U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

Plays for assessment in Region II, Pacific Coast as of October 4, 1993 1995 National Assessment of Oil and Gas

compiled by

D.L. Gautier[1] and K.L. Varnes [1]

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This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature.

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The U.S. Geological Survey periodically makes appraisals of the undiscovered oil and gas resources of the Nation. For the 1995 National Assessment the onshore areas and adjoining State waters of the Nation have been divided into eight Regions which are subdivided into 72 provinces. Regions II through VIII comprise the Lower 48 States; Alaska comprises Region I. A map at scale 1:5,000,000 showing the boundaries of Regions II through VIII for this assessment has been released in open file (Dolton, G.L., Varnes, K.L., Gautier, D.L., and Baird, J.K. compilers, 1992, Oil and gas assessment areas, 1992, Lower 48 States: U.S. Geological Survey Open-File Report 92-696, scale 1:5,000,000).

The provinces and assigned Province Geologists for Region II are listed in Table 1. The basic assessment unit is the play. Table 2 lists the plays considered at this time (October 1993) in Region II, Pacific Coast. Descriptions of the plays follow; in virtually all cases these descriptions are written by the indicated Province Geologist (Table 1).

Because this National assessment is currently in progress, these listings and descriptions are preliminary. The plays and/or their names may change as work progresses, some plays may be added and other plays may be dropped. The descriptions may also change. The plays, play names, and descriptions may or may not duplicate plays appraised in previous National assessments.

Page

Table 1. List of Provinces and Province Geologists, in Region II, Pacific Coast

Prov.	Province Name	Province Geologist	Telephone No.
4	Western Oregon - Washington	Johnson, S.Y.	(303) 236-1545
5	Eastern Oregon - Washington	Tennyson, M.E.	(303) 236-5785
6	Klamath - Sierra Nevada	Tennyson, M.E.	(303) 236-5785
7	Northern Coastal	Stanley, R.G.	(415) 354-3013
8	Sonoma - Livermore Basin	(To be announced)	
9	Sacramento Basin	Magoon, L.B.	(415) 354-3010
10	San Joaquin Basin	Beyer, L.A.	(415) 354-3018
11	Central Coastal	Stanley, R.G.	(415) 354-3013
12	Santa Maria Basin	Tennyson, M.E.	(303) 236-5785
13	Ventura Basin	Keller, M.A.	(415) 354-3016
14	Los Angeles Basin	Beyer, L.A.	(415) 354-3018
15	San Diego - Oceanside	(To be announced)	
16	Salton Trough	Barker, C.E.	(303) 236-5797

Table 2. List of plays for consideration, Region II, Pacific Coast

Prov.	Play No.	Play Name
4	402	Bellingham Basin/Puget Lowland Gas Play
4	403	Puget Lowland/S. Washington Cascades Conductor Deep-Sourced Gas
4	404	Tofino - Fuca Basin
4	405	Western Coastal/Offshore Washington Hoh-Ozette
4	406	Western Grays Harbor Basin Neogene
4	407	Cowlitz-Macintosh-Spencer
4	408	Astoria
4	409	Coaledo
4	410	Southern Tyee Basin
4	411	Yaquina Delta
5	501	Northwestern Columbia Plateau
5	502	Central and Northeastern Oregon Paleogene
6	600	unassigned
7	701	Eel River Gas
7	702	Fractured Franciscan Oil
7	703	Sargent/Hollister Oil and Gas
8	801	Livermore Oil
9	901	Northern Forbes-Kione
9	902	Southern Forbes-Kione
9	903	Western Winters through Domingene
9	904	Eastern Winters through Domingene
10	1001	Pliocene Non-associated Gas
10	1002	Southeast Stable Shelf
10	1003	Lower Bakersfield Arch
10	1004	Southwest Post-Miocene Major Fold Belt
10	1005	Central East Flank and Stable Shelf
10	1006	Pre-Pliocene Structured Southwest Margin
10	1007	Northern Area Non-associated Gas
10	1008	Southern Thrust Salient
11	1101	Point Arena Oil
11	1102	Point Reyes Oil
11	1103	Pescadero Oil
11	1104	La Honda Oil
11	1105	Bitterwater Oil
11	1106	Salinas Oil
11	1107	Faulted Western Cuyama Basin Margin
11	1108	Subthrust
11	1109	Cox Graben
12	1201	Anticlinal Trends
12	1202	Basin Margin
12	1203	Sub-thrust
12	1204	Diagenetic
13	1301	Paleogene
13	1302	Folded and Faulted Neogene
13	1303	Pliocene Stratigraphic
14	1401	Santa Monica-Malibu Coast Fault System
14	1402	Southwest Shelf and Adjacent Offshore State Lands
14	1403	Newport-Inglewood Fault Zone
14	1404	Northern Shelf
14	1405	Whittier Fault Zone Southward to Axis of Central Syncline
14	1406	Puente Hills, San Jose Hills, and Chino Marginal Basin
14	1407	San Gabriel Valley Marginal Basin
14	1408	Capistrano Syncline
15	1500	unassigned
16	1600	unassigned

Descriptions of Plays to be Considered
Region II, Pacific Coast

Province 4. Western Oregon - Washington

Play 402 Bellingham Basin/Puget Lowland Gas
Gas accumulations in Eocene fluvial and distributary channel ss of Huntingdon Fm, Chuckanut Fm, Puget Group, Tiger Mt Fm, Carbonado Fm., generated from Eocene carbonaceous shale and coal of Chuckanut, Huntingdon, Tiger Mt, and Carbonado Fm and Puget Group, trapped in structural and stratigraphic traps. Hypothetical.

Play 403 Puget Lowland/ S .Washington Cascades Conductor Deep-Sourced Gas
Gas accumulations in Eocene fluvial and marine sandstone of Puget Group and equivalents, generated from Eocene marine rocks (Raging River Formation and correlative rocks in Seattle basin and "Southern Washington Cascades Conductor"); structural and stratigraphic traps. Hypothetical.

Play 404 Tofino-Fuca Basin
Gas accumulations in Eocene submarine fan sandstone generated from Eocene mudstone in lower or upper plate of Crescent thrust, trapped in folds on flank of north-dipping homoclinal sequence or in stratigraphic traps. Hypothetical.

Play 405 Western Coastal/Offshore Washington Hoh-Ozette
Gas and/or oil accumulations in coherent sandstone blocks in Ozette and Hoh melange and broken formation, generated from mudstone in Ozette and Hoh melange and broken formation. Trapped in fault blocks and folds in melange; possibly unconformity at base of upper Miocene. Hypothetical.

Play 406 Western Grays Harbor Basin Neogene
Gas, possibly minor oil accumulations in sandstones or Miocene Montesano Formation, in structural or stratigraphic traps. Hypothetical.

Play 407 Cowlitz-Macintosh-Spencer
Gas accumulations in Eocene Cowlitz, Spencer or Macintosh Formation, generated from Eocene marine mudstone (or coal?), and

trapped in middle Miocene and younger faults and/or anticlines or in Eocene stratigraphic traps. Confirmed.

Play 408 Astoria
Gas and possible minor oil accumulations in Astoria Formation sandstone, generated from Oligocene to Miocene mudstone and/or from the Hoh-Ozette melange, fault or stratigraphic (fan or delta channels) traps. Hypothetical.

Play 409 Coaledo
Gas accumulations in sandstones of Eocene Coaledo Formation, generated from coal or organic-rich mudstone in Coaledo and underlying rocks, trapped in anticlines, fault traps or stratigraphic traps. Hypothetical.

Play 410 Southern Tyee Basin
Gas accumulations in sandstone of Olalla Creek Member of Lookingglass Formation, coal-bearing sandstone of White Tail Ridge Member of Flournoy Formation, Bushnell Rock coal-bearing sandstone facies of Lookingglass Formation, or arkosic sandstone facies of Tyee and Roseburg Formations; generated from mudstone or coal in Tyee Formation, carbonaceous shale in Umpqua, or mudstone in Cretaceous rocks, trapped in Paleogene folds or reverse faults and/or stratigraphic traps. Hypothetical.

Play 411 Yaquina Delta
Gas accumulations in Oligocene deltaic Yaquina Formation generated from Eocene Nestucca Formation, Miocene Nye Formation, or Tyee Formation, trapped in Neogene normal faults or in stratigraphic traps. Hypothetical.

Province 5. Eastern Oregon - Washington

Play 501 Northwestern Columbia Plateau
Gas accumulations in Eocene and/or Oligocene fluvial sandstones below Columbia River Basalt Group, generated from Eocene lacustrine/fluvial shales and coal beds, trapped in middle Miocene and younger folds and/or reverse faults or in stratigraphic traps. Hypothetical.

Play 502 Central and Northeastern Oregon Paleogene
Gas, possibly minor oil or condensate accumulations in Paleogene "Herren Fm" fluvial sandstone, Eocene Clarno Fm sandstones and volcaniclastic rocks, possibly Cretaceous rocks, generated from Cretaceous marine rocks, coal or mudstone in Herren Fm, or

mudstone in Clarno Formation; trapped in Miocene and younger folds or stratigraphic traps in Paleogene fluvial rocks. Hypothetical.

Province 6. Klamath - Sierra Nevada

No plays to be considered at this time.

Province 7. Northern Coastal

Play 700 Unassigned

Play 701 Eel River Gas

Comprises anticlinal and stratigraphic accumulations of non-associated gas in Cenozoic (mainly Pliocene) marine sandstones and fractured Miocene shales in the Eel River (Humboldt) basin, Humboldt County. (confirmed)

Play 702 Franciscan Oil

Includes accumulations of oil and gas in poorly-understood fractured sandstone and shale reservoirs. Comprises parts of the coastal and central belts of the Franciscan assemblage, Humboldt and Mendocino Counties. (confirmed)

Play 703 Sargent/Hollister Oil and Gas

Includes anticlinal, stratigraphic, and tar-sealed accumulations of oil and gas in Miocene and Pliocene sandstones, as well as oil in fractured Franciscan rocks, in the southern Santa Clara Valley area, Santa Clara and San Benito Counties. (confirmed)

Province 8. Sonoma - Livermore Basin

Play 801 Livermore Oil Play

Upper Miocene to Pleistocene siliciclastic reservoirs in anticlinal and possible fault-block traps in the Livermore basin.

Province 9. Sacramento Basin

Play 901 Northern Forbes-Kione

Includes Cretaceous and early Tertiary sandstone reservoirs in combination, stratigraphic and faulted anticline traps in the northern Sacramento basin.

Play 902 Southern Forbes-Kione

Includes Cretaceous and early Tertiary sandstone reservoirs in combination, stratigraphic and faulted anticline traps in the southern Sacramento basin, and underlies plays 903 and 904.

Play 903 Western Winters through Domingene
Includes Late Cretaceous to Eocene sandstone reservoirs in the area west of the Midland fault in the southern Sacramento basin overlying play 902.

Play 904 Eastern Winters through Domingene
Includes Late Cretaceous to Eocene sandstone reservoirs east of the Midland fault overlying play 902 in the southern Sacramento basin.

Province 10. San Joaquin Basin

Play 1001 Pliocene Non-associated Gas
Biogenic gas in Pliocene sandstones primarily on elongate domes and secondarily as stratigraphic or fault traps associated with these structures in south central San Joaquin basin.

Play 1002 Southeast Stable Shelf
Occurs along structurally and depositionally distinct southeast margin of the San Joaquin basin and consists of oil/gas, sourced from primarily Late Miocene shales and secondarily from older shales, in Upper Eocene through Recent sandstones and basement rocks in structural, stratigraphic, and other traps.

Play 1003 Lower Bakersfield Arch
Occurs in southern San Joaquin basin west of play 1002 and consists of oil/gas, sourced primarily from Late Miocene shales, in Upper Miocene "Stevens" and older sandstones in structural and combination traps.

Play 1004 Southwest Post-Miocene Major Fold Belt
Occurs in western San Joaquin basin area from Coalinga region southward to White Wolf fault and its westward extension. Consists of oil/gas, sourced from Eocene, Middle and Late Miocene shales, in Eocene through Pleistocene sandstones and Eocene and Late Miocene fractured shales and diatomaceous rocks in structural, combination, permeability, hydrodynamic, and possible sub-detachment traps.

Play 1005 Central East Flank and Stable Shelf
Occurs in central and eastern part of mid-San Joaquin basin and consists of oil/gas, sourced from Eocene through Late Miocene shale, in Eocene through Miocene sandstones in structural and combination traps.

Play 1006 Pre-Pliocene Structured Southwest Margin
Occurs along south half of western margin of San Joaquin basin and consists of oil/gas, sourced primarily from Eocene through Middle Miocene shales, in Late Cretaceous through Middle Miocene

sandstones in structural, combination, and possible sub-detachment traps.

Play 1007 Northern Area Non-Associated Gas
Occurs in northern San Joaquin basin area and consists of dry gas, sourced from Cretaceous shale, in Late Cretaceous through Miocene sandstones in structural, combination, and stratigraphic traps.

Play 1008 Southern Thrust Salient
Occurs along western part of south San Joaquin basin margin and consists of oil/gas, sourced from Eocene to Late Miocene shales, in Eocene through Late Miocene sandstones in primarily structural traps including possible sub-detachment traps.

Province 11. Central Coastal

Play 1101 Point Arena Oil
Includes mainly anticlinal accumulations of oil and gas in Miocene sandstones and fractured shales in an area west of the San Andreas fault near Point Arena, Mendocino County. (hypothetical)

Play 1102 Point Reyes Oil
Includes anticlinal and stratigraphic accumulations of oil and gas in Tertiary (mainly Miocene) sandstones and fractured Miocene shales on and near the Point Reyes Peninsula, Marin County. (hypothetical)

Play 1103 Pescadero Oil
Includes anticlinal and stratigraphic accumulations of oil and gas in Cretaceous, Miocene, and Pliocene sandstones and fractured Miocene shales in an area west of the San Gregorio fault zone near Point Año Nuevo, San Mateo County. (hypothetical)

Play 1104 La Honda Oil
Includes anticlinal and stratigraphic accumulations of oil and gas in Tertiary (mainly Eocene and Miocene) sandstones, Miocene limestones, and fractured Miocene shales in the Santa Cruz Mountains of San Mateo, Santa Clara, and Santa Cruz Counties. (hypothetical)

Play 1105 Bitterwater Oil
Includes mainly anticlinal accumulations of oil and gas in Miocene sandstones in the Bitterwater and Peach Tree Valleys, Monterey and San Benito Counties. (hypothetical)

Play 1106 Salinas Oil

Includes anticlinal and stratigraphic accumulations of oil and gas in Tertiary (mainly Miocene) sandstones and fractured Miocene shales in the Salinas basin, Monterey and San Luis Obispo Counties. (confirmed)

Play 1107 Faulted Western Cuyama Basin Margin

Oil accumumulations in structural traps in Vaqueros Formation sandstones deposited on fault-controlled bathymetric platform on west side of Cuyama basin, generated from Soda Lake shale in Miocene to Pliocene time. Confirmed.

Play 1108 Subthrust

Oil accumulations in footwall blocks of Morales, Big Spring (Freeborn), Whiterock, Ozena, and South Cuyama faults, reservoired in Vaqueros, Branch Canyon, Santa Margarita Formation, Morales Formation, generated from Miocene mudstone in Miocene to Pliocene time. Confirmed.

Play 1109 Cox Graben

Oil accumulations in Vaqueros or Branch Canyon in fault-controlled traps along flanks of Cox graben southeast of South Cuyama field. Hypothetical but small accumulations known.

Province 12. Santa Maria Basin

Play 1201 Anticlinal Trends

Oil accumulations in Sisquoc, Monterey, Point Sal, and Lospe Formations, trapped in the crests of Pliocene to Quaternary major and minor faulted anticlines, sealed by Pliocene mudstone, generated from Miocene mudstone in Pliocene-Quaternary time. Confirmed.

Play 1202 Basin Margin

Oil accumulations in Monterey, Sisquoc, and Pismo Formations, trapped along Monterey-Sisquoc unconformity or in overlying Sisquoc and Pismo Formation sandstones enclosed by Pliocene mudstone or sealed by tar. Confirmed.

Play 1203 Subthrust

Oil accumulations in Monterey Formation fault or fold traps in footwall blocks of reverse or thrust faults. Hypothetical (no accumulations > 10^6 bbl), but smaller accumulations proven.

Play 1204 Diagenetic
Oil accumulations in Monterey Formation fractured cherts trapped by the absence of fracture porosity above the opal CT- quartz transition. Hypothetical.

Province 13. Ventura Basin

Play 1301 Paleogene
Structurally trapped oil and dry gas accumulations in sandstones of Paleogene, early Miocene, and Cretaceous age on the margins of the central Ventura basin and its offshore extension.

Play 1302 Folded and Faulted Neogene
Structurally trapped oil and gas accumulations in middle Miocene, Pliocene, and Pleistocene sandstones (+fractured shale) of the central & eastern Ventura basin, its offshore extension, & the San Fernando embayment.

Play 1303 Pliocene Stratigraphic
Stratigraphically trapped oil and gas accumulations in Pliocene sandstones of the central Ventura basin and its offshore extension.

Province 14. Los Angeles Basin

Play 1401 Santa Monica-Malibu Coast Fault System
Occurs along north Los Angeles basin margin and consists of oil/gas, sourced from Middle and Late Miocene shales, in mostly Upper Miocene sandstones in structural or combination traps controlled by Malibu-Santa Monica-Hollywood and Las Cienegas fault systems.

Play 1402 Southwest Shelf and Adjacent Offshore State Land
Occurs along western shelf Los Angeles basin and consists of oil/gas, sourced from Middle Miocene shale, in Middle and Late Miocene sandstones and weathered or fractured basement rocks in structural or combination traps.

Play 1403 Newport-Inglewood Fault Zone
Occurs along southwest flank of central basin syncline Los Angeles basin and consists of oil/gas, sourced primarily from Middle and Late Miocene shales, in Middle Miocene through Early Pliocene sandstones in structural or combination traps controlled by the Newport-Inglewood fault zone.

Play 1404 Northern Shelf
Occurs along northern shelf east of Play 1401 Los Angeles basin and consists of oil/gas, sourced primarily from Late Miocene shales, in Late

Miocene through Pliocene sandstones in structural or combination traps.

Play 1405 Whittier Fault Zone Southward to Axis of Central Syncline
Occurs along Whittier fault zone and east-west trending uplifts to the south to the central syncline Los Angeles basin and consists of oil/gas, sourced primarily from Late Miocene shales, in Middle Miocene through Pliocene sandstones in structural or combination traps.

Play 1406 Puente Hills, San Jose Hills, and Chino Marginal Basin
Occurs north of Whittier fault zone Los Angeles basin and consists of oil/gas, sourced primarily from Middle Miocene shales, in Late Miocene through Pliocene sandstones in structural and combination traps.

Play 1407 San Gabriel Valley Marginal Basin
Occurs west of Play 1406 and north of Play 1404 Los Angeles basin and consists of oil/gas, sourced from Middle or Upper Miocene shales, in Late Miocene through Early Pliocene sandstones in structural or combination traps (economic reservoirs unproven).

Play 1408 Capistrano Syncline
Occurs southeast of San Joaquin Hills Los Angeles basin and consists of oil/gas, apparently sourced from Cretaceous shales, in Cretaceous sandstones in structural or stratigraphic traps (may not be assessed due to low potential).

Province 15. San Diego - Oceanside
No plays to be considered at this time.

Province 16. Salton Trough
No plays to be considered at this time.