

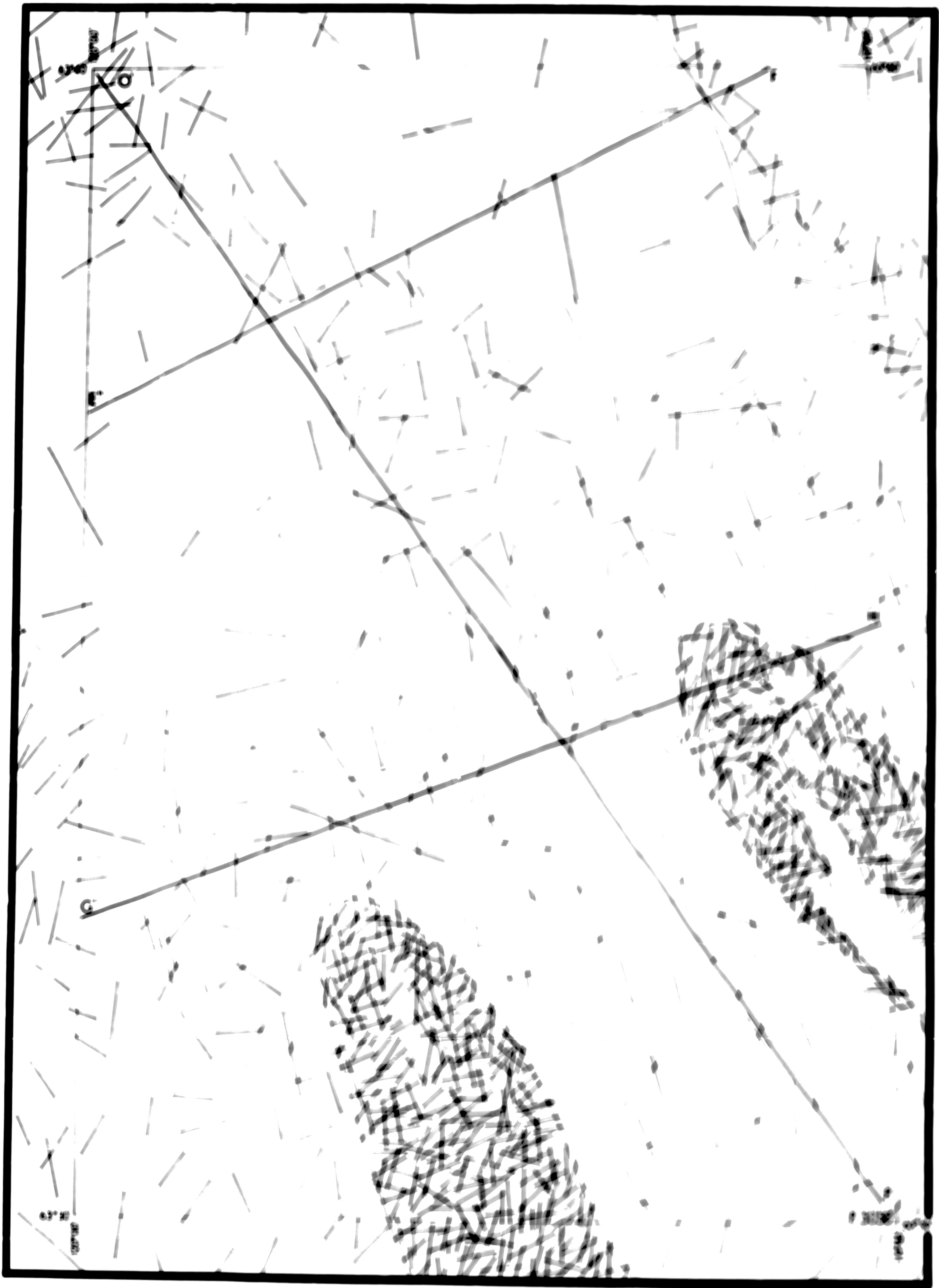


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P. & NG PERMIT 5050

SCALE IN MILES 662-24-4



THIS AERIAL PHOTOGRAPH WAS TAKEN AND CORRECTED TO BE TAKEN AS AN
AERIAL PHOTOGRAPH MAP



CROSMONT OIL & GAS FIELD

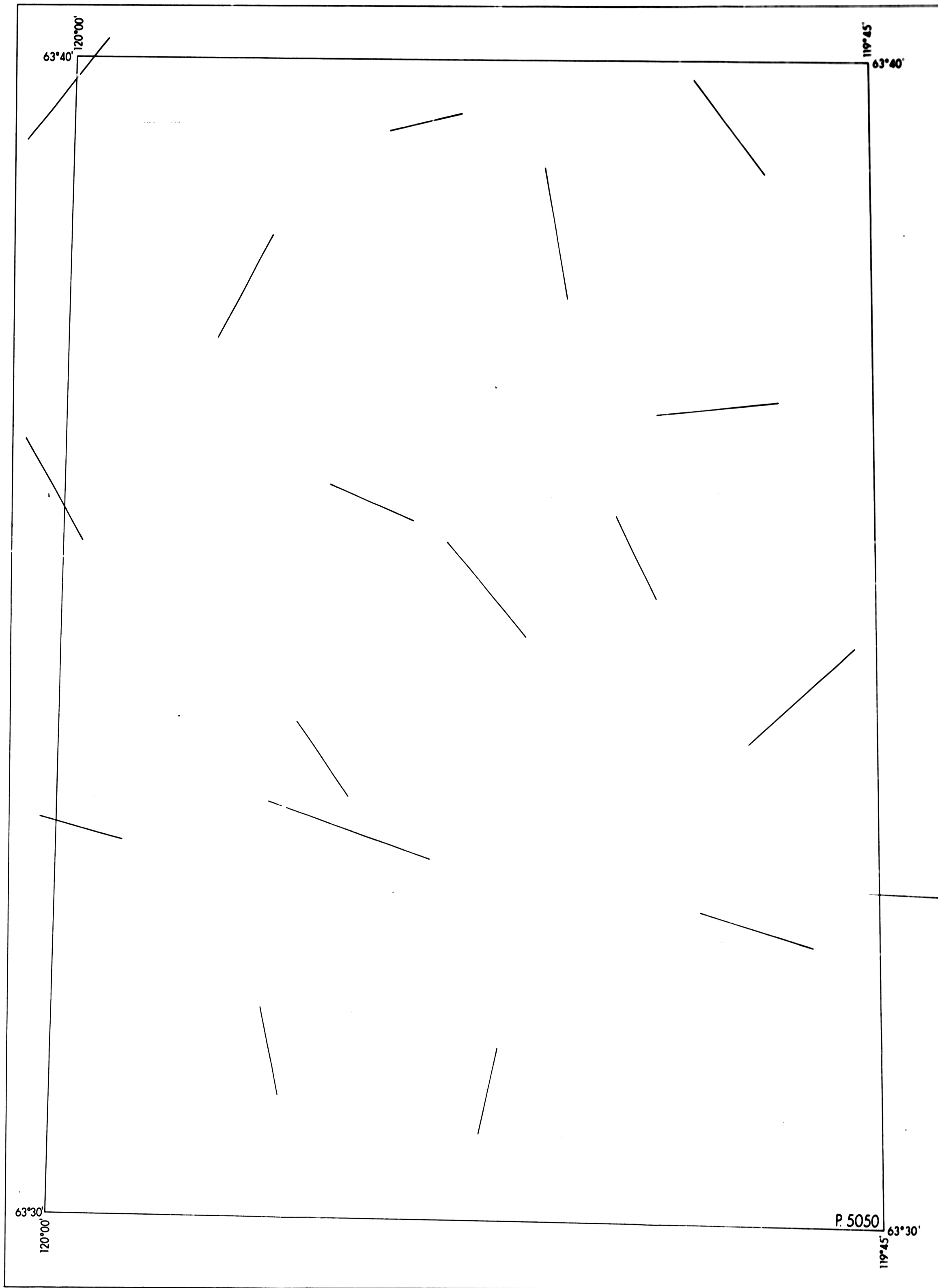
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TOTAL FRACTURE PATTERN

SCALE IN FEET

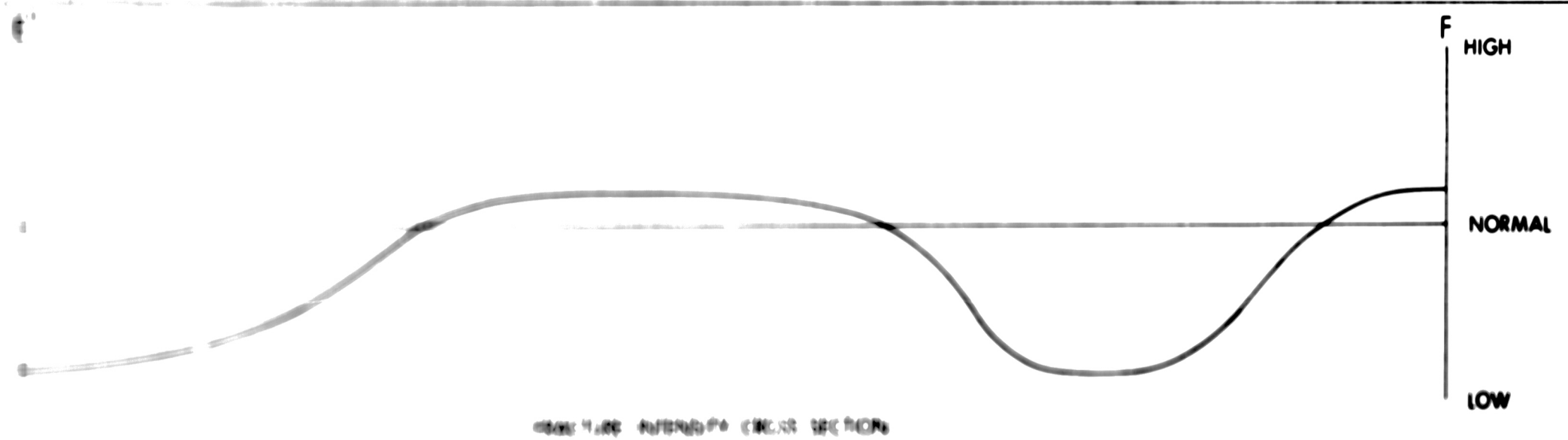
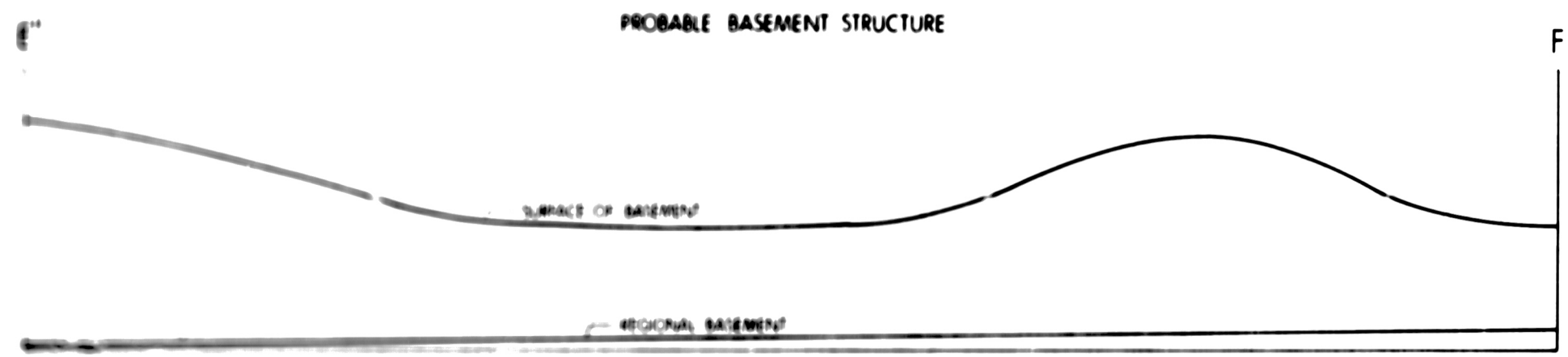


- 1" - 1000'
- 1/2" - 500'
- 1/4" - 250'



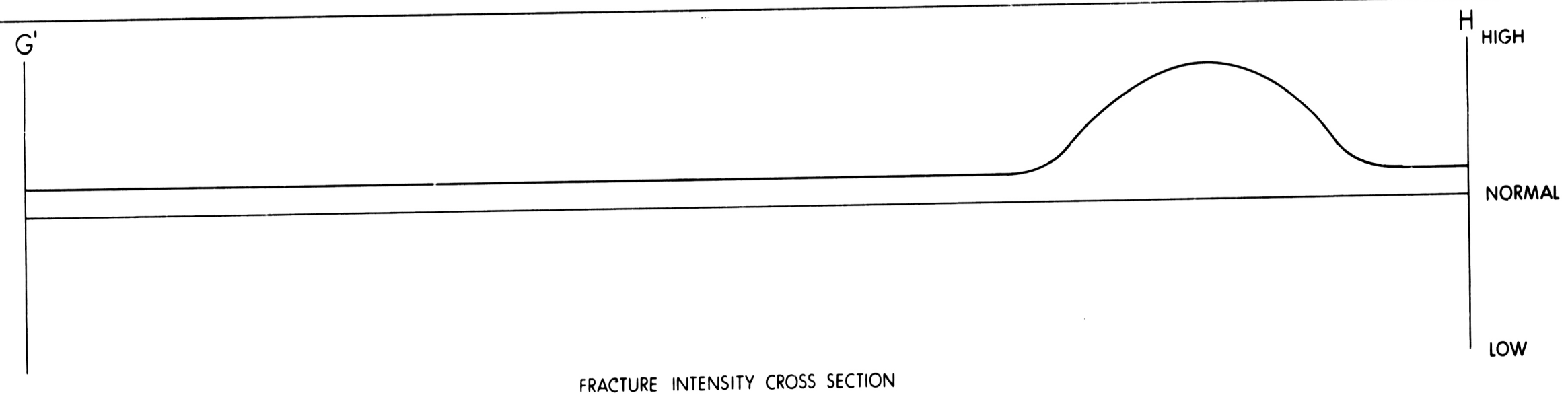
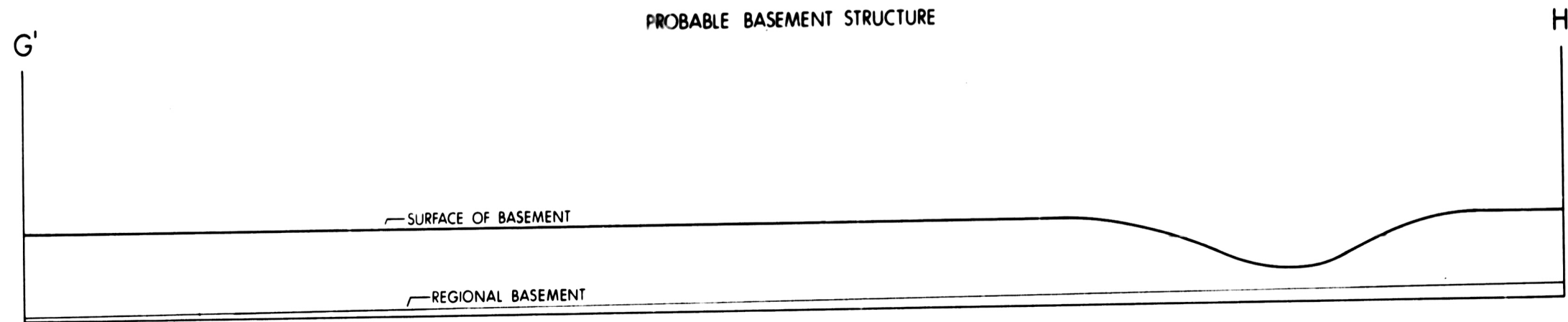
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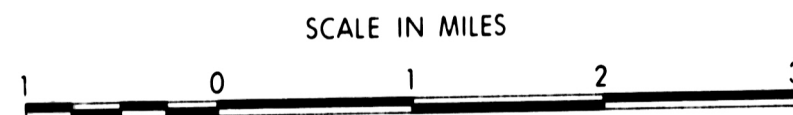


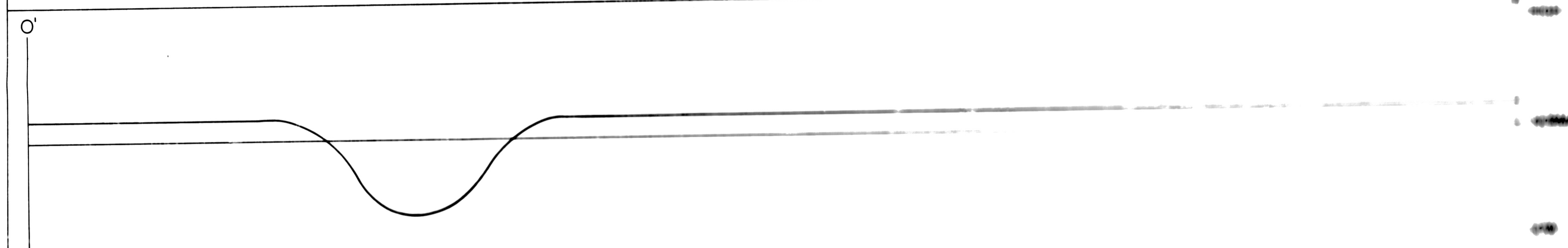
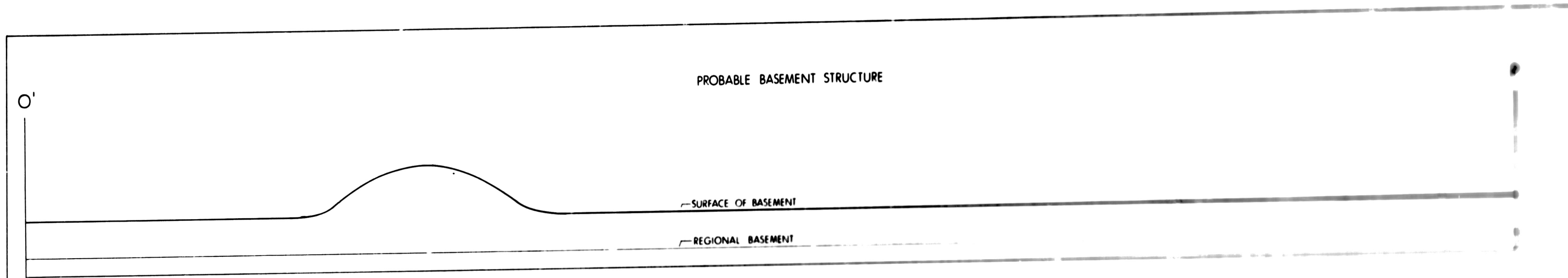
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FRACTURE INTENSITY CROSS SECTION

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SCALE IN METERS



662.2.4.4

**GENERAL GEOLOGY
&
FRACTURE ANALYSIS SURVEY**

of

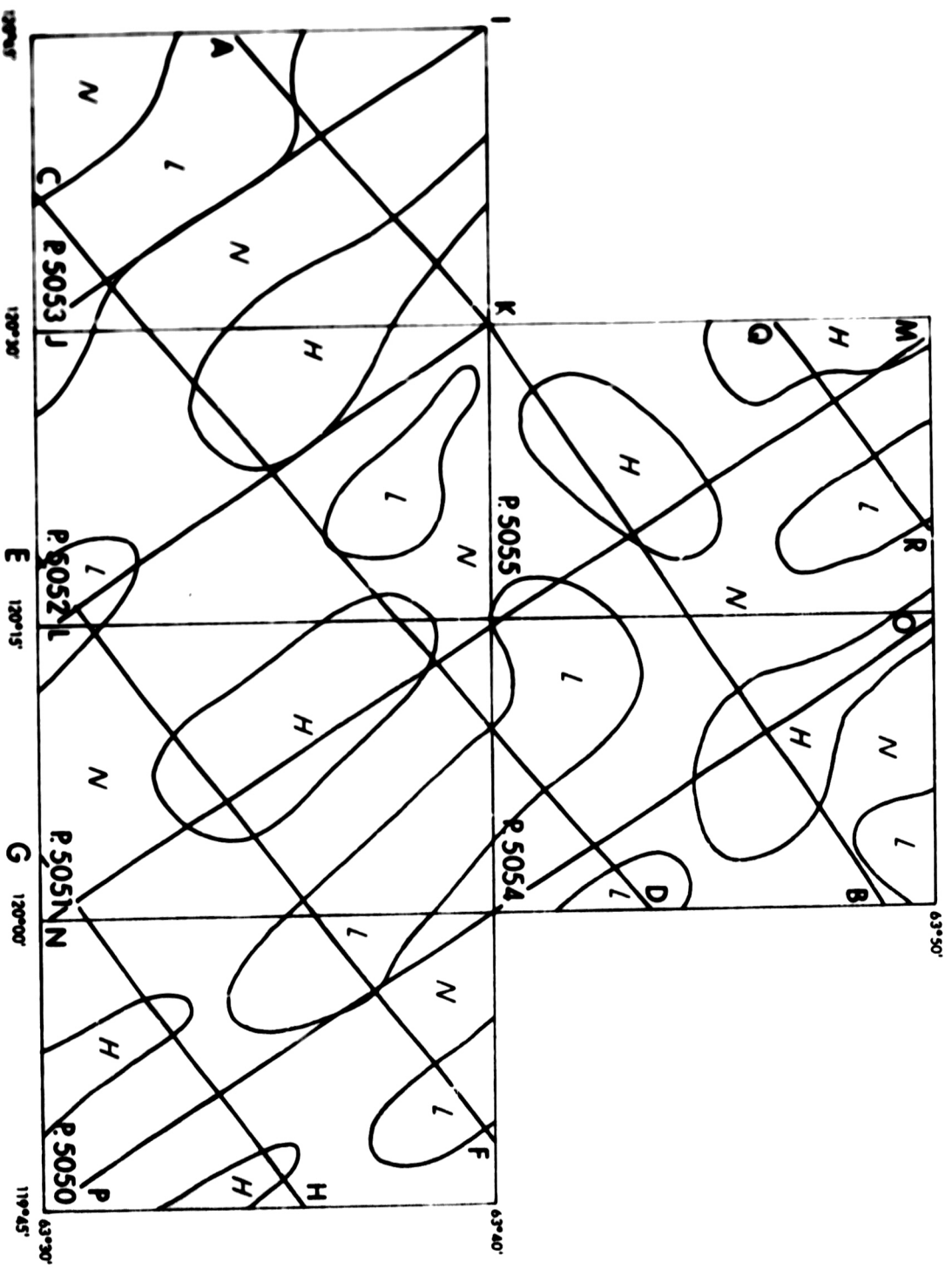
P & N G PERMIT NO 5050

for

GROSMONT OIL & GAS LTD

by

RAYALTA PETROLEUMS LTD.



GROSMONT OIL & GAS LTD.
INDEX MAP

INTRODUCTION

This report discusses the results of a General Geology and Fracture Analysis Survey carried out within, and in the immediate vicinity of, Petroleum and Natural Gas Permit No. 5050. This Permit is located in the Northwest Territories and is held under the Canada Oil and Gas Land Regulations and is located between $119^{\circ} 45'$ to $120^{\circ} 00'$ longitude and $63^{\circ} 30'$ to $63^{\circ} 40'$ latitude. The Permit is 730 miles north of Edmonton and 200 miles north-northwest of Yellowknife.

The Yellowknife Highway is about 170 miles southeast of the Permit and this is the only road which passes through the area. Access to the Permit itself is by helicopter or on foot during the summer or by vehicle during the months when the ground is frozen. However, there are no roads in the area and considerable road con-

struction would be required to reach any particular area.

The surface of the Permit is quite flat-lying and total relief does not exceed 350 feet. There is no developed drainage pattern within this area but there are many irregularly shaped large and small elongated lakes present. Most of these lakes have no drainage streams. A layer of very soft muskeg covers this part of the Northwest Territories, and this muskeg is so soft that it is impassable to all but specialized vehicles.

Vegetation consists of thick stands of thin evergreen trees interspersed with many open areas. These open areas are covered by muskeg grass and scrub deciduous growth. The evergreen trees show up as a medium gray tone on the mosaic and the open areas are a lighter gray

A few small patches of deciduous trees are present.

There is no topographic form or aerial photo feature present which immediately suggests the presence of any geologic structure

The results of this survey are illustrated on the Total Fracture Map, the Mega Fracture Map plus the mosaic with the fractures superimposed. In addition there are four hypothetical cross sections. All the above can be found in the folder at the back of this report.

STRATIGRAPHY

The sedimentary section under Petroleum & Natural Gas Permit No. 1010 is about 2,000 feet thick and the Ordovician, Devonian and Cretaceous systems are represented. An unconformity is present between the Ordovician and Devonian systems. (Between the Chazy formation and the Onondaga formation) and another is present between the Devonian and the Cretaceous. The Ordovician is mostly siliceous with some amount of carbonate while the Devonian section is composed of siliceous and carbonate rocks. The Cretaceous is composed of siliceous

CONCLUSIONS

The Onondaga section is about 100 feet thick and is divided into the Onondaga and the Onondaga. The Onondaga is divided into the Onondaga and the Onondaga. The Onondaga is mostly siliceous with siliceous and carbonate

calgonite being the dominant rock type. A sandstone unit occurs at the base of the section.

OLD FORT ISLAND FORMATION

The Old Fort Island formation is the oldest Pleistocene rock unit present in the area north and northwest of Great Slave Lake. The unit is probably a 'Gravel Wash' type of deposit and where exposed in outcrop consists essentially of sandstone. Rappin (1962) describes the unit as 'consisting of up to 100 ft thick, fine to coarse grained, vertically bedded but mostly white, friable, quartzose sandstone some thin beds of greenish grey and dusky red siltstone and occasional laminae and partings of green shale'. The sandstones are usually well sorted and often friable. Rappin's description of this unit correlates very well with the present author's description of the Gravel Wash formation as present in the North End of the Fort Resolution area. It is the base of the Fort Resolution formation.

As the Old Fort Island Formation has yielded no fossils as yet its exact age is unknown and a similar age problem exists with the Granite Wash in northern Alberta. However, both formations appear to be conformable with the overlying beds and both are often confined to topographic low areas on the Pre-Cambrian Shield. The age of the Old Fort Island formation is, therefore, probably Middle Ordovician, but older than the La Matre Falls formation. The sandstone beds of this unit are an excellent potential reservoir.

LA MATRE FALLS FORMATION

The LaMatre Falls formation is 300 to 350 feet thick in the region under discussion, and consists of red and green shale, fine to coarse grained sandstone and silty to sandy dolomite. The base of the La Matre Falls is often an argillaceous silty, oolitic limestone with some sandy and conglomeratic dolomite and sandstone. Gypsum and salt are also often present.

The shales are platy, fissile and are varicolored with red and green being the most common color, but pinks, brown and gray also being present, silty to sandy and at times slightly dolomitic. The sandstone beds are medium to light gray, and fine to coarse grained. Where the sandstone lies directly on the Pre-Cambrian Shield it is often arkosic and in this area it is a "Granite Wash". Grapholite remains, date this formation as Middle Ordovician. The sandstone and dolomite members of this formation are good potential reservoir horizons.

CHEDABUCTO LAKE FORMATION

The Chedabucto Lake formation is about 200 to 250 feet thick in the vicinity of the Permit and the unit consists of massive, cliff-forming dolomites some of which are sandy and conglomeratic. Norris (1962) describes the formation "consists of a thick bedded to massive,

highly resistant, scarp-forming, fine grained , granular, in places minutely vuggy, medium brown dolomite, commonly weathering a pale orange or orange-brown in the south, and a yellowish brown and gray in the north". Purple mottling is common and chert is often present. The age of the Chedabucto Lake formation is Upper Ordovician. The reservoir possibilities of this unit in the subsurface do not appear to be great as only minor vugs are reported from the surface exposures. This formation is overlain unconformably by the Middle Devonian System and the Chinchaga formation of the Middle Devonian is the overlying unit.

DEVONIAN

The Devonian section is about 1,075 feet thick and consists of the Chinchaga formation plus units which are equivalent to the Keg River and Muskeg formations. The exact sequence

present is unknown due to a lack of wells in the area plus the lack of surface knowledge in this northern area. In addition, the Middle Devonian succession in this area is very complex and many abrupt lithologic changes are present. The Chinchaga formation is recognized as a mappable unit but the units above the Chinchaga cannot be correlated to the northern Alberta type section area.

CHINCHAGA FORMATION

The Chinchaga is about 325 feet thick and in this area the unit consists of evaporites, some minor dolomite plus some dolomite and limestone breccia. The Chinchaga unconformably overlies the Chedabucto Lake formation and is conformably overlain by younger Middle Devonian beds. Norris (1965) states " The Chinchaga formation is mostly gypsumeasily eroded and does not produce

Norris (1963) describes the lower part of the Lonely Bay formation as "massive dark brown aphanitic in part styloitic limestone; thinly bedded light gray fine grained to aphanitic limestone, weathering orange-brown; irregularly thin-bedded light olive gray to medium gray, fine grained limestone; medium -bedded aphanitic slightly dolomitic limestone; and thinly bedded pale brown slightly argillaceous limestone. A younger section is described as consisting of ... "massive, dark to medium brown, fine grained to fetid limestone, overlain by irregularly thin-bedded medium brown, fine grained to aphanitic limestone interbedded with nodular limestone".

MUSKEG FORMATION EQUIVALENT

In the area north of Great Slave Lake there are units present which correlate to the muskeg of northwestern Alberta. It is up to 500 feet thick in this area and is comprised of a

lower 100 feet of bituminous shale; a middle 175 feet of green calcareous shale; and an upper member up to 225 feet thick which consists of gray to white reefal dolomite. This upper member correlates to the Presqu'ile reef of the Pine Point area.

Fracture intensity contrasts could reflect the edge of the Presqu'ile reef or where there is rapid change in lithology within the section.

CRETACEOUS

The Cretaceous sediments are about 400 to 800 feet thick depending on surface elevation. The thicker sections are present under the hills.

Lithologically the section consists of dark gray, concretionary, gypsiferous shales. These shales are Lower Cretaceous in age and are probably equivalent to the Peace River and Spirit River formations of northern Alberta.

TERTIARY

A thin layer of glacial clay, sand boulders and till lies on the surface of the map area. The thickness of these deposits varies from place to place but probably does not exceed 100 feet.

FRACTURE ANALYSIS

This section of the report discusses the results of a Detailed Factorial Analysis of the data from the first three phases of the study. The results are presented in three main sections: (1) the results of the analysis of variance, (2) the results of the analysis of covariance, and (3) the results of the analysis of the interaction between the two phases of the study.

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“五·三〇”事件 是“左”还是“右”

“五·三〇”事件 是“左”还是“右”

“五·三〇”事件，是“左”还是“右”，这是一个值得研究的问题。在“五·三〇”事件发生之前，我们曾看到过许多关于“五·三〇”事件的报道，有的说“五·三〇”事件是“左”的，有的说“五·三〇”事件是“右”的。但是，在“五·三〇”事件发生之后，我们却看到了一些新的情况，这些情况使我们感到，在“五·三〇”事件中，既有“左”的成分，也有“右”的成分。因此，我们不能简单地认为“五·三〇”事件是“左”的，也不能简单地认为“五·三〇”事件是“右”的。我们必须从实际出发，对“五·三〇”事件进行全面的、客观的分析，才能得出正确的结论。

首先，我们要看到“五·三〇”事件中的“左”的成分。在“五·三〇”事件中，有一些人主张“左”倾冒险主义，他们不顾客观条件，盲目地发动群众运动，给国家和人民造成了严重的损失。这些人的行为，是“左”的，是错误的。但是，我们也要看到“五·三〇”事件中的“右”的成分。在“五·三〇”事件中，也有一些人主张“右”倾机会主义，他们害怕群众运动，害怕社会变革，他们站在保守派的立场上，反对任何改革。这些人的行为，也是“右”的，是错误的。

其次，我们要看到“五·三〇”事件中的“左”和“右”的相互转化。在“五·三〇”事件中，一些“左”倾冒险主义者，在运动过程中，由于缺乏经验，往往容易走向极端，变成“右”倾机会主义者。同样，一些“右”倾机会主义者，在运动过程中，由于害怕群众运动，往往容易变成“左”倾冒险主义者。这种相互转化的现象，在“五·三〇”事件中是普遍存在的。

最后，我们要看到“五·三〇”事件中的“左”和“右”的相互斗争。在“五·三〇”事件中，“左”倾冒险主义者和“右”倾机会主义者之间，存在着激烈的斗争。这种斗争，是“五·三〇”事件中的一个重要特点。但是，我们也要看到，这种斗争并不是不可调和的。在一定的条件下，“左”和“右”是可以相互转化的。因此，我们不能简单地认为“左”和“右”是不可调和的，我们必须从实际出发，对“五·三〇”事件中的“左”和“右”进行具体的、历史的分析。

In general the initiating forces which generate fractures must have continued for a very long time and the process involved are continuous and are probably active at the present time. Furthermore, Mollard (1957) states, 'The mechanism required to reflect lineaments on ground surface must be reasonably simple, for simple patterns are produced on diverse topography and on diverse types and depths of surficial deposits for diverse different kinds of relatively flat-lying sedimentary rocks of varying thickness. The mechanism producing the lineament pattern must persist over extensive and widespread belts of the earth's outer shell, that is, the generating mechanism in fact be world-wide.'

Continued research such as earth tide obviously fit these conditions. Some internal forces may also easily occur in the form of deep seated horizontal forces, and the magnitude of these is certainly sufficient

have become consolidated enough to fracture. This upward propagation is caused by the fatigue caused by stress, which in turn is caused by diurnal earth tides.

EXPRESSION OF FRACTURE

Fractures have been observed in aerial photographs from every climate and on every continent in the world. They are expressed as topographic relief, vegetation differences and soil tonal differences.

TOPOGRAPHIC RELIEF LINEAMENTS

As a generalization, fractures are expressed as topographic relief lineaments. These lineaments may be expressed as a series of small, closely spaced, parallel ridges and valleys, or as a single, broad, shallow depression. The relief is usually small, but it is often enough to be visible in aerial photographs. The lineaments are usually oriented in a direction perpendicular to the direction of the principal stress. The lineaments are usually oriented in a direction perpendicular to the direction of the principal stress. The lineaments are usually oriented in a direction perpendicular to the direction of the principal stress.

VEGETAL LINEAMENTS

Vegetal lineaments are the most common in the parkland and muskeg areas of western Canada and many excellent examples of fractures can be seen on almost any aerial photograph of northern Saskatchewan, Alberta or British Columbia. Straight lines of both deciduous and evergreen trees as well as scrub growth are universally visible. However, the most common vegetal lineament seen by this writer is a straight "edge" to a clump of trees or bushes. In many cases these fractures control the size and shape of cultivated fields. Excellent examples of this latter expression of fractures are present in the western part of the Peace River district.

SOIL TONAL LINEAMENTS

These reflect differentiation in soil moisture and general ground water conditions. These are common

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stratigraphic anomalies. The actual count of fractures per unit area is made and values are contoured on a "Fracture Intensity Map". In areas of known reefs the fracture intensity is 2-3 times greater on the flanks of the reef than directly above the reef.

In any fracture pattern there are two main systems of fractures: the axial system and the shear system. In both systems the fractures are sub-parallel and in general the two systems are at approximate right angles to each other.

Because of certain inherent limiting factors, Structure Incidence Surveys have a lower order of reliability than Detailed Fracture Analysis Surveys. To some extent at least, surface conditions affect the fracture count. In areas covered by lakes, sloughs and rivers, the fracture count is zero. Cultivated areas generally yield a lower count than adjacent virgin territory. Consequently, a difference or contrast

in fracture count (F/I) between two points may be in part due to structure, but, also due in part to different surface conditions. To some extent, this can be compensated for by applying appropriate weightings to the observed counts, but over or under corrections may result.

Nevertheless, in spite of these sources of error, it has been demonstrated in (plains) areas where abundant subsurface control is available, that the incidence of fracturing is considerably above normal in the surrounding area immediately out from the steepest part of the flanks of the structure. This is in contrast with a low or normal incidence over the crestal area, and also to a normal incidence off structure.

FRAC TURE ANAL YSIS
OF
PERMIT NO. 1000

The fracture pattern as shown on the enclosed mosaic and maps shows a great variation in intensity over various areas of the Permit. The Permit is located in the muskeg area east of Keller Lake, Northwest Territories and is many miles from the closest settlement.

The sedimentary section is probably about 2,400 feet (plus) thick and several systems are represented. In addition a thin layer of Tertiary glacial till covers nearly all of the area. Potential reservoir horizons are present within both the Ordovician and Devonian sections.

Fractures as plotted on the mosaic show considerable variation in intensity. There are two areas where the fracture intensity is greater than

~~SECRET~~

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. 101. 102. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121. 122. 123. 124. 125. 126. 127. 128. 129. 130. 131. 132. 133. 134. 135. 136. 137. 138. 139. 140. 141. 142. 143. 144. 145. 146. 147. 148. 149. 150. 151. 152. 153. 154. 155. 156. 157. 158. 159. 160. 161. 162. 163. 164. 165. 166. 167. 168. 169. 170. 171. 172. 173. 174. 175. 176. 177. 178. 179. 180. 181. 182. 183. 184. 185. 186. 187. 188. 189. 190. 191. 192. 193. 194. 195. 196. 197. 198. 199. 200. 201. 202. 203. 204. 205. 206. 207. 208. 209. 210. 211. 212. 213. 214. 215. 216. 217. 218. 219. 220. 221. 222. 223. 224. 225. 226. 227. 228. 229. 230. 231. 232. 233. 234. 235. 236. 237. 238. 239. 240. 241. 242. 243. 244. 245. 246. 247. 248. 249. 250. 251. 252. 253. 254. 255. 256. 257. 258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285. 286. 287. 288. 289. 290. 291. 292. 293. 294. 295. 296. 297. 298. 299. 300. 301. 302. 303. 304. 305. 306. 307. 308. 309. 310. 311. 312. 313. 314. 315. 316. 317. 318. 319. 320. 321. 322. 323. 324. 325. 326. 327. 328. 329. 330. 331. 332. 333. 334. 335. 336. 337. 338. 339. 340. 341. 342. 343. 344. 345. 346. 347. 348. 349. 350. 351. 352. 353. 354. 355. 356. 357. 358. 359. 360. 361. 362. 363. 364. 365. 366. 367. 368. 369. 370. 371. 372. 373. 374. 375. 376. 377. 378. 379. 380. 381. 382. 383. 384. 385. 386. 387. 388. 389. 390. 391. 392. 393. 394. 395. 396. 397. 398. 399. 400. 401. 402. 403. 404. 405. 406. 407. 408. 409. 410. 411. 412. 413. 414. 415. 416. 417. 418. 419. 420. 421. 422. 423. 424. 425. 426. 427. 428. 429. 430. 431. 432. 433. 434. 435. 436. 437. 438. 439. 440. 441. 442. 443. 444. 445. 446. 447. 448. 449. 450. 451. 452. 453. 454. 455. 456. 457. 458. 459. 460. 461. 462. 463. 464. 465. 466. 467. 468. 469. 470. 471. 472. 473. 474. 475. 476. 477. 478. 479. 480. 481. 482. 483. 484. 485. 486. 487. 488. 489. 490. 491. 492. 493. 494. 495. 496. 497. 498. 499. 500. 501. 502. 503. 504. 505. 506. 507. 508. 509. 510. 511. 512. 513. 514. 515. 516. 517. 518. 519. 520. 521. 522. 523. 524. 525. 526. 527. 528. 529. 530. 531. 532. 533. 534. 535. 536. 537. 538. 539. 540. 541. 542. 543. 544. 545. 546. 547. 548. 549. 550. 551. 552. 553. 554. 555. 556. 557. 558. 559. 560. 561. 562. 563. 564. 565. 566. 567. 568. 569. 570. 571. 572. 573. 574. 575. 576. 577. 578. 579. 580. 581. 582. 583. 584. 585. 586. 587. 588. 589. 590. 591. 592. 593. 594. 595. 596. 597. 598. 599. 600. 601. 602. 603. 604. 605. 606. 607. 608. 609. 610. 611. 612. 613. 614. 615. 616. 617. 618. 619. 620. 621. 622. 623. 624. 625. 626. 627. 628. 629. 630. 631. 632. 633. 634. 635. 636. 637. 638. 639. 640. 641. 642. 643. 644. 645. 646. 647. 648. 649. 650. 651. 652. 653. 654. 655. 656. 657. 658. 659. 660. 661. 662. 663. 664. 665. 666. 667. 668. 669. 670. 671. 672. 673. 674. 675. 676. 677. 678. 679. 680. 681. 682. 683. 684. 685. 686. 687. 688. 689. 690. 691. 692. 693. 694. 695. 696. 697. 698. 699. 700. 701. 702. 703. 704. 705. 706. 707. 708. 709. 710. 711. 712. 713. 714. 715. 716. 717. 718. 719. 720. 721. 722. 723. 724. 725. 726. 727. 728. 729. 730. 731. 732. 733. 734. 735. 736. 737. 738. 739. 740. 741. 742. 743. 744. 745. 746. 747. 748. 749. 750. 751. 752. 753. 754. 755. 756. 757. 758. 759. 760. 761. 762. 763. 764. 765. 766. 767. 768. 769. 770. 771. 772. 773. 774. 775. 776. 777. 778. 779. 780. 781. 782. 783. 784. 785. 786. 787. 788. 789. 790. 791. 792. 793. 794. 795. 796. 797. 798. 799. 800. 801. 802. 803. 804. 805. 806. 807. 808. 809. 810. 811. 812. 813. 814. 815. 816. 817. 818. 819. 820. 821. 822. 823. 824. 825. 826. 827. 828. 829. 830. 831. 832. 833. 834. 835. 836. 837. 838. 839. 840.

Figure 1

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Chemical structures of various substituted benzene derivatives, including nitrobenzene, aniline, and various substituted benzenes.

1. **Identify the subject and predicate.**
 2. **Identify the object and complement.**
 3. **Identify the modifier.**
 4. **Identify the adverb.**
 5. **Identify the adjective.**
 6. **Identify the preposition.**
 7. **Identify the conjunction.**
 8. **Identify the interjection.**
 9. **Identify the pronoun.**
 10. **Identify the verb.**
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(a)  (b)  (c)  (d)  (e) 

ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED

1. 1954 年 10 月 1 日 起 至 1955 年 9 月 30 日 止

2. 1955 年 10 月 1 日 起 至 1956 年 9 月 30 日 止

3. 1956 年 10 月 1 日 起 至 1957 年 9 月 30 日 止

4. 1957 年 10 月 1 日 起 至 1958 年 9 月 30 日 止

5. 1958 年 10 月 1 日 起 至 1959 年 9 月 30 日 止

6. 1959 年 10 月 1 日 起 至 1960 年 9 月 30 日 止

7. 1960 年 10 月 1 日 起 至 1961 年 9 月 30 日 止

8. 1961 年 10 月 1 日 起 至 1962 年 9 月 30 日 止

9. 1962 年 10 月 1 日 起 至 1963 年 9 月 30 日 止

10. 1963 年 10 月 1 日 起 至 1964 年 9 月 30 日 止

11. 1964 年 10 月 1 日 起 至 1965 年 9 月 30 日 止

12. 1965 年 10 月 1 日 起 至 1966 年 9 月 30 日 止

13. 1966 年 10 月 1 日 起 至 1967 年 9 月 30 日 止

14. 1967 年 10 月 1 日 起 至 1968 年 9 月 30 日 止

15. 1968 年 10 月 1 日 起 至 1969 年 9 月 30 日 止

16. 1969 年 10 月 1 日 起 至 1970 年 9 月 30 日 止

17. 1970 年 10 月 1 日 起 至 1971 年 9 月 30 日 止

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is probably present

1. **TOPOGRAPHIC RELIEF ON AN
INTRA SEDIMENTARY
UNCONFORMITY**

Unconformity is a possible source
of fracture intensity anomalies, but
within the Permian area it is unlikely
that the relief on any unconformities
within the sedimentary section is great
enough to affect the fracture pattern.

Reference to the Total Fracture
Pattern Map which accompanies this
report will show that there are two
areas of "high" fracture intensity, and
two areas of "low" fracture intensity
(green). The general interpretation
is that the low fracture intensity areas
are underlain by topographic highs on
the Basement. With this established,

the deduction is that the Basement is high in the northeast and north-central areas of Permit No. 5050.

These Basement high features are most interesting from the oil and gas point of view. The general shape of both features is such that the causative features must be a hill on the Basement surface. A fault is unlikely as the causative features as the high areas are over one and one-half miles in width. If a fault caused the fracture "low" the width of the low would be about one mile or less. Granite Wash sand is probably present around the flanks of these Basement highs but is probably absent on the top.

Four hypothetical structure cross-sections accompany this report and reference to them will show Basement "highs" are inferred to be present beneath areas of low fracture intensity. Three

[illegible]

Figure 1. The effect of the concentration of the inhibitor on the rate of polymerization of α -methylstyrene in the presence of SnCl_4 at 0°C .

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