E	(Lines MOL-28 bis, CEP-8, CEP-5 bis),
~N-S	(Line CEP-6).

A Wild RDS transit and stadia rods were used for elevation survey. Horizontal distances along the lines were chained.

2.4.2. Survey Method

The survey was carried out with 6fold subsurface coverage. Shot-receiver configuration: unilateral spread (0 m - 300 m - 1680 m) +)

Geophone group spacing:	60 m
Shot spacing:	120 m
In-line offset:	300 m

For correctional purposes, two uphole surveys were carried out on Line CEP-2 at geophone station 150 and on Line CEP-5 at geophone station 392; the shotholes were as deep as 70 m and 60 m. Uphole times were recorded from shot depths of 5 m or 10 m intervals (encl. 6 and 7).

2.4.3. Tests

Some initial shot depth tests on Line CEP-1 were performed at 21 m, 28 m and 42 m, showing that 21 m might be a reasonable depth standard.

Occasional depth tests during the current survey confirmed, that record quality increased from shallower depth (9 m, 15 m) to 21 m. From shots below 21 m, however, no further quality increase could be achieved.

Multiple shots (3 x 15 m, 3 x 21 m) with charges of 3 x 5 kg and 3 x 10 kg, respectively, did not show any quality gain compared to 10 kg single-hole shots.

+) The figures in parentheses designate the distances of the geophone groups closest to and farthest from the shotpoint position 0.

2.4.4. Survey arrangement

The survey parameters used on the shot side depended on the results of the tests described above; on the emitter side routine parameters were applied based on previous experience in neighbouring areas.

Shooting

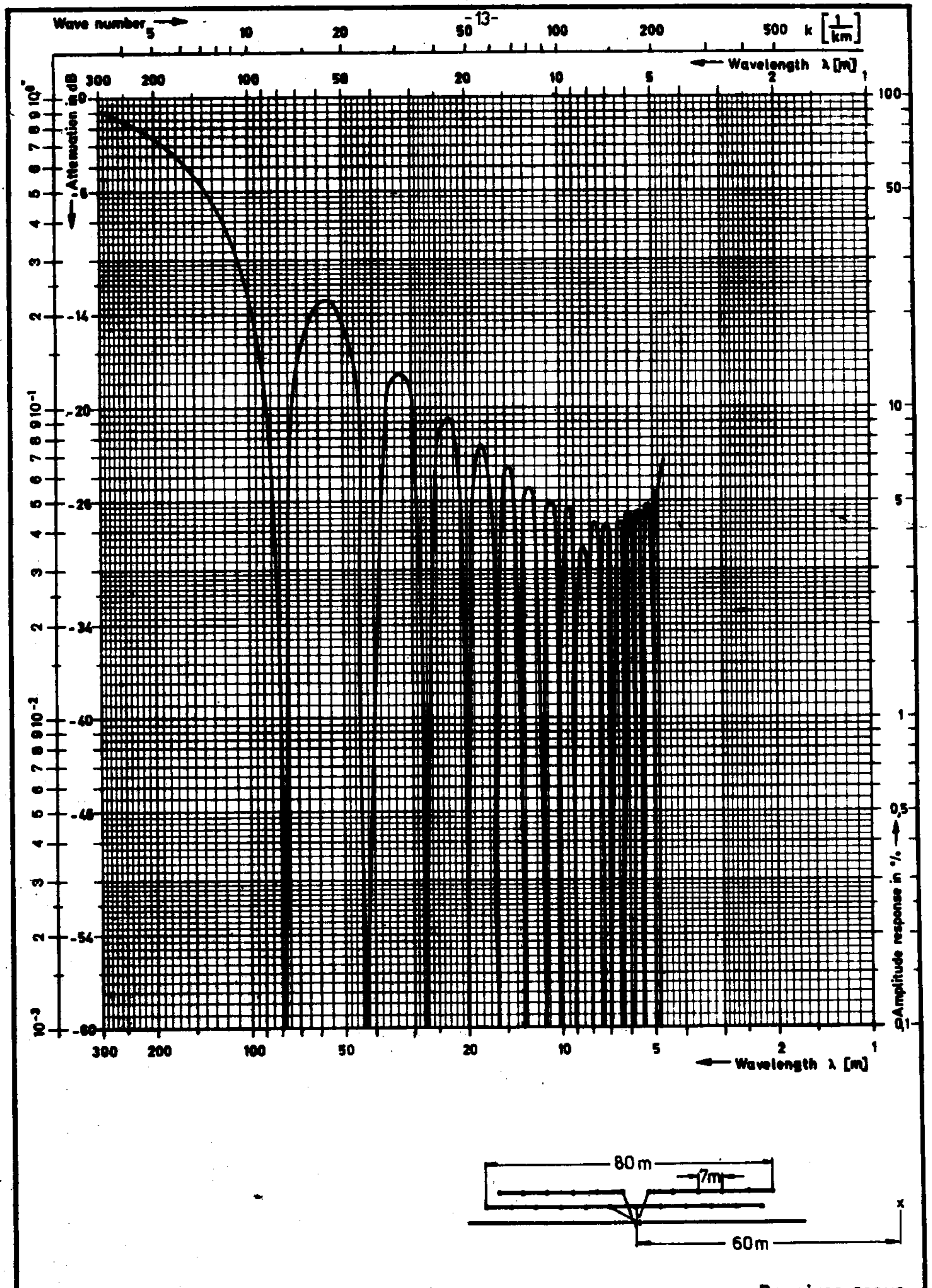
Shot pattern:	single-hole shots, mostly at 21 m
Charge:	10 kg to 15 kg, on average 13.6 kg
Tamping:	with gravel

Receiving

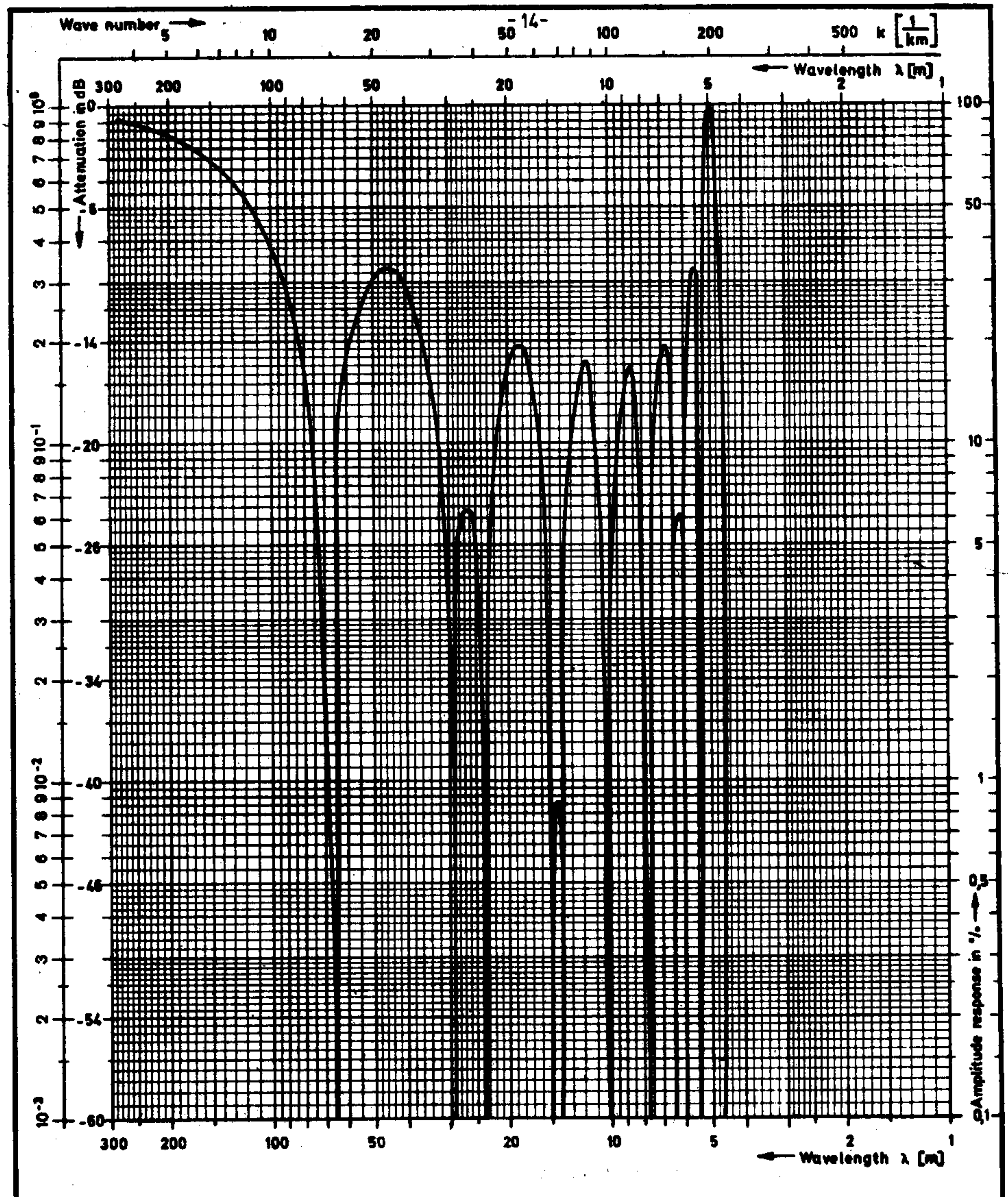
Geophones per group:	24
Group length:	80 m in Cercepiccola area
	60 m in Campobasso area

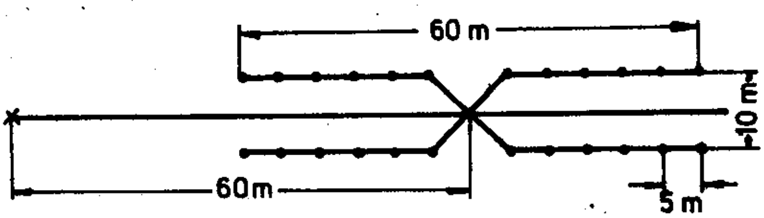
The change in geophone pattern design for the lines in Campobasso area was made on request of the client. A comparison between the respective array response curves (tables 1 and 2) shows better noise reduction by the 80 m pattern design with 3.5 m equal spacing of the geophones, compared to the 60 m pattern with 5 m spacings and a 10 m gap in the centre of the group.

In both cases the amplitude attenuation between the wavelengths of 40 and 60 m might be improved by application of so-called HF-patterns. The choice of geophone patterns seems to be of little practical importance, however, due to the absence of pronounced disturbing organized noise waves.



Author: Dr. F. Nemes	Cercepiccola 1972	Sc. ——	PRAKLA SEISMOS
Drawn: Lottmann		Table: 1	
Date: Apr. 10th, 1973	Receiver Array Response	721 011	





Receiver group

Author: Dr. F. Nemes	Campobasso 1972	Sc. ———
Drawn: Lottmann		Table: 2
Date: Apr. 10th, 1973	Receiver Array Response	721 034

PRAKLA-SEISMOS

The geophone groups were provided with shunt resistors of 2.2 kΩ, to damp the geophones appropriately and as uniformly as possible.

The effective maximum and minimum damping resistances (R_{Amax} and R_{Amin}) for the individual geophones of the groups farthest from and nearest to the instrument are determined by insertion of the respective values for

m = number of geophones per string connected in series = 6

n = number of strings connected in parallel = 4

R_s = shunt resistance per group = 2.2. kΩ

R_e = input resistance of the recording instrument 4.8 kΩ

R_{kmax} = maximum cable resistance = 1.6 kΩ(3195 m x 0.5 Ω)

R_{kmin} = minimum cable resistance = 0.02 kΩ(practically = 0)

in the respective formulae:

$$R_{Amax} = \frac{n}{m} \cdot \frac{R_s \cdot (R_e + R_{kmax})}{R_s + R_e + R_{kmax}} \; ; \qquad R_{Amin} = \frac{n}{m} \cdot \frac{R_s \cdot (R_e + R_{kmin})}{R_s + R_e + R_{kmin}}$$

$$= \frac{4}{6} \cdot \frac{2.2\,(4.8 + 1.6)}{2.2 + 4.8 + 1.6} \qquad\qquad = \frac{4}{6} \cdot \frac{2.2 \cdot 4.8}{2.2 + 4.8}$$

$$= 1.09\ k\Omega \qquad\qquad = 1.005\ k\Omega$$

According to the response curves of the geophone SM 2 this means a damping between 63 % and 65 % for the individual geophones.

2.4.5. Recording

Recording was done with a unit of type DFS III on 9track magnetic tape (1/2" SEG A format).

The first breaks on the paper seismograms swing downwards, corresponding to negative values on the magnetic tape.

Record length:	6 s (5 s in Campobasso area)
Sampling rate:	4 ms
50 Hz notch filter:	in
Low cut filter:	8 Hz, 18 dB/oct
High cut filter:	62 Hz, 72 dB/oct
Gain control:	binary gain
Upper set point:	62 %
Lower set point:	18 %
Release rate:	fast
Final gain:	90 dB
Gain constant:	24 dB
Initial gain:	between 30 dB and 72 dB

2.5. Performance and Material Consumption

	Campobasso	Cercepiccola	Total
Total working time (hrs):	99.5	614.5	714.0
Journey to and from survey area (hrs):	8.0	8.0	16.0
Legal holidays (hrs):	-	40.0	40.0
Actual survey time (hrs):	91.5	566.5	658.0
Field survey days:	10	61	71

	Campobasso	Cercepiccola	Total
Surveying			
Line kilometres (subsurface):	12.5	83.0	95.5
Line kilometres per 10hr day:	1.37	1.46	1.45
Reflection shots:	94	640	734
of which reshots:	1	1	2
Reflection shots per 10 hr day:	10.3	11.3	11.2
Additional shots for			
tests:	7	20	27
2 uphole surveys:	-	17	17
Shooting			
Amount of explosives used (in kg) (Geodin B):	1 510	9 085	10 595
Number of caps used:	202	1 368	1 570
Drilling			
Total rig time (hrs):	275	1 913	2 188
Total metres drilled:	2 170	14 373	16 543
Metres drilled per 10 hr day per rig:	79	75	75.5
Number of shotholes:	102	685	787

3. Preparation of Survey Data, Interpretation and Presentation of Results

3.1. Corrections, Datum Level

Static corrections were calculated in the field office using a correctional velocity of 3 000 m/s below the weathering layer, and taking uphole times into account. The datum level was 500 m above sea level.

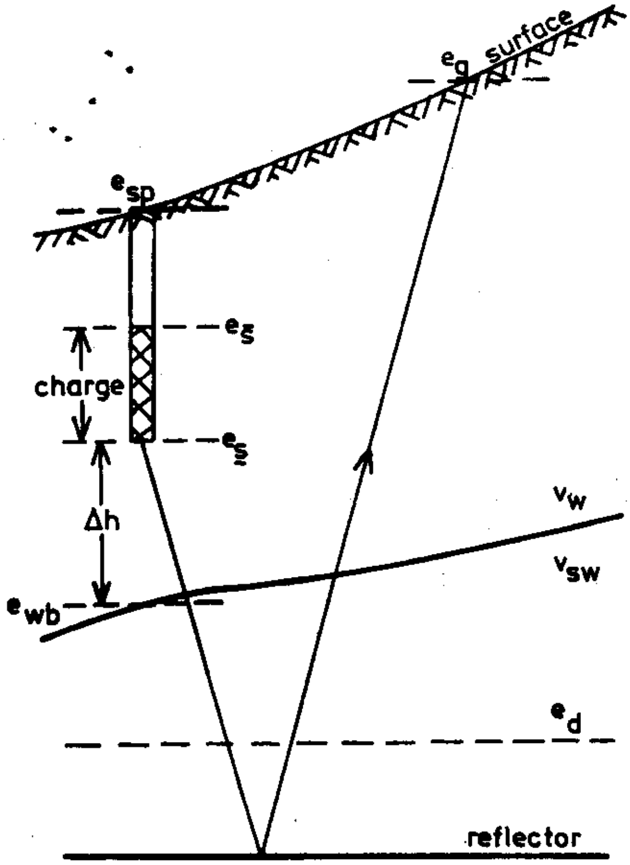
As the intercept times of the arrivals originating from the top of the 3 000 m/s-consolidated layer in general exceeded the uphole times recorded from the respective shots, static residuals based on subhole corrections were applied. The order of these residuals was between 0 and -40 ms for one way.

The formulae applied for the determination of static corrections are compiled in table 3 (page 19).

3.2. Interpretation

Four sections of lines surveyed somewhat earlier in this area (FER 1, 2, 3,and 4) had been placed at disposal by the client to enable an interpretation to some reasonable extent of the lines actually surveyed (CEP-1 to -8) excluding, however, lines MOL 28 and 28 bis of the area Campobasso.

No further background knockledge with respect to the specific geologic situation was made available to the interpreters. The general geologic situation was known to a certain extent from own experience from the fairly neighbouring areas 10 - 15 km to the east (report Castelpagano 1971/Benevento 1971/Foiano di Val Fortore 1971 for AGIP/Montecatini, dated May 2nd, 1972). Interpretation was made using paper copies in original scale of display (1 s ≙ 3 3/4 ").



e_{sp} = elevation of shotpoint

e_g = elevation of geophone

e_d = elevation of datum level

$e_{\bar{s}}$ = elevation of top of shot

$e_{\underline{s}}$ = elevation of bottom of shot

e_{wb} = elevation of weathering base

v_w = weathering velocity

v_{sw} = subweathering velocity

t_u = uphole time

t_i = intercept time

t_{sd} = correction shot to datum

t_{gd} = correction geophone to datum

$\Delta t_{sd} = \Delta t_{gd}$ = residual correction to be applied, when shot above base of weathering formation

$$t_{sd} = -\left(\frac{e_{\underline{s}} - e_d}{v_{sw}} + \Delta t_{sd}\right)$$

$$t_{gd} = -\left(t_u + \frac{(e_{\bar{s}} - e_d) + (e_g - e_{sp})}{v_{sw}} + \Delta t_{gd}\right)$$

$$\Delta t_{gd} = -\Delta h\left(\frac{1}{v_w} - \frac{1}{v_{sw}}\right)$$

from the standard intercept formula

$$\Delta h = (t_i - t_u) \cdot \frac{v_w}{2\sqrt{1 - q^2}} \qquad \left[q = \frac{v_w}{v_{sw}}\right]$$

we find:

$$\Delta t_{gd} = -(t_i - t_u)\,\frac{1}{2}\sqrt{\frac{1 - q}{1 + q}}$$

Author: Dr. F. Nemes	Campobasso 1972	Sc. ———	PRAKLA SEISMOS
Drawn: Schmalz	Cercepiccola 1972	Table: 3	
Date: Apr. 10th, 1973	Formulae for Determination of Static Corrections	721 034 721 011	

3.3. Presentation of Results

The said sections had been photographically reduced by the client such that 1 s $\hat{=}$ 5 cm, and two paper sets of these sections were sent to Hannover. The interpretation was transferred by us into these sections in red and blue pencil. Two of the four copies of the final report, thus, could be provided with interpreted seismogram sections (encl. 8 to 20). The remaining two copies contain only enclosures 1 to 7. The time contour map of horizon C is given in 1 : 100 000 (encl. 4) and in 1 : 25 000 (encl. 5). Enclosures 6 and 7 display the T-D graphs of two uphole surveys on lines CEP-2 and CEP-5 bis.

The signatures used in maps and sections are explained in the legend (encl. 1).

4. Results

4.1. Quality of Reflections

No outstanding quality of reflections was expected according to what is generally known on reflection response in areas where the objective aimed at is covered partly by thousands of metres of chaotic allochthonous deposits. Fairly reliable information was obtained, however, in extended parts of the seismogram sections of the lines in the northern part of the area.

South of a suggested line which nearly coincides with 41°21' latitude, the fairly strong character of the reflections observed in the north is nearly lost among.numerous, but little differentiated, seismic events.

Those portions of the lines without usable contributions to a meaningful interpretation are indicated in the time contour map (encl. 4 and 5) by short hatching.

4.2. Remarks on Interpretation

In order to match the FER-lines into the CEP-line system, two supplementary corrections were applied to the FER-lines:

1. a differential datum correction of -66 ms to reduce the timing from 600 m to the 500 m datum,
2. a field filter correction of +30 ms,

both summing up to a total of about -35 ms in two-way time.

(The Ferrazzano lines (FER) had been recorded with a low-cut filter 12 Hz/36 dB/oct, whereas the actual CEP-lines were recorded using a low-cut filter 8 Hz/18 dB/oct. The high-cut filters (alias filters)were 124 Hz and 62 Hz, respectively. According to the phase-response diagram shown in table 4 the travel-time difference at an average signal frequency of 17 Hz amounts to 30 ms, the signals of the CEP-lines being 30 ms delayed relative to the FER-lines.)

An attempt was made to provide a general structural interpretation by a time map of a reflection horizon which, from general experience in Apennine seismic prospection, was correlated to the top region of the mesozoic limestone. The strongest event at the tie between lines CEP-6 and FER-1 was labelled C and assumed to represent this horizon.

From this point of origin the interpretation developed fairly easily towards the north and a short step towards the south, including line FER-2 (approximately until 41°26' north). Within this outline the interpretation is based on well defined reflections, but by all means not without ambiguity; correlation across numerous faults is always associated with uncertainties.

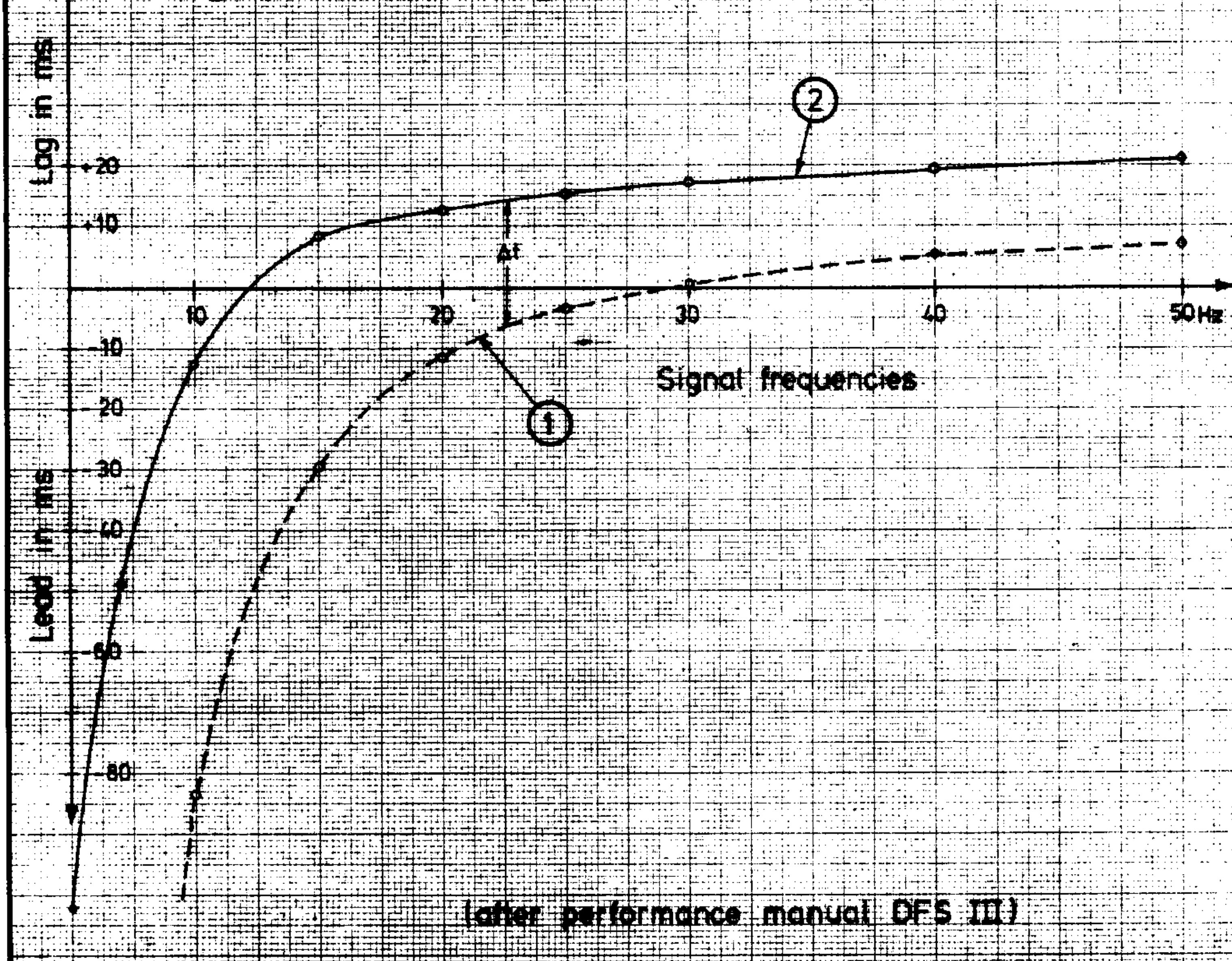
Reflection travel time variations in ms

as a function of analog frequency filtering

(Instrument DFS III)

Filter Setting \ Signal Frequency in Hz	10	15	20	25	30	40	50
① HC 124 Hz; LC 12 Hz / 36 dB/oct	-83.5	-29.6	-11.1	-3.3	+0.9	+5.2	+7.0
② HC 62 Hz; LC 8 Hz / 18 dB/oct	+12.5	+8.3	+12.5	+15.5	+17.2	+19.5	+21.0
Δt	71.0	37.9	23.6	18.8	16.3	14.3	14.0

[Lead: negative values
Lag: positive values]



(after performance manual DFS III)

Author: Dipl. Ing. R. Bading	Campobasso 1972	Sc. ——	PRAKLA SEISMOS
Drawn: W. G. Büttner	Cercepiccola 1972	Table 4	
Date: Apr. 10 th, 1973	Phase Response v.s. Field Filtering	721 034 721 011	

The interpretation in the remaining area south of this outline is gradually less dependable, because the character of the reflection traced seems to be completely lost. Nevertheless at least the concept of the main structural features mapped is considered to be rather probable and compatible with the general tectonic system.

4.3. Discussion of the Time-Contour Map of Horizon C

A sequence of pronounced structural elements trends with the Apennine strike. Several short-time and long-time axes in quick succession follow each other from SW towards NE, accompanied by large overthrust faults thrusting towards the NE, and by some minor normal faults which dip towards the SW. The faults designated a, b, and c are with some certainty overthrusts. Fault d may be another overthrust rather than a normal fault, as is assumed from the substantially compressional tectonics.

The anticlinal axis SW of the d-fault is comparably well defined in the southernmost line CEP-1; it is fairly recognizable in line CEP-3, and it is detectable with some imagination and good will in line CEP-5, the crest presenting here a minimum time of about 1.4 s only.

The deep synclinal axis adjoining to the NE is followed again by another short-time axis; its culmination is interpretable in line CEP-7. The corresponding indications in lines CEP-3 and 1 are weak. Beyond overthrust c in line CEP-7 a fair indication to establish the time-level of horizon C is found at the tie-point with line CEP-2. The rest of line CEP-2 does not render any usable information for mapping.

The rather flat anticlinal axis between overthrusts b and c is well defined by lines FER-1 and -2; this short-time structure has probably SE axial dip. It is separated in the NE by overthrust b from a large short-time ridge, which is subdivided in blocks by the SW-dipping normal faults e and f. There is no unequivocal evidence as to the dip of the axis towards SE, as the correlation between lines FER-1 and -2 east of overthrust b is not confirmed by direct line ties. The indications for semistructures in connection with the short-time area NE of overthrust b bounded by faults e and f are optimistic featural versions of mapping.

5. Summary

During two periods in 1972 seismic reflection surveys were carried out in Cercepiccola area (April to June) and Campobasso area (in September and October). Field operations were strongly impaired by rainy weather rendering the terrain sometimes inaccessible. Subsurface coverage was 6fold, the total line extent was 95.5 km.

An interpretation was made excepting lines MOL-28 and MOL-28 bis (Campobasso), but including four previous lines (FER-1 to -4). Several anticlinal structures in connection with overthrust faults are indicated in the line sections which may be of considerable prospective interest. These indications should be more thoroughly investigated by detailed surveys to check and supplement the present attempt of a structural interpretation.

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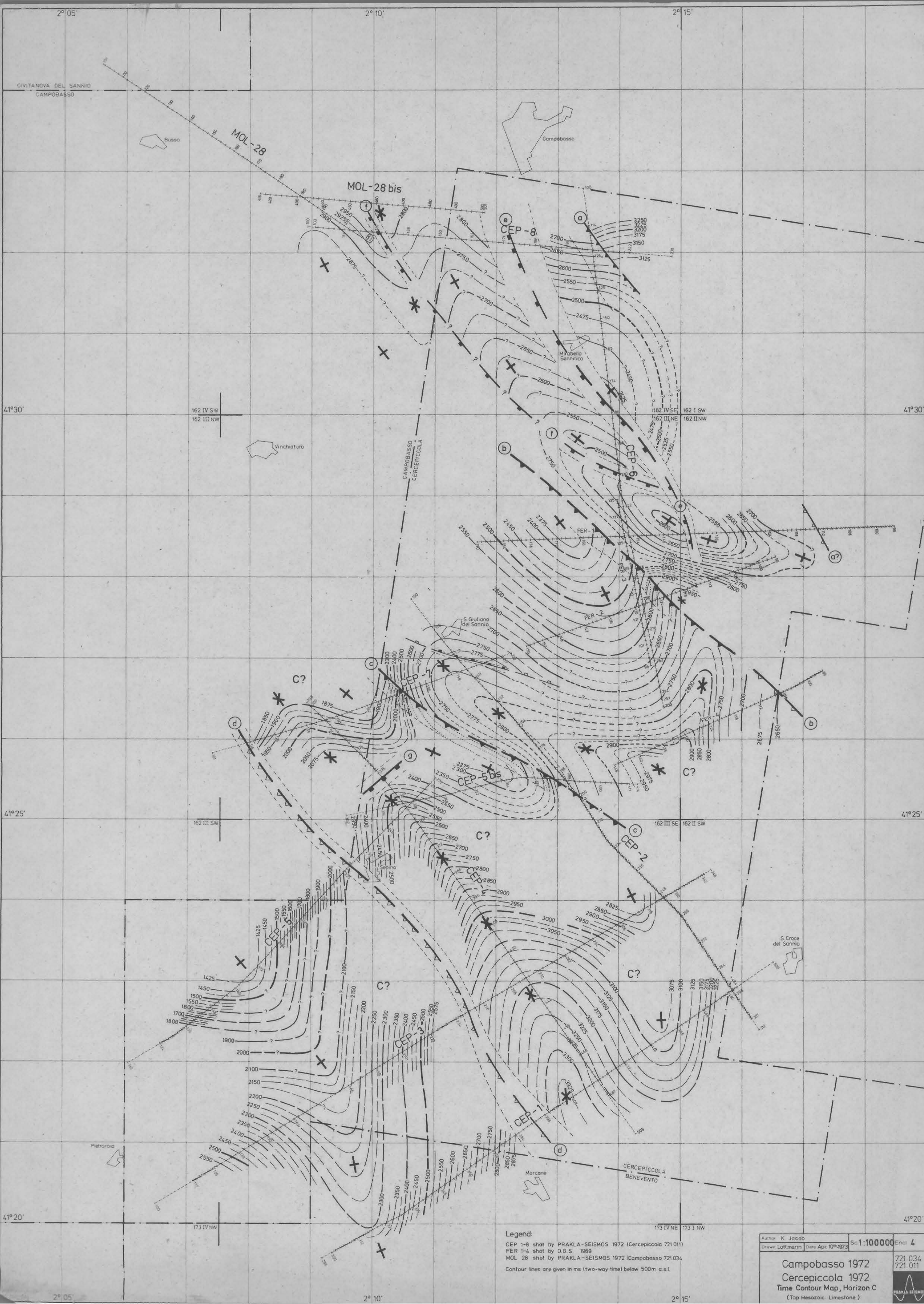
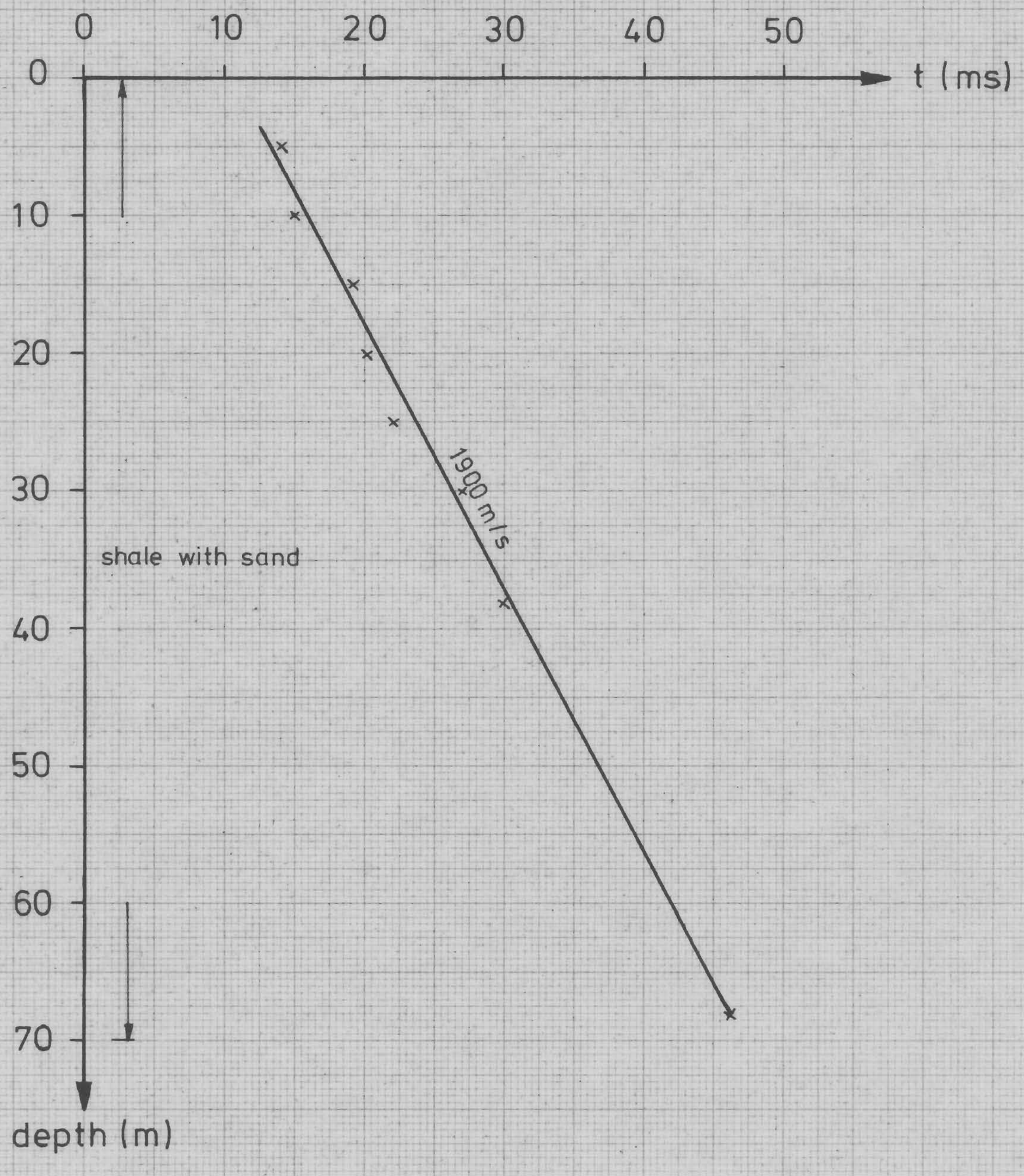
(Dr. H.-J. Trappe) (Dipl.-Ing. R. Bading)

23.5.73/DS



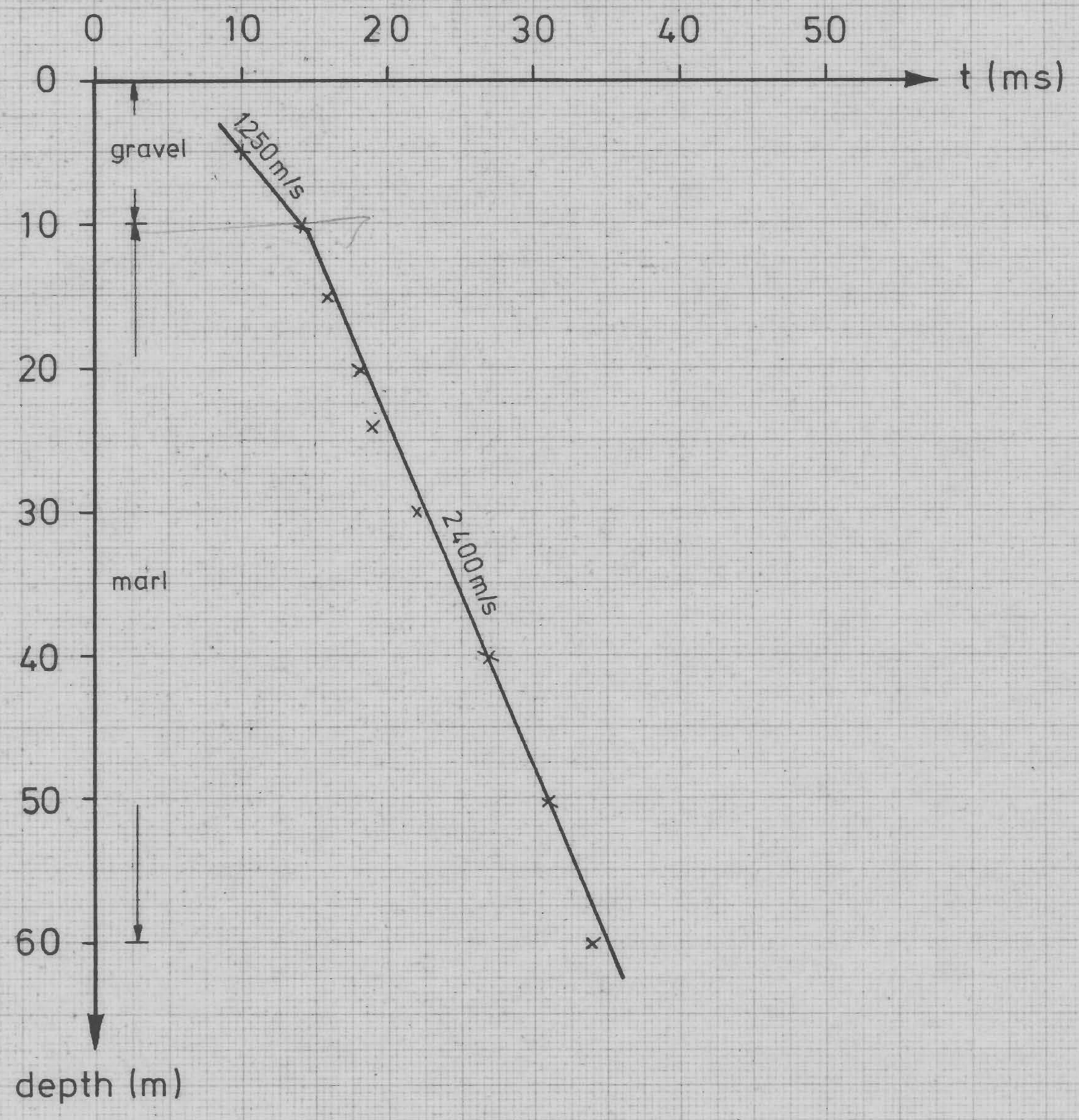
2° 05'
2° 10'
2° 15'
41°30'
41°25'
41°20'
CIVITANOVA DEL SANNIO
CAMPOBASSO
Busso
Campobasso
MOL-28
MOL-28 bis
CEP-8
CEP-6
CEP-5
CEP-5 bis
CEP-4
CEP-3
CEP-2
CEP-1
FER-1
FER-2
FER-3
FER-4
Mirabello Sannitico
Vinchiaturo
CAMPOBASSO
CERCEPICCOLA
S. Giuliano del Sannio
S. Croce del Sannio
Pietraroia
Morcone
CERCEPICCOLA
BENEVENTO
162 IV SW
162 III NW
162 I SW
162 IV SE
162 III NE
162 II NW
162 III SW
162 III SE
162 II SW
173 IV NW
173 IV NE
173 I NW
C?
Legend:
CEP 1-8 shot by PRAKLA-SEISMOS 1972 (Cercepiccola 721 011)
FER 1-4 shot by O.G.S. 1969
MOL 28 shot by PRAKLA-SEISMOS 1972 (Campobasso 721 034
Contour lines are given in ms (two-way time) below 500m a.s.l.
Author K. Jacob
Drawn Lottmann
Date Apr. 10th 1973
Sc 1:100000
Encl 4
721 034
721 011
Campobasso 1972
Cercepiccola 1972
Time Contour Map, Horizon C
(Top Mesozoic Limestone)
PRAKLA-SEISMOS

Time-depth graph

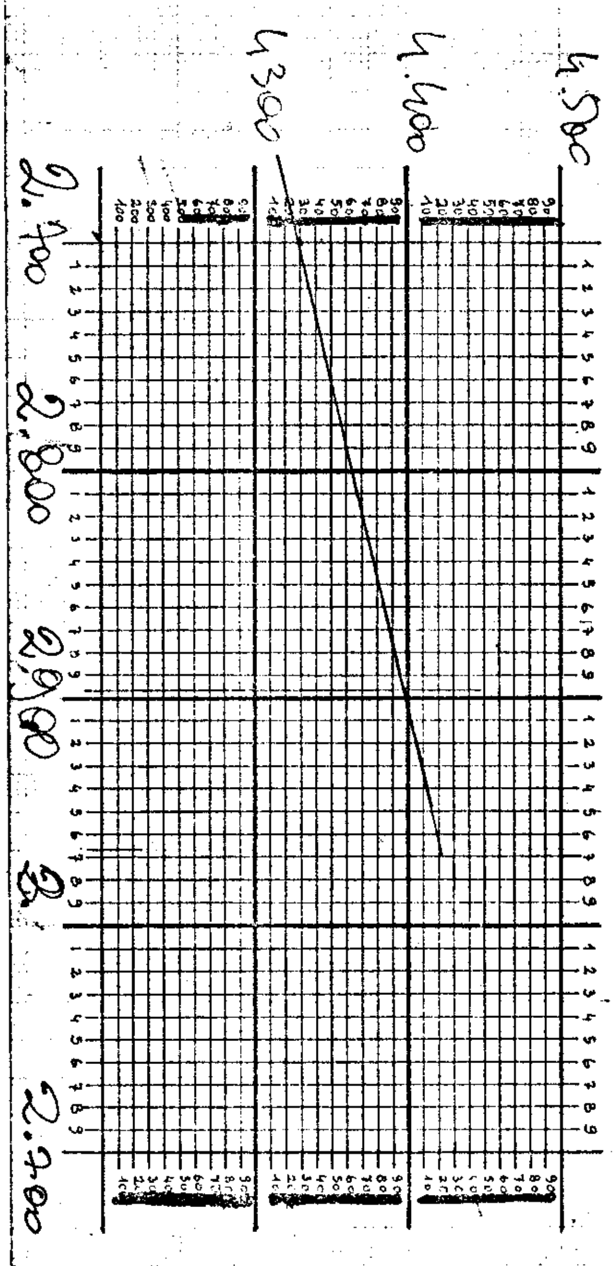


Author: Dr. Nemes	Campobasso 1972	Sc. —	PRAKLA-SEISMOS
Drawn: Lottmann	Cercepiccola 1972	Encl. 6	
Date: Apr. 10th, 1973	Uphole Survey CEP-2, station 150	721 034 721 011	

Time-depth graph



Author: Dr. Nemes	Campobasso 1972	Sc. —	PRAKLA-SEISMOS
Drawn: Lottmann	Cercepiccola 1972	Encl. 7	
Date: Apr. 10 th, 1973	Uphole Survey CEP-5 bis, station 392	721 034 721 011	


4.300
4.400
4.500
2.700
2.800
2.900
3
2.700

CEP 5 bis

P.S.	TEMPO DOPPIO	VELOCITÀ	T.EFFETTIVO	T.EFF.xVELOCITÀ
316	2,550	4.375	1,275	5578
318	2,530	4.365	1,265	5522
320	2,525	4.362	1,2625	5507
322	2,535	4.367	1,2675	5535
324	2,545	4.372	1,2725	5563
326	2,550	4.375	1,275	5578
328	2,560	4.378	1,280	5604
330	2,560	4.378	1,280	5560
332	2,560	4.378	1,280	5604
334	2,560	4.378	1,280	5604
336	2,560	4.378	1,280	5604
338	2,490	4.347,5	1,245	5413
340	2,470	4.770	1,235	5891
342	2,470	4.770	1,235	5891
344	2,470	4.770	1,235	5891
346	2,470	4.770	1,235	5891
348	2,460	4.763	1,230	5858
350	2,360	4.653	1,180	5490
352	2,350	4.643	1,175	5455
354	2,350	4.643	1,125	5223
356	2,340	4.630	1,170	5417
358	2,310	4.600	1,155	5313
360	2,320	4.145	1,160	4808
362	2,310	4.142	1,155	4784
364	2,300	4.140	1,150	4761
366	2,295	4.138	1,1475	4748
368	2,300	4.140	1,150	4761
370	2,320	4.145	1,160	4808
372	2,340	4.150	1,170	4855
374	2,340 - 2,740	4.150 - 4.342,5	1,170 - 1,370	4855 - 5949
376	2,350 - 2,775	4.155 - 4.355	1,175 - 1,3875	4882 - 6042
378	2,405 - 2,780	4.170 - 4.357	1,2025 - 1,390	5014 - 6056
380	2,430 - 2,790	4.178 - 4.360	1,215 - 1,395	5077 - 6082
382	2,450 - 2,800	4.185 - 4.365	1,225 - 1,40	5127 - 6111
384	2,450 - 2,820	4.185 - 4.370	1,225 - 1,410	5127 - 6162

P.S.	TEMPO DOPPIO	VELOCITA'	T.EFFETTIVO	T.EFF. x VELOCITA'
386	2,870	4.388	1,435	6297
388	2,865	4.386	1,4325	6283
390	2,860	4.385	1,430	6270
392	2,895			
394	2,870			
396	2,890			
398	2,910			
400	2,920			
402	2,930			
404	2,920			
406	2,930			
408	2,940			
410	2,970			

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P.S.	TEMPO DOPPIO	VELOCITÀ	TEMPO EFFETTIVO	T.EFF. × VELOCITÀ
118	2,720	3.460	1,360	4706
120	2,720	3.460	1,360	4706
124	2,700	3.455	1,350	4664
126	2,680	3.450	1,34	4623
128	2,655	3.445	1,3275	4573
130	2,650	3.985	1,325	5280
132	2,630	3.850	1,315	5063
134	2,600	3.978	1,3	5171
136	2,575	3.953	1,2875	5089
138	2,560	3.946	1,28	5051
140	2,545	3.940	1,2725	5014
142	2,520	3.930	1,26	4952
144	2,520	3.930	1,26	4952
146	2,520	3.930	1,26	4952
148	2,505	3.923	1,2525	4913
150	2,490	3.915	1,245	4874
152	2,480	3.913	1,24	4852
154	2,480	3.913	1,24	4852
156	2,475	3.910	1,2375	4839
158	2,470	3.907	1,235	4825
160	2,470	3.907	1,235	4825
162	2,460	3.903	1,23	4801
164	2,465	3.905	1,2325	4813
166	2,465	3.905	1,2325	4813
168	2,465	4.220	1,2325	5201
170	2,465	4.220	1,2325	5201
172	2,49	4.227	1,245	5263
174	2,495	4.229	1,2475	5276
176	2,465	4,220	1,2325	5201

192	2,600	4.257,5	1,3	5535
194	2,590	4.253,5	1,295	5508
196	2,575	4.250	1,2875	5472
198	2,565	4.247,5	1,2825	5447
200	2,550	4.243,5	1,275	5410

CEP ...

20P.S.	TEMPO DOPPIO	VELOCITA'	TEMPO EFFETTIVO	T.EFF. X VELOCITA'
202	2,530	4.237,5	1,265	5360
204	2,535	4.239	1,2675	5373
206	2,525	4.236	1,2625	5348
212	2,660	4.265	1,33	5672
214	2,655	4.005	1,3275	5317
216	2,680	4.017,5	1,34	5383
218	2,690	4.025	1,345	5414
220	2,700	4.030	1,35	5440
222	2,700	4.030	1,35	5440
224	2,730	4.050	1,365	5528
226	2,740	4.058	1,37	5559
228	2,740	4.058	1,37	5559
230	2,745	4.060	1,3775	5593
232	2,750	4.065	1,375	5589
234	2,760	4.072	1,38	5619
236	2,760	4.072	1,38	5619
238	2,785	4.090	1,3925	5695
240	2,790	4.093	1,395	5710
242	2,810	4.105	1,405	5767
244	2,825	4.115	1,4125	5812
246	2,860 - 2,565	4.140 - 3.900	1,43 - 1,2825	5920
248	2,845 2,570	4.130 - 3.905	1,4225 - 1,285	5875
250	2,845 2,560	3.655 - 3.611,5	1,4225 - 1,28	5199
252	2,850 2,590	3.657,5 - 3.612,25	1,425 - 1,295	5212
254	2,585	3.612,15	1,2925	4669
256	2,595	3.612,35	1,2975	4687
258	2,600	3.612,5	1,3	4696
260	2,600	3.612,5	1,3	4696
262	2,610	3.612,75	1,305	4715
264	2,600	3.612,5	1,3	4696
266	2,590	3.612,25	1,295	4678
268	2,600	3.612,5	1,3	4696
270	2,610	3.612,75	1,305	4715
272	2,630	3.613,25	1,315	4751

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P.S.	TEMPO POPPA	VELOCITÀ	TEMPO EFFETTIVO	T.EFF. X VELOCITÀ
274	2,630	3613,25	1,315	4751
276	2,660	3614	1,33	4807
278	2,670	3.614,25	1,335	4825
280	2,680	3.614,50	1,34	4843
282	2,685	3.614,625	1,3475	4871
284	2,710	3.617,5	1,355	4902
286	2,730			
288	2,740			
290	2,760			
292	2,765			
294	2,765			

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- 5002
- 5018
- 4623
- 4678

O.P.S.	TEMPO DOPPIO	VELOCITA'	T. EFFETTIVO	T. EFF. X VELOCITA'
116	1,850	3.407,5	0,925	3152
118	1,880	3.432,5	0,940	3226
120	1,900	3.450	0,950	3277
122	1,930	3.475	0,965	3353
124	1,950	3.495	0,975	3408
126	1,965	3.507,5	0,9825	3446
128	1,990	3.530	0,995	3512
130	1,980	3.520	0,990	3485
132	2,000	3.538	1,000	3538
134	2,020	3.555	1,01	3590
136	2,030	3.565	1,015	3618
138	2,030	3.565	1,015	3618
140	2,010	3.547,5	1,005	3565
142	2,045	3.577,5	1,0225	3655
144	2,045	3.577,5	1,0225	3658
146	1,965	3.507,5	0,9825	3446
148	1,945	3.230	0,9725	3141
150	1,945	3.230	0,9725	3141
152	1,920	3.207,5	0,960	3079
154	1,900	3.190	0,950	3030
156	1,900	3.190	0,950	3030
158	1,895	3.190	0,9475	3022
160	—	—	—	[illegible]
162	1,885	3.190	0,9425	3006
164	1,900	3.190	0,950	3030
166	1,900	3.190	0,950	3030
168	1,950	3.233	0,975	3152
170	1,960	3.240	0,980	3175
172	2,020 - 2,320	3.292,5 - 3.535	1,010 - 1,160	3325 - 4101
174	2,020 - 2,350	3.292,5 - 3.560	1,010 - 1,175	3325 - 4183
176	2,090 - 2,525	3.352 - 3.650	1,045 - 1,2625	3503 - 4608
178	2,600	3.690	1,30	4797
180	2,615	3.697,5	1,3075	4834
182	2,660	3.717,5	1,330	4944
184	2,710	3.738	1,355	5065
186	2,770	3.765	1,385	5214

188	2,785	3.770	1,3925	5250
190	2,820	3.782	1,410	5333
192	—		—	
194	—		—	
196	2,800	3.775	1,4	5285
198	2,800	3.775	1,4	5285
200	2,800	3.775	1,4	5285
202	2,810	3.782	1,45	5484
204	2,820	3.787	1,410	5340
206	2,820	3.787	1,410	5340
208	2,800	3.775	1,4	5285
210	2,825			
212	2,825			
214	2,780			
216	2,775			

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① P.S.	② TEMPO DOPPIO	③ VELOCITA'	④ TEMPO EFFETTIVO	④×③ T.EFF. × VELOCITA'
103	2,90	3580	1,45	5191
104	2,92	3588	1,46	5238
106	2,91	3584	1,455	5215
108	2,925	3590	1,4625	5250
110	2,92	3588	1,46	5238
112	2,91	3584	1,455	5215
114	2,935	3594	1,4675	5274
116	2,94	3596	1,47	5286
118	2,96[redacted]	3604	1,48	5334
120	2,965	3606	1,4825	5346
122	2,99	3616	1,495	5406
124	2,985	3614	1,4925	5394
*				
126	2,980	4100	1,49	6109
128	2,950	4082	1,475	6021
130	2,84	4022	1,42	5711
132	2,85	4028	1,425	5740
134	2,835	4019	1,4175	5697
136	2,825	4013 (3)	1,4125	5669
138	2,815	4008	1,4075	5641
140	2,800	4000	1,4	5600
142	2,825	4013	1,4125	5668
144	2,810	4006	1,405	5628
146	2,820	4011	1,41	5655
148	2,810	4006	1,405	5628
150	2,800	4000	1,4	5600
152	2,800	4000	1,4	5600
154	2,825	4013	1,4125	5668

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① F.S.	② TEMPO DOPPIO	③ VELOCITA'	④ TEMPO EFFETTIVO	④×③ T.EFF × VELOCITA'
156	2,84	4022	1,42	5711
158	2,82	4011	1,41	5655
160	2,80	4000	1,40	5600
162	2,83	4016	1,415	5683
163	2,825	4013	1,4125	5668
164	2,825	4013		
166	2,825	4013		
168	-			
170				
172				
174				
176				
178				
180				
182				
184				
186				
188	2,69			
190	2,69			
192	2,675			
194	2,69			
196	2,68			
198	2,70			
200	2,72			
202	2,675			
204	2,68			
206	2,675			
208	2,68			
210	2,68			
212	2,70			
214				
216				
218				
220				
222				

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