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DENVER U.S.

83277ART0014

AMOCO PRODUCTION COMPANY
RESEARCH CENTER

SOURCE ROCK EVALUATION

Ordovician and Pennsylvanian Cores, Six Kansas Wells

Geochemistry Services Group

R. J. Harwood

Technical Service 839327CS

Requested by R. M. Lorkowski

APC (USA) DENVER SOUTHERN

R.L. AMES (10-5-83)
by [signature]
RRJ

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OFFICE DENVER DISTRICT NORTHERN
 AUTHORIZED BY BOB LORKOWSKI
 TECHNICAL SERVICE NUMBER 839327

SOURCE ROCK SUMMARY
 TABLE 1.
 DATE 09/30/83

| SAMPLE NUMBER | SMPL TYPE | FORMATION | AGE | LITHOLOGY | FIELD NO. OR DEPTH FEET TOP***BASE | PETROLEUM GENERATION CAPABILITY | KEROGEN TYPE (OIL/GAS) | STAGE OF DIAGENESIS |
|-------------------------------|-----------|-------------------------------|------|-----------|------------------------------------|---------------------------------|------------------------|---------------------|
| STATE KANSAS COUNTY RICE | | WELL LOCATION SEC11-120S-R8W | | | | | | |
| WELL NAME SHELL | | LEASE MAUGHLIN #1 | | | | | | |
| S-790 | CR | VIOLA | ORD | SH | 3221 | 3222 | NON SOURCE | |
| STATE KANSAS COUNTY RICE | | WELL LOCATION SEC33-T18S-R9W | | | | | | |
| WELL NAME SHELL | | LEASE PLOOG #1 | | | | | | |
| S-791 | CR | SIMPSON | ORD | SH | 3258 | 3259 | NON SOURCE | |
| S-792 | CR | SIMPSON | ORD | SH | 3269 | 3270 | NON SOURCE | |
| STATE KANSAS COUNTY ELLSWORTH | | WELL LOCATION SEC18-T17S-R9W | | | | | | |
| WELL NAME HOLLOW OIL | | LEASE JANZEN #1 | | | | | | |
| S-793 | CR | SIMPSON | ORD | SH | 3248 | 3251 | NON SOURCE | |
| STATE KANSAS COUNTY MCPHERSON | | WELL LOCATION SEC16-T21S-R3W | | | | | | |
| WELL NAME SHELL | | LEASE KOEHN #4 | | | | | | |
| S-794 | CR | SIMPSON | ORD | SII | 3407 | 3412 | EXCELLENT OIL | EARLY PEAK OIL |
| STATE KANSAS COUNTY NESS | | WELL LOCATION SEC25-T20S-R26W | | | | | | |
| WELL NAME MID CONTINENT | | LEASE COLLINS #1 | | | | | | |
| S-795 | CR | CHEROKEE | PENN | SH | 4406 | 4407 | EXCELLENT | NOT KNOWN PEAK GAS |
| S-796 | CR | CHEROKEE | PENN | SH | 4430 | 4431 | MARGINAL | NOT KNOWN PEAK GAS |
| STATE KANSAS COUNTY LOGAN | | WELL LOCATION SEC13-T15S-R33W | | | | | | |
| WELL NAME ALMA OIL | | LEASE WATCHHORN #1 | | | | | | |
| S-797 | CR | MORROW | PENN | SH | 4454 | 4455 | NON SOURCE (GAS) | (EARLY PEAK GAS) |

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12:39 FRIDAY, SEPTEMBER 30, 1983

R839327 ROCKEVAL PYROLYSIS DATA

| SAMPLE NO. | TOP OF ANALYZED INTERVAL | FORMATION | TOTAL ORGANIC CARBON WT% (TOC) | PPM VOLATILE HYDROCARBONS (S1 X 1000) | VOL/ TOC | PPM GENERATED HYDROCARBONS (S2 X 1000) | GEN/ TOC | TEMP OF MAX GEN | VOL/ VOL + GEN |
|--------------------------------------|--------------------------|-----------|--------------------------------|---------------------------------------|----------|--|----------|-----------------|----------------|
| Shell No. 1 Maughlin S-798 | 3221 | VIOLA | 0.4 | 110 | 0.03 | 550 | 0.14 | | 0.17 |
| Shell No. 1 Ploog S-791 | 3258 | SIMPSON | 0.2 | 10 | 0.01 | <10 | <.01 | | 1.00 |
| S-792 | 3269 | SIMPSON | 0.2 | <10 | <.01 | <10 | <.01 | | . |
| Hollow No. 1 Janzen S-793 | 3248 | SIMPSON | 0.2 | 90 | 0.05 | 1030 | 0.51 | | 0.08 |
| Shell No. 4 Koehn S-794 | 3407 | SIMPSON | 18.2 | 4720 | 0.03 | 120780 | 0.66 | | 0.04 |
| Mid Continent No. 1 Collins S-795 | 4406 | CHEROKEE | 2.3 | 160 | 0.01 | 300 | 0.01 | | 0.35 |
| S-796 | 4430 | CHEROKEE | 0.6 | 40 | 0.01 | 70 | 0.01 | | 0.36 |
| Alma No. 1 Watchhorn S-797 | 4454 | MORROW | 2.6 | 130 | 0.01 | 720 | 0.03 | | 0.15 |

Table 2

CONVEYOR
SERIAL SERVICE NUMBER

DISTRICT SOUTHERN
839327

SOURCE ROCK DATA
TABLE 3.
DATE 09/30/83

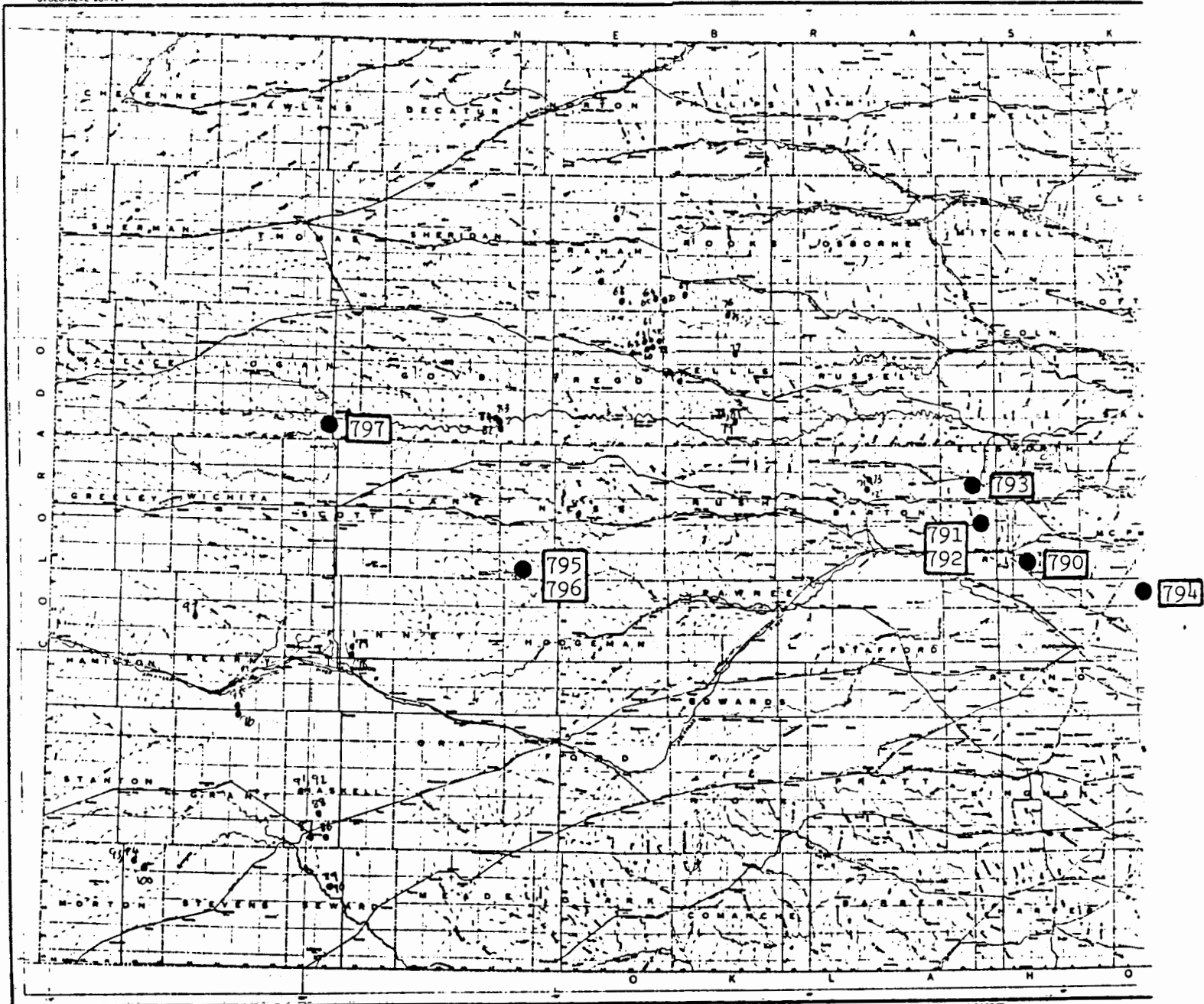
| SAMPLE NUMBER | FIELD NO. OR DEPTH FEET | | GEOLOGICAL AGE | INSOLUBLE RESIDUE % | TOTAL ORGANIC C % | BITUMEN | | SAT HC | | SAT HC / BITUMEN | | REMARKS | | |
|--|-------------------------|--------|----------------|---------------------|-------------------|---------|-----|--------|-----|------------------|----------|---|-------|------|
| | TOP | BOTTOM | | | | DBL/AF | PPM | BBL/AF | PPM | BITUMEN | TL ORG C | | | |
| STATE KANSAS COUNTY RICE WELL LOCATION SEC11-T20S-R8W | | | | | | | | | | | | | | |
| WELL NAME SHELL LEASE MAUGHLIN #1 | | | | | | | | | | | | | | |
| S-790 | 3221 | 3222 | ORD | | | .4 | | | | | | BBL/AF = (PPM X .0180) Saturate δC^{13} ‰ Pristane/Phytane | | |
| STATE KANSAS COUNTY RICE WELL LOCATION SEC33-T18S-R9W | | | | | | | | | | | | | | |
| WELL NAME SHELL LEASE PLOOG #1 | | | | | | | | | | | | | | |
| S-791 | 3258 | 3259 | ORD | | | .2 | | | | | | | | |
| S-792 | 3269 | 3270 | ORD | | | .2 | | | | | | | | |
| STATE KANSAS COUNTY ELLSWORTH WELL LOCATION SEC18-T17S-R9W | | | | | | | | | | | | | | |
| WELL NAME HOLLOW OIL LEASE JANZEN #1 | | | | | | | | | | | | | | |
| S-793 | 3248 | 3251 | ORD | | | .2 | | | | | | | | |
| STATE KANSAS COUNTY MCPHERSON WELL LOCATION SEC16-T21S-R3W | | | | | | | | | | | | | | |
| WELL NAME SHELL LEASE KOEHN #4 | | | | | | | | | | | | | | |
| S-794 | 3407 | 3412 | ORD | | | 18.2 | 90 | 5023 | 21 | 1159 | .23 | .03 | -29.8 | 1.65 |
| STATE KANSAS COUNTY NESS WELL LOCATION SEC25-T20S-R26W | | | | | | | | | | | | | | |
| WELL NAME MID CONTINENT LEASE COLLINS #1 | | | | | | | | | | | | | | |
| S-795 | 4406 | 4407 | PENN | | | 2.3 | 9 | 476 | 2 | 107 | .23 | .02 | | |
| S-796 | 4430 | 4431 | PENN | | | .6 | 3 | 179 | | | | .03 | | |
| STATE KANSAS COUNTY LOGAN WELL LOCATION SEC13-T15S-R33W | | | | | | | | | | | | | | |
| WELL NAME ALMA OIL LEASE WATCHHORN #1 | | | | | | | | | | | | | | |
| S-797 | 4454 | 4455 | PENN | | | 2.6 | 5 | 264 | | | | .01 | | |

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DISTRICT SOUTHERN
 839327

KEROGEN DATA
 TABLE 4.
 DATE 09/30/83

| LAB SAMPLE NUMBER | FIELD NO. OR DEPTH FEET | | GEOL. AGE | NORM. ELEMENTAL ANALYSIS, WT. | | | | ATOMIC RATIO O/C | ATOMIC RATIO H/C | VISUAL KEROGEN TYPE | CARBNZ. SCALE | VIT REFLECT %RO |
|---|----------------------------|--------|---|-------------------------------|----------|--------|----------|------------------------|------------------------|---------------------------|------------------|-----------------------|
| | TOP*** | BOTTOM | | CARBON | HYDROGEN | OXYGEN | NITROGEN | | | | | |
| STATE KANSAS COUNTY RICE WELL NAME SHELL | | | WELL LOCATION SEC11-T20S-R8W LEASE MAUGHLIN #1 | | | | | | | | | |
| S-790 | 3221 | 3222 | ORD | | | | | | | | | |
| STATE KANSAS COUNTY RICE WELL NAME SHELL | | | WELL LOCATION SEC33-T18S-R9W LEASE PLOOG #1 | | | | | | | | | |
| S-791 | 3258 | 3259 | ORD | | | | | | | | | |
| S-792 | 3269 | 3270 | ORD | | | | | | | | | |
| STATE KANSAS COUNTY ELLSWORTH WELL NAME HOLLOW OIL | | | WELL LOCATION SEC18-T17S-R9W LEASE JANZEN #1 | | | | | | | | | |
| S-793 | 3248 | 3251 | ORD | | | | | | | | | |
| STATE KANSAS COUNTY MCPHERSON WELL NAME SHELL | | | WELL LOCATION SEC16-T21S-R3W LEASE KOEHN #4 | | | | | | | | | |
| S-794 | 3407 | 3412 | ORD | 81 | 9.7 | 8 | .9 | .07 | 1.44 | STRUCTURED | | |
| STATE KANSAS COUNTY NESS WELL NAME MID CONTINENT | | | WELL LOCATION SEC25-T20S-R26W LEASE COLLINS #1 | | | | | | | | | |
| S-795 | 4406 | 4407 | PENN | 85 | 2.5 | 10 | 2.2 | .08 | .36 | MIXED | | 1.54 |
| S-796 | 4430 | 4431 | PENN | 85 | 2.3 | 10 | 2.3 | .08 | .32 | MIXED | | 1.56 |
| STATE KANSAS COUNTY LOGAN WELL NAME ALMA OIL | | | WELL LOCATION SEC13-T15S-R33W LEASE WATCHHORN #1 | | | | | | | | | |
| S-797 | 4454 | 4455 | PENN | 83 | 2.8 | 12 | 1.8 | .10 | .41 | STRUCTURED | 4-5 | .77 |



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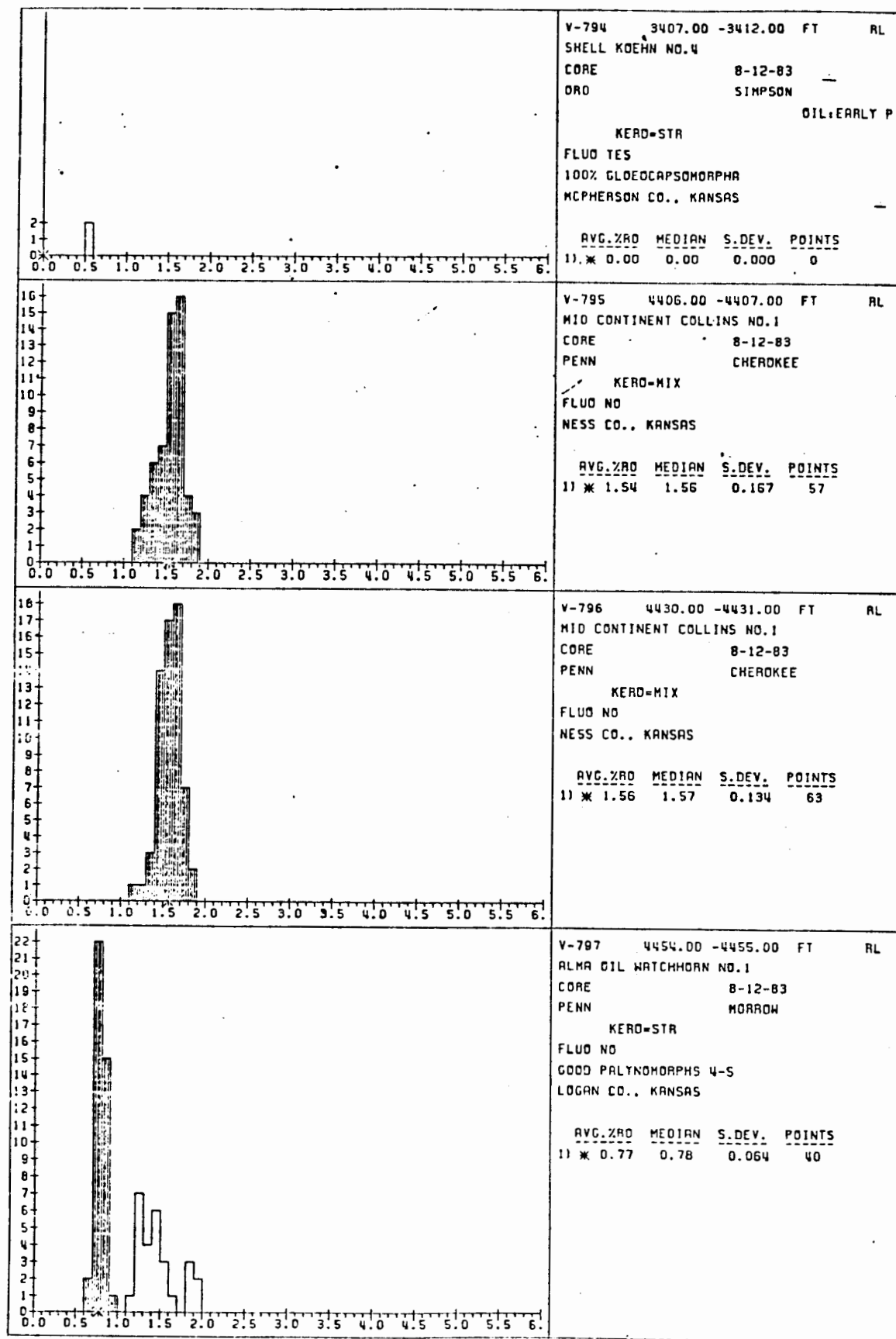
TS 839327CS
Figure 1

VITRINITE REFLECTANCE ANALYSIS

VARIOUS LEASES, KANSAS.

LOCALITY 9327

TECH SVC NO:9327



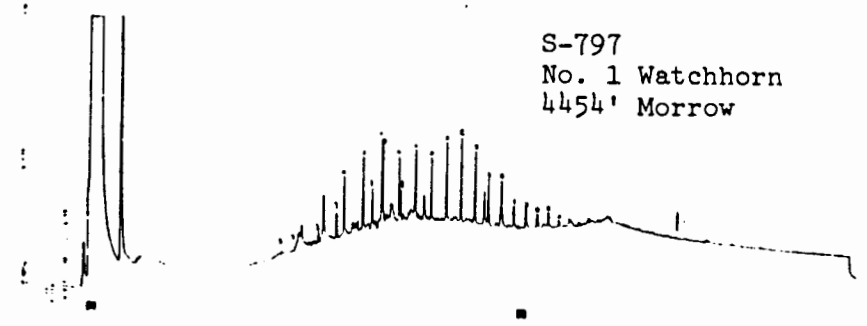
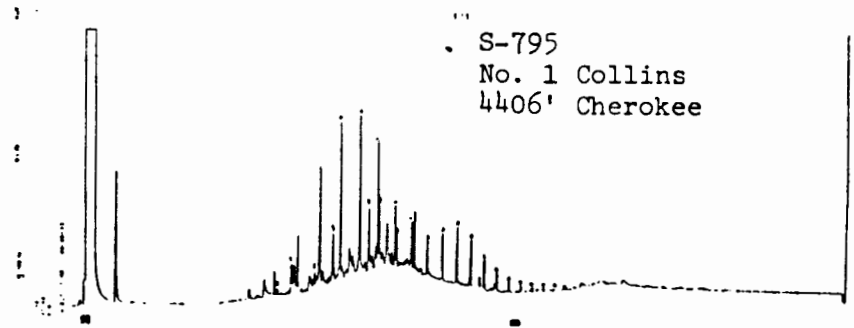
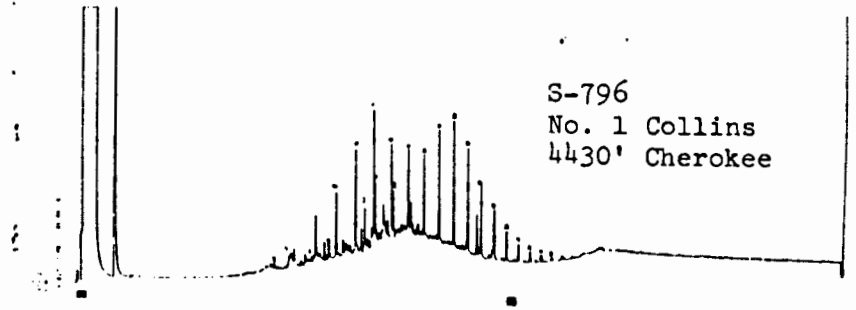
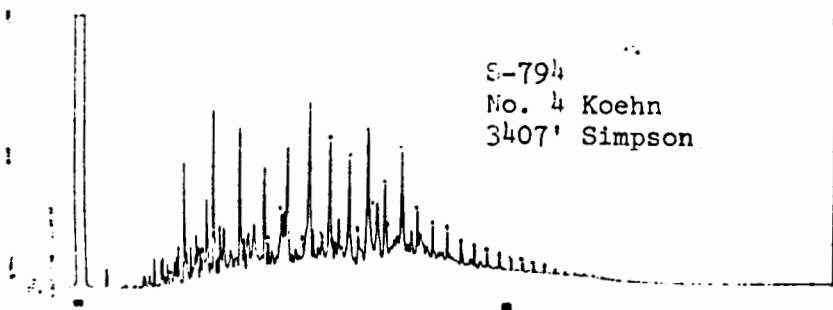
X-AXIS - PERCENT REFLECTANCE OF VITRINITE (%R0)

Y-AXIS - FREQUENCY

AVERAGE %R0 FOR POP.1 = 0.97

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 Figure 2



Whole Extract Chromatograms

-- TS 839327CS
Figure 3a

4356

7662

9115

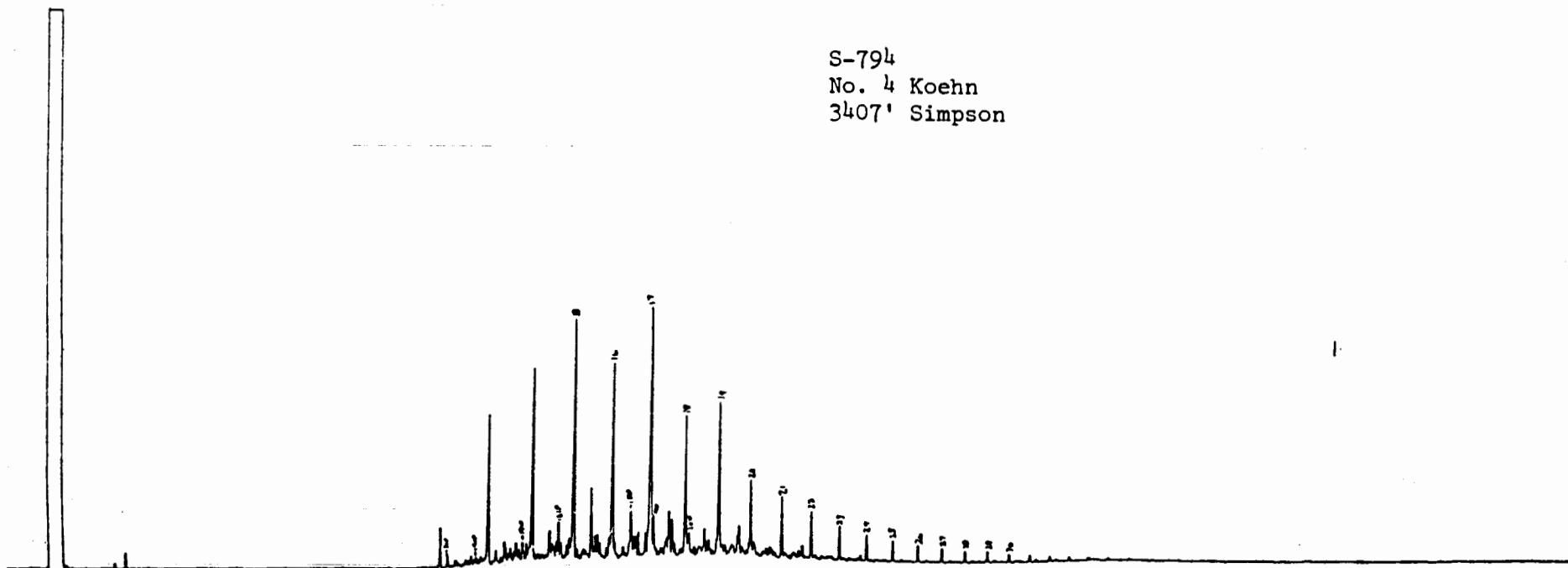
S-794

31.4
47.256
RUN

INJECT TIME 21195107

170

S-794
No. 4 Koehn
3407' Simpson



Saturate Fraction Chromatogram
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Figure 3b