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Discussion paper

Strategy and hegemony in chemical tanker shipping, 1960-1985

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STRATEGY AND HEGEMONY IN CHEMICAL TANKER SHIPPING, 1960-1985

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Abstract:

The article analyses the emergence of chemical shipping as a specialized shipping segment. In the 1950s and 1960s seaborne transport of chemicals was characterized by rapid technological development. This was based on the introduction of parcel tankers, which could carry chemicals in bulk. Norwegian shipping companies were among the pioneers in this trade. By the early 1970s the two leading Norwegian companies had built up substantial market shares, but were challenged by financially stronger British companies. The article traces the background of the main companies involved in chemical shipping in the 1970s. In particular, we look at their entry into the chemical tanker market and the strategies that enabled them to capture a considerable share of the trade. Two elements – fleet structure and timing – can explain why the Norwegian companies managed to fend off the British challenge, and emerged in an even stronger position in the first half of the 1980s.

Keywords:

Chemicals, Shipping, Parcel tankers, Chemical tankers, Norway, Shipping companies

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The chemical industry was one of the most rapidly growing industries of the twentieth century, expanding faster than the manufacturing sector as a whole. Owing to the spatial concentration of chemical production and intra-industry trade among the major areas of production, intercontinental trade in base and intermediate chemicals increased immensely, particularly after World War Two. Yet, one is immediately struck, even at the cursory level, at the dearth of scholarly articles in the field of the seaborne carriage of chemicals.¹ Perhaps, this is partly understandable by the lack of any substantive treatment of the subject in the various histories of the major oil and chemical companies. Even in the company history of one of the pioneers in the field, Dow Chemicals, chemical shipping only merits one page.² Moreover, in the last of a series of ten short books on the history of the ship, published by the National Maritime Museum, Greenwich, chemical tankers are not even mentioned.³

Despite this lacuna, the chemical shipping market is worthy of note for a number of reasons. First, technological innovations within chemical shipping gave a substantial decline in transport costs, facilitating the growth of international trade in chemicals. Second, the chemical tanker market provides an interesting counterpoint to most other shipping segments, where the supply side tends to consist of a large number of participants. Consequently, the historical development of the market, with a limited number of agents and relatively transparent strategies, provides a good basis for business history case studies. Finally, the leading firms by the middle of the 1980s shared the same geographical background (Norway), and were all among the sector's pioneers. Moreover, they managed to fend off attempts at gaining market shares by financially stronger British companies in the 1970s and early 1980s. By considering both the antecedents to and the

growth of the chemical tanker market, it is our intention to show how two strategic factors – fleet structure and timing – can explain the Norwegian pre-eminence, as well as the failure of the British challenge.

The chemical tanker market had by the early 1970s coalesced around three companies: Stolt-Nielsen, a Norwegian company, but one whose operations were based from the 1950s in the United States; the London-based Anglo-Norwegian joint enterprise Athel Anco (later Panocean-Anco), and the Norway-based Odfjell group. By 1973, the three companies held almost 80 per cent of chemical tanker tonnage over 6,000 dead weight tons (dwt), including vessels operated in pools or taken on charter.⁴ This level of concentration was much higher than in the other liquid bulk markets. However, it is partly explicable by the oil and chemical majors' reluctance to internalize chemical tanker fleets to their own account.⁵ The oil majors did of course concentrate on what they knew best, petroleum exploration, production and processing, as well as the relatively simple seaborne transportation of crude oil. The major chemical producers were pioneers within chemical shipping. But as transport needs increased to a much wider sphere of operational scope from the mid-1950s onwards they chose to outsource most of their transport requirements. Whereas the oil companies owned around 40 per cent of the crude oil tanker fleet in the mid-1970s, the major chemical and oil companies controlled less than ten per cent of the chemical tanker fleet. Moreover, there had been practically no investment in new capacity, reflected in the fact that the corporation-owned 'integrated' fleet had an average age that was more than twice as high as the 'independent' chemical tanker fleet.⁶

During the 1960s the market for seaborne transports of chemicals became highly specialized, even more so with the advent of parcel tankers (so called because each tank constitutes a ‘parcel’ of cargo). After an introduction to this market in Section I, we look at developments in two periods. The first, from the early 1960s to 1975, saw the consolidation of tanker supply around three companies. Their background and entry into the chemical tanker market is presented in Section II. The status in the mid-1970s, with a focus on the competitive position of the main participants, is detailed in Section III, while the years from 1975 to 1985 are analysed in Section IV.

Norwegian shipowners were pioneers in the parcel tanker trade during the 1960s. However, in the first half of the 1970s the Norwegian hegemony was seriously threatened by financially superior British interests, encouraged by what was generally acknowledged as the high profitability of the chemical tanker sector in the previous years. Yet by 1985, the Norwegian dominance was even more prominent than before. The question of how the Norwegians managed to emerge victorious, despite the British challenge, is one of the main topics of this paper. The main participants in chemical shipping will be analysed individually, with emphasis on their growth and how their respective strategies evolved. This approach has been aided by access to the archives of two of the leading companies/principals; Odfjell and Peninsular & Oriental (P&O).

I

Prior to the 1920s – and in fact beyond it – chemical manufacturers relied upon traditional raw materials such as animal and vegetable matter. However, the significant use of hydrocarbons as raw materials for the synthesis of organic chemicals began in the USA around this time. Cracker gases, rich in olefins (ethylene, propylene and butylenes)

were initially regarded as by-products of oil refining, but from the 1920s onwards it was realized that they could be profitably used as feedstock for chemical manufacture. For instance, by the 1930s, natural gas had largely replaced coke gases as feedstock for the synthesis of ammonia. American chemical companies such as Dow Chemicals and Union Carbide and Carbon Corporation saw petroleum as promising raw materials for their existing chemical products.⁷

By 1930, two major oil companies, Standard Oil of New Jersey and Shell Transport and Trading had also committed to extensive petrochemical production.⁸ In 1931 Shell Chemical Corporation recorded receipts of just \$135,000. By 1946, however, the recorded receipts had increased to \$23 million.⁹ This was partly a reflection of the growth of petrochemical manufacturing processes up to 1939, although traditional raw materials continued to be the dominant source of chemical supplies. Shortages of natural raw materials during World War Two further stimulated the expansion of the petrochemicals industry. Thereafter, extensive use was made of petrochemicals in numerous products including plastics, fibres, adhesives, paints, solvents, detergents, fertilizers, insecticides, synthetic rubber and explosives.¹⁰ Post-war, the petrochemical industry developed along the US Gulf Coast, and new chemical plants were built alongside the Texas and Louisiana oil refineries and natural gas fields.

Initially, shipments from chemical plants were transported in drums and in portable tanks by road on the US Interstate highway system, as well as by rail tank cars to the US Atlantic coast. Individually packaged chemicals had also been transported in glass carboys, drums and tank containers on conventional ships, by river and sea. Owing to the

rapid increase in demand and the possibility to utilize economies of scale, however, riverine and seaborne chemical transports in bulk were contemplated.¹¹

The surplus of wartime T2 tankers ensured an ample supply of ships that could be converted for the large-scale carriage of bulk chemicals. Conversion of such vessels was not technologically demanding, but necessary to enable cargo segregation. By 1948 Union Carbide had converted the *R.E. Wilson* (née *Monocracy*) to carry nine different chemicals in bulk and to carry petroleum products in her wing tanks. Six years later Dow pioneered the first large tanker to exclusively carry chemicals in bulk, the *Marine Dow Chem*, built by the Bethlehem Shipbuilding Company at Quincy, Massachusetts in 1954. The vessel had double bulkheads to separate the tanks, each with separate transfer systems, pipes and connections. She was used to carry eleven chemical cargoes, each with their own different characteristics, from Dow's Texas plants to US ports, the Caribbean and Central and South America. At 551 feet in length the *Marine Dow Chem* was capable of carrying 16,000 long tons of chemicals in her specially designed hold.¹²

Given the early lead by US companies, petrochemical manufacturing in Europe did not increase in scale until the 1950s, by which stage the European energy market had greatly expanded. By the end of the decade, Exxon, for example, had invested £10 million in a chemicals plant at its Fawley refinery on the south coast of England through its European arm Esso.¹³ Nonetheless, in the immediate post-war period, European shipping companies played an important role in the rise of intercontinental seaborne transportation of chemicals from the US, but by relatively small ships. From the early 1960s onwards the major chemical companies refrained from expanding their transport engagements, choosing instead to outsource the service to the European participants.

The Dutch Broere brothers had begun to ship chemicals by sea from US ports late in 1949, and in 1954 took delivery of the 2,500 dwt *Elizabeth Broere*, complete with fifteen tanks. Also in 1949, three Norwegian owners had launched a transatlantic service for the carriage of bulk liquids, managed by A.O. Andersen of Oslo with the chartering and operations side carried out in London by H.W. Collingwood. First known as Parcel Tankers Service, but later the Anco Tanker Service, the vessels had several tank subdivisions to carry a range of liquid bulk cargoes. The first, Iver Bugge's *Svanaas*, completed in 1949, had the distinction of being the world's first purpose-built parcel tanker. Anco ships carried a range of products including solvents, lube oils and some benign chemicals.¹⁴

Increasing demand and technological improvements in chemical production established an economic basis for fleets of specialized chemical tankers. Maintaining the quality of the product and ensuring safe containment were prerequisites of chemical tanker design and construction. Dedicated tankers for heavy chemicals such as sulphuric acid, nitric acid and caustic soda, all suitable for transport in bulk to satisfy the demands of industry, soon came into their own. As the market grew so too did the concept of better modes of seaborne transportation for the increasing range of chemicals.

Whilst the Broere brothers increasingly focussed on short-distance shipping of chemicals, Anco were accompanied by two compatriots – Stolt-Nielsen and Odfjell – in the intercontinental trade. This was the part of the chemical tanker segment that increased more rapidly, and where the technological advances were more pronounced. Indeed, by the mid-1970s, approximately 80 per cent of the chemical tanker tonnage – including the majority of the advanced vessels – was employed in this segment.¹⁵

During the 1960s, the parcel tanker became the favoured vessel for the intercontinental carriage of a wide range of chemicals. The economic basis for these ships was the combination of various cargoes, each too small to justify the chartering of a full ship, in different tanks. This kind of transport gave substantial cost reductions relative to shipments in individual containers on conventional ships. In 1963 Stolt-Nielsen pointed out that “Before we started exporters here were paying \$35 to \$45 a ton to Japan, for example. Our rates today are \$16 to \$20 a ton. We believe we are making the American chemical industry far more competitive on the world market.”¹⁶

Much of the parcel tanker trade operated on a *quasi* liner basis. Contracts were entered into with major chemical and oil companies and vegetable oil shippers. These contracts committed part cargoes on a number of ships to given routes at given times, owners then filling out the vessel with spot and short-term contracts. Contracts tended to be for relatively short periods, mostly for one year, sometimes for two. Moreover, there were frequently a considerable range of product types and quantities in each contract, with the number of potential contract customers being relatively small.

In the first half of the 1970s Stolt-Nielsen, Odfjell and Athel-Anco were the leading intercontinental chemical shippers, with the only serious challenge coming from Panocean, a British company with a strong shipping industry backing. Each company did, however, differ essentially with regard to its entry into the market and the composition of its fleet.

III

Founded by Botolf Stolt-Nielsen in 1891 in Haugesund, Norway, Stolt-Nielsen rapidly expanded during and after World War One, ordering some 45 vessels. However, the

company became a victim of the interwar slump, and by 1925 most of the company's assets had been sold off to appease its bankers. By this stage the company had only two ships left. One was sunk during World War Two and subsequently replaced, and the other rebuilt in 1952.

During the 1950s Botolf's grandson Jacob Stolt-Nielsen, Jr., who had trained as shipbroker in London, substantially turned around the company. In 1953 he relocated to New York due to an interest in the solvent trades. In 1955 Stolt-Nielsen converted a time-chartered Norwegian vessel, *Freddy*, at Galveston, Texas and fitted her with deep-well pumps. Two years later he chartered a small parcel tanker from his uncle, Sverre Amlie, for the transport of lard from Chicago to the UK.¹⁷ In 1959 Stolt-Nielsen really entered shipping with the purchase of a ten-year-old Norwegian ship, *Rimfonn*, which was converted into a parcel tanker and renamed *Stolt Avance*. This led to the establishment of Parcel Tankers Inc. and a lucrative time-charter for the vessel on the US Gulf-Northern Europe run. In the early 1960s the activities increased, with further tonnage and shipping operations in other regions.

Stolt-Nielsen's route into the seaborne transportation of chemicals was by the relatively inexpensive method of conversion, rather than new buildings. The strategy offered quick returns and a large market share. By 1961, Stolt-Nielsen Chartering Inc. was established in New York to handle all the company's charters; a service was inaugurated to the Far East, and in the following year to South America. Stolt-Nielsen also pioneered a service between the USA and Japan. The mainly converted fleet operated by Stolt-Nielsen steadily grew to over twenty parcel tankers by the end of the 1960s. However, the company owned only a small proportion of the tonnage – most of

the ships were chartered from other owners. In order to increase ownership, Stolt-Nielsen committed a substantial share of its assets in 1968 to order seven new builds from the Boelwerf shipyard at Temse, Belgium. The ships would have double bottoms and double-skin and each would be built with nine stainless steel tanks, representing “a long stride forward in the development of liquid bulk parcel carriers”.¹⁸

Throughout the period Stolt-Nielsen had grown rapidly on the back of the boom in chemical transportation to become the number one firm in the parcel tankers market. Beginning with converted tonnage to serve a growing market, the company concentrated, on high-volume shipments of relatively benign chemical cargoes, and then by new building.

Stolt-Nielsen’s focus on larger, relatively simple tankers meant that the fleet structure differed considerably from its main Norwegian competitor, the Odfjell group. Founded by two Norwegian captains, Abraham and Fredrik Odfjell, the main company, AS Rederiet Odfjell was incorporated in Bergen in 1915.¹⁹ By 1939, the Odfjell fleet comprised six general cargo vessels aggregating 30,000 dwt and one specialized Dutch-built tanker, MT *Lind*, of 600 dwt. The latter carried different liquid cargoes including creosote, tar and vegetable and mineral oils. The success of *Lind* encouraged the firm to order another two specialized tankers before the outbreak of war,

Despite the profitable investments in the small tanker trade, general cargo tonnage dominated the Odfjell interests, and by 1960 tankers comprised only 15 per cent of its fleet. By this stage management had passed to the two sons of the founders. After 1960 and the acquisition of the third MT *Lind*, replete with stainless steel centre tanks, Odfjell increasingly specialized in chemical tankers. By 1964, these vessels for the first time

exceeded the tonnage of Odfjell's general cargo vessels and by 1968 the company had sold off its conventional ships and become a dedicated chemical tanker operator. Of the companies under consideration, Odfjell was easily the most innovative and also the one prepared to lead the market in sophisticated tonnage of increasing size.

During the 1960s the Odfjell fleet grew rapidly through the receipt of 24 specialized parcel tankers, culminating in 1969 with the more than 20,000 dwt. MT *Bow Cedar*.²⁰ By this stage Odfjell's fleet was the most modern and technologically advanced of the major chemical carriers. Specifically, the fleet had substantial stainless steel capacity, a concept that Odfjell pioneered and had more or less on its own until 1970. Stainless steel tanks were expensive, but offered relatively easy cleaning and enabled the transport of a number of cargoes that could not be shipped in conventional, coated mild-steel tanks.

With its sophisticated tonnage, Odfjell could concentrate on the more demanding (and therefore, more lucrative) parts of the chemical market. From the late 1960s the company also invested in terminals in various parts of the world.²¹ The aim was to reduce loss-bringing port-time, an element that became increasingly important as the ships became more expensive; "In several foreign ports storage capacity for chemical products is a bottleneck in the distribution. The company has established terminals to alleviate these difficulties and consequently attain better utilization of the vessels."²² Odfjell also retained a substantial fleet of smaller vessels, reflecting that small specialized ships, rather than large converted tankers, had been its gateway into the parcel tanker market.

Vessels owned by other companies were used to complement Odfjell's own shipping capacity. From 1964 onwards, Odfjell was responsible for the commercial

operation of six Westfal-Larsen tankers totalling over 130,000 dwt, which later in 1970 led to a pooling arrangement between the two companies.²³ The company also co-operated closely with a number of other shipowners in connection with investments in smaller ships. The aim of the co-operation was to increase the size of the fleet – thereby improving the service to the customers – without committing too much of its own resources. Like Stolt-Nielsen, Odfjell also increased its transport capacity by chartering ships from other shipowners. However, pool tonnage and joint investments with other owners partly alleviated the need for such contracts.

The operation of parcel tankers in the advanced segment of the chemical tanker market was very lucrative, with annual average returns on Odfjell ships often exceeding 15 per cent. Moreover, in 1963 Odfjell had established Minde Chartering, an in-house brokerage company. In addition to bringing in commissions from ships owned by or associated with Odfjell, the in-house broker co-operated closely with Odfjell's operations department in identifying new niche markets and streamlining existing services. As other operators also acquired stainless steel capacity, Odfjell embarked in the early 1970s on a massive new build programme in Poland. The order included twelve 28,000-dwt parcel tankers, half of which were for Odfjell, and the remainder under co-operative ventures with Westfal-Larsen.

Athel-Anco, the main competitor to Stolt-Nielsen and Odfjell, had two sets of roots; in Britain and Norway. The British antecedents to Athel-Anco lie in the creation in 1926 of the United Molasses Company Ltd., a holding company for British Molasses (incorporated 1915) and Pure Cane Sugar (incorporated 1919).²⁴ Molasses, a seasonal trade, is an extract of sugar cane or sugar beet, and is twice as heavy as water. Molasses

had to be heated when discharged and the tanks thoroughly cleaned by salt water afterwards for carriage of, for instance, mineral oils.

United was an integrated concern, in which transport was a business area supplementing the main activity – trade in molasses. The company originally owned ten ships and a new building contract. Thereafter, the Athel Line, as it came to be unofficially known grew in size. The vessels were primarily concerned with the carriage of molasses, but also with oil, a duality of trade that served United Molasses well. With branches in Liverpool, Hull, Greenock, Glasgow, and subsidiaries in Holland, Germany, Italy, South Africa, the West Indies, Java and San Francisco by the 1930s, United had a truly international outlook.²⁵

In December 1939, United finally legalized the Athel Line name when it formed a wholly owned subsidiary company, Athel Line Ltd., to manage its fleet.²⁶ Losses during World War Two were high. Post-war, eleven new ships were ordered, the last, *Atheltemplar*, delivered by 1952.²⁷ United Molasses had in 1949 obtained a controlling interest in the Anchor Line, and four years later wholly owned the company, with management left to existing personnel.²⁸ By this stage, United owned seventeen tankers through the Athel Line, another six tankers through a subsidiary, Tankers Ltd., and four passenger liners and five cargo liners through the Anchor Line.²⁹

After 1952, the Athel Line ordered another four tankers for delivery by 1957. The *Athelmere*, delivered 1954, had some chemical capacity. The subsequent year the company received the *Athelstane*, which – in addition to more ‘traditional’ Athel Line goods such as molasses, oil and spirits – had the ability carry a full cargo of chemicals.³⁰ In the interim, the sugar giant Tate & Lyle had turned to the Athel Line to part own, plan,

construct and manage for a period of ten years a new shipping fleet of six vessels of 9,500 gross tons each for the carriage of sugar and associated cargoes in bulk. The partnership was to be known as the Sugar Line.³¹

United Molasses' ships, backed by an extensive world-wide system of installations, continued their dual molasses-oil role. However, the increase in tanker sizes after the Suez Crisis of 1956 somewhat left them behind in the petroleum trade. Nonetheless, an alternative strategy existed. A year earlier the Athel Line had embarked on the carriage of chemicals with a five-year contract with Imperial Chemical Industries to carry caustic soda liquor between Birkenhead and Port Esquivel, Jamaica. Two 10,000 dwt new builds were modified to enable the carriage of not only caustic soda liquor used in the preparation of bauxite, but also spirits and other chemicals.

In 1958 the Athel Line obtained a contract with Socony Vacuum to carry lubricating oils, additives and solvents, all of which required extremely clean tanks. Thus began the company's involvement in the parcel tanker trade, a trade which continued after United Molasses, then valued at £30 million, was taken over by Tate & Lyle in April 1965. The purchase was aided by some £14 million in reserves in United's coffers.³² This level of reserves is readily explicable in that United had always had a high level of liquidity that had allowed the Athel Line to buy its ships unencumbered by mortgages. By this stage the Athel Line had also invested in building two 59,000-dwt oil tankers. Although consideration was given to selling them, during the Arab-Israeli conflagration in 1967 and the second closure of the Suez Canal, both vessels earned in the region of £1 million per annum until the competition caught up.³³

By the time of the acquisition by Tate & Lyle, the Athel Line's fleet was ageing and comparatively expensive to run. United's policy was to continue to carry molasses but on a decreasing scale. The older conventional molasses carriers went one-by-one to the breakers, to be replaced by chartered-in tonnage.³⁴ In 1965 the Anchor Line was sold and the Athel Line entered into an agreement with Anco Tanker Services, the pioneering Norwegian parcel tanker pool.³⁵ The modified *Athelqueen* was transferred to the Anco pool and subsequently re-named *Anco Queen*. Soon after, the Athel Line commissioned the building of three specially designed 16,500 dwt parcel tankers from Uddevallavarvet, Sweden. Later, in 1968, four larger, more sophisticated ships of 23,500 dwt were ordered from Eriksberg, another Swedish shipyard. The orders were a clear indication that the parcel tanker trade, and not molasses transports, was now the priority. The new strategy was confirmed in 1969 when another two 23,500-dwt parcel tankers were ordered from Uddevallavarvet, giving a potential for ten Athel Line ships in the Athel-Anco pool.

Resulting from this, a new company, AS Anco Tanker Service, was formed in Oslo in 1969 with a tripartite management structure. Athel Line held a one-third share, despite its preponderance in tonnage. The other principals were Ole Schröder (Norway) and Salénrederierna (Sweden).³⁶ The Athel Line continued to be based in London, but the in-house seaborne carriage of molasses had by this stage taken a back seat and increasingly chartered tonnage was used in this trade. After a re-organization of United Molasses, finalized in 1970, Athel Line had to look for the most profitable cargo, virtually pricing itself out of the carriage of molasses.

By February 1971, the first of the new Anco vessels ordered in 1968-9, *Anco Empress* had been launched. However, tensions had surfaced in the Anco triumvirate. By

the end of 1972, Athel Line, with its preponderance in tonnage, had bought out its Scandinavian partners. Management of Anco was transferred to London by July 1973, with the emphasis now firmly on chemical tankers. Indeed, the name, ANCO, now eclipsed the old nomenclature of the Athel Line both in the names and numbers of the ships and of the business generally. Tate & Lyle had by this stage already decided to merge the Athel Line and its Sugar Line fleet to establish a shipping division within the group. Tate & Lyle Shipping Ltd. was established under one roof by the end of August 1974. There were manifest reasons why such a merger made sense, not least to bring under the control of one management the many shipping interests acquired over the years. This would enable a sharper focus on what was profitable and what was not.

The Anco take-over by British interests ensured that the Norwegian companies now faced a financially strong competitor. However, it was an open question just how committed the company was to chemical transportation over the long-term. Despite the apparent consolidation of the market through Stolt-Nielsen, Odfjell and Anco, a new entrant had singled out the parcel tanker market as a potentially rewarding avenue of expansion. The Panocean Shipping and Trading Company was formed as late as 1969 as a joint enterprise between two leading British shipping companies, the London-based Peninsular and Oriental (P&O) and the Liverpool-based Ocean Transport and Trading (formerly the Blue Funnel Line).³⁷

However, neither P&O nor Ocean, the two giants of British shipping, can be said to have rushed into the chemical transports market. By 1965 both companies had expressed an interest in entering the trade for the sophisticated carriage of chemicals. This led to a co-operative approach, and by November 1966 a preliminary report on

prospects had been made. During 1966 and 1967 extensive market research was undertaken in the USA and in Australia. It soon became evident that the market was growing. However, it proved difficult to establish any clear pattern, suffice that chemical movements took place largely between developed countries. Moreover, transports could taper off suddenly as new plants came into existence, and there were instances of cargo flows reversing. Nonetheless, it was eventually concluded that the pattern of a regular liner service on a round-the-world basis was likely to capture a significant and profitable share of the market.³⁸

According to the potential entrants' market intelligence, opposition tonnage totalled some 625,000 dwt in 1965, but there was a considerable amount of ageing converted tonnage operating at the time. P&O and Ocean anticipated that owners would find difficulties in replacing their tonnage, and initially saw that they should go for comparatively sophisticated tonnage and aim for the type of cargoes which did not move in large quantities.³⁹

P&O and Ocean had worldwide agencies and vast experience in liner operation. The advantages of a regular liner service were noted in comparison to an *ad hoc* tramp operation. After initial reservations on design were expressed by tendering shipyards, a major reappraisal led to new tenders being issued for the construction of four 24,000-dwt parcel tankers. From 1958 when the world chemical tanker fleet comprised nine vessels totalling 43,000 tons deadweight, the increase a decade later was marked but hardly exponential, with the fleet now comprising 58 vessels totalling approximately 700,000 dwt.⁴⁰ Nevertheless, the tempo of bulk chemical movements had increased and demand had risen accordingly. By December 1968, Cammell Laird, the Mersey shipbuilders and

engineers, had won the entire order from Panocean, with each vessel costing £4.05 million and the service expected to commence in the middle of 1971. Subsequently, the order was announced on 15 January 1969.⁴¹

However, Panocean's plans suffered a considerable setback when Cammell Laird was subject to a liquidity crisis, which deteriorated rapidly and threatened liquidation, in January 1970. The Mersey firm was eventually rescued by British Government intervention in June through its Industrial Reorganisation Corporation.⁴² The rescue was, however, dependent on the cancellation of the Panocean vessels. This forced Panocean to order abroad and a four-vessel contract for less sophisticated vessels was placed with the government-owned Norwegian shipyard Horten Verft in July, with delivery pencilled in for late 1973. The order was underpinned by the availability of an allocation in 1973 of Nkr. 53 million to Horten from the Norwegian Shipbuilding Credit Scheme.⁴³

Parallel with its entry into the chemical trade, Panocean had also decided to enter the comparatively unsophisticated palm oil trade, based primarily on Malaysia with the bulk of present traffic going to Northern Europe. This trade would supplement the liner sailings within the Far East Freight Conference, in which both P&O and Ocean were members. The aim was to achieve a monthly service by early 1972, for which four vessels were needed. By June 1970 attempts to secure second-hand tonnage for conversion had been unsuccessful and authority had been given to purchase on the stocks three new buildings of some 27,000 dwt each. A fourth and smaller vessel was also available in Spain. It was expected that the total cost of these vessels for the palm oil and vegetable oil trades would not exceed £15 million.⁴⁴

Panocean, in line with its main objectives of the provision of through-cargo service sought storage facilities in North West Europe. This led to the 1970 cash acquisition of a British-owned public company, Antwerp and Rotterdam Oil Storage Ltd. that had oil, chemical and lube oil storage and blending facilities in Antwerp, and a modern oil and chemical storage depot in Rotterdam. Plans to construct another storage terminal at Eastham on Merseyside were already well-advanced.

Panocean was a late starter, but the expansion rapidly gathered momentum. A £50 million capital investment programme, covered, *inter alia*, a fleet of ten coastal chemical tankers by 1974 and nine 24,400-dwt parcel tankers. Panocean had by June 1975 expended a capital investment totalling £80 million on specialized tankers and barges and on terminals for the storage of bulk liquids. In just five years Panocean owned a seagoing fleet of 23 vessels ranging from 1,000 to 25,000 dwt, had quadrupled its storage capacity, and had embarked on a joint venture, Panocean Lloyd (with the German Hamburger Lloyd Company) to operate chemical barges on Europe's inland waterways.⁴⁵

The first of the Norwegian-built tankers on order, *Post Challenger*, designed to comply with the latest regulatory requirements, was indicative of the increasing complexity of parcel tankers. With an automated engine room, she had 41 tanks of differing size, including four stainless steel cylindrical tanks on deck. All the hull tanks were coated with either epoxy paints or zinc silicate. Four tanks, each with a separate pump and pipeline system separated by cofferdams from the remainder, were designed to withstand higher than average temperatures and to hold dangerous cargoes.⁴⁶

Panocean's initial strategy against Stolt-Nielsen, Athel-Anco and Odfjell was to concentrate on the European market – aided by a fleet of ten coastal chemical tankers –

and west to east trade patterns to South Africa, Australia and the Far East and back to Europe via the Pacific with Japanese exports. In 1975, Panocean entered into a joint venture with the Malaysian International Shipping Corporation based on the Malaysian palm oil trade. The new vehicle, MISC-Panocean was planned to integrate the marketing and operation, especially in the vegetable oil trades, of the two companies' tanker fleets, with shipments expected to Japan and Europe.⁴⁷

Given Panocean's investment programme in new tonnage, Tate and Lyle's decision to merge Anco with it in December 1975, whilst still retaining ownership of the latter, was sensible and resulted in a combined Panocean-Anco fleet of 21 deep-sea vessels, including two vessels owned and managed by the French Worms Group and contained through a pooling arrangement for revenue only. The parcel tanker market was fast moving, and becoming ever more expensive in terms of sophisticated vessels. The aim of the Panocean-Anco partnership was to generate some rationalization within the industry and to expand the cover and service to customers. By combining the two complementary fleets, this could be accomplished without additional capital expenditure, or aggravating what had become an extant situation of oversupply of tonnage. Additionally, the aim was also to reduce the number of vessels operated to service joint trades, and to strengthen the worldwide marketing capability.

III

By 1976 the British challenge to the Norwegian entrepreneurs seemed overwhelming. Athel had already swallowed Anco, though retained the name. After the merger with Panocean, the British threat was backed by three financially strong and diversified companies; Tate & Lyle, P&O and Ocean. The financial muscle of these conglomerates was superior to the mainly privately-owned Norwegian competitors. However, over the

following years it became evident that willingness to expand and dedication to the chemical transport segment could go a long way towards compensating for financial resources.

Despite their different routes into the market, in the middle of the 1970s the companies were broadly similar in their strategies. The main approach had been to build new tonnage as a means to remain in competition, aided by the continuing growth in the chemicals market. Moreover, the sophisticated stainless steel tanks that Odfjell had pioneered had become an industry standard that featured in the new builds of all three companies. This expensive approach not only demanded liquidity to overcome short-term crises, but good credit standing and reputation. An additional ingredient was the need to hedge what could be termed over-exposure to one particular segment of the market.⁴⁸

As previously stated, the parcel tanker market was by the 1970s characterized by a higher degree of concentration than the more atomistic dry and liquid bulk markets. The driver in the development of the trade had been towards improved technology rather than on an exponential increase in the size of ships. With costs of increasingly sophisticated tonnage rising steadily, those firms at the top of the market had the advantage of being first movers. They had an innate advantage, based on their specialized market knowledge and networks of efficiency-enhancing terminals. Furthermore, they were to some extent protected by the high start-up costs to impending competitors and the increasing regulatory burden on the seaborne transport of chemicals. Indeed, in the early 1970s international control of the bulk shipments of chemicals had been *de facto* addressed by the United Nations-backed International Maritime Consultative Organisation (IMCO). IMCO had promulgated a Bulk Chemical Code for the construction and equipment of

ships carrying dangerous chemicals in bulk. The Code was applicable to all ships built or converted after April 1972. Moreover, after a six-year grace period, the Code would be extended to include all chemical carriers in operation⁴⁹

The increasingly stringent regulations and the limited amount of chemical tankers on the second-hand market reinforced the concentration, as did the fact that a fleet of at least a dozen vessels was necessary to provide an adequate intercontinental or world-wide service in an increasingly competitive global market place.⁵⁰ Nevertheless, Panocean's swift climb to a leading position in the market indicates that though barriers to entry existed, these were not insurmountable for companies with sufficient financial resources.

By the second half of the 1970s the race for market shares in fact involved only three significant participants. Stolt-Nielsen was the main operator, a position built on the strength of a substantial presence in the high-volume transports of relatively benign chemicals and massive chartering-in of tonnage from other owners. Odfjell had concentrated on sophisticated tonnage for transport of the most difficult cargoes. It had the smallest, but also most modern and technologically advanced, fleet. The merging of Panocean and Anco's interests had enabled the build-up of a substantial fleet. However, following the rapid expansion through take-overs and new buildings, the company refrained from major investments in the second half of the 1970s – a stark contrast to the massive new building programmes of Stolt-Nielsen and Odfjell. As shipping was struck by over-capacity and crisis, this seemed a beneficial strategy.

IV

When the OPEC price hike really began to bite in 1974, parcel tanker tonnage, although growing, was not hugely in excess of present or likely demand. In fact, while 1974 was

the first year of the general tanker crisis, it represented an all-time-high for chemical tanker shipping.⁵¹ The parcel tanker owners nonetheless soon became victims of the world-wide trade recession. The good results in 1974 reflected profitable contracts entered into before the oil price increase; however, as Odfjell noted, “We are fully aware that chemicals primarily are second generation petroleum and that the effects of the reduced oil production will affect us as well.”⁵²

The effects of the OPEC price increase were somewhat delayed, but not by much. Freight rates fell by some 60 per cent from early 1974 to mid-1975.⁵³ In 1974 Tate & Lyle’s shipping interests contributed £13,300,000 before tax to the parent company’s profits. The following year Tate & Lyle shipping produced a measly £140,000.⁵⁴ The picture was much the same for the competitors. In 1974 Odfjell’s operating result exceeded the book value of the company’s fleet by almost 50 per cent, reflecting both the booming market and the low book value of a depreciated fleet. By 1975 the value of the fleet had trebled due to new expensive deliveries. The operating result fell by more than 40 per cent, so its share of the fleet value plunged from 149 per cent to less than 25 per cent.⁵⁵ Clearly a recession of such severity demanded a new strategy from the leading firms. The decision to merge Panocean and Anco should be seen in this light.

Tate and Lyle, in releasing Anco in December 1975, in effect admitted that the huge cost of new tonnage to one subsidiary militated against investment in many others. Depressed trading conditions in the parcel tanker market compounded matters still further. Panocean had however, in Anco, a partner with a compatible product mix and pattern of trade. As Corkhill noted, the merger also eased the threat of overcapacity in parcel tankers by obviating the needs of both operators to place orders for new tonnage in

the next few years in an attempt to retain competitiveness.⁵⁶ Although Panocean-Anco at birth held some twenty per cent of world parcel tanker capacity, that was likely to be reduced given the challenge from the existing operations of Stolt-Nielsen and Odfjell, and from changes in the market for the seaborne transportation of chemicals.

The annual average growth rate of base petrochemical production had fallen from 17 per cent in the 1960s to just over five per cent in the 1970s. This reflected a substantial rise in production costs at a time of reduced opportunities for market expansion. In these depressed conditions, Panocean-Anco seemed to be better equipped than its competitors to cope with the situation. First, Panocean-Anco had a strong financial backing through its principals. Stolt-Nielsen and Odfjell, on the other hand, were organized in the traditional Norwegian manner, with a privately-owned management company at the top, and a series of limited liability companies or limited partnerships below. These companies and partnerships, usually with a substantial portion of external investors, owned all or parts of the ships. This kind of business organization made it extremely difficult to raise capital.⁵⁷ Second, Panocean-Anco did not have an expensive new building programme. In the crude oil tanker market, new ships went directly from the building berth into lay-up, and there were well-founded fears that this could happen to parcel tankers as well.

After 1975, when Panocean took delivery of the last of their new parcel tankers, the trade was in a tonnage oversupply position. From 1975 to 1978 the three major operators all suffered financially, but the situation was particularly precarious for the two Norwegians, mainly due to their limited reserves and expansive new building programmes. Stolt-Nielsen had ordered seven ships for delivery in the period 1976-1977,

and had also agreed to take six Korean-owned tankers on 15-year charters from 1978 onwards. Odfjell had, in addition to the new buildings from Poland, six chemical tankers of various sizes on order in Norway and Finland.

The combination of high gearing, a costly new building programme and meagre income meant that by 1977 Stolt-Nielsen was heading towards bankruptcy and in desperate need for capital to be able to meet overdue stage payments on its newbuildings.⁵⁸ In the end, rescue came in the shape of British Petroleum (BP), which granted a US\$ 50 million loan in the spring of 1977. In return, BP got three members on the Stolt-Nielsen board, as well the option of converting the loan to becoming a 50 per cent shareholder within ten years. Panocean-Anco, which had been interested in securing a stake in Stolt-Nielsen for itself, reacted negatively to the fact that ‘the British government (BP’s main shareholder)’ was ‘bailing out a foreign operator’.⁵⁹

There were considerable liquidity problems in the Odfjell group as well. However, the combination of revenues from vessel sales, commissions from the in-house brokerage and re-financing of the debt saw the company through the crisis. The financial exposure was also reduced by the fact that six of the twelve Polish tankers designated for the Odfjell fleet were owned by their partners Westfal-Larsen and operated in a pool. Nevertheless, Odfjell estimated that it would have an accumulated liquidity deficit of US\$ 25 million in the period 1977-1981.⁶⁰

Pool partnerships and chartered-in tonnage had played a much more important role for Odfjell and Stolt-Nielsen than for Panocean-Anco. This implied that the long-term exposure was smaller than their respective shares of the market indicated. The chartered-in ships that the companies had relied upon to fulfil their transport requirements

could be handed back to the owners as charters expired. This ‘swing capacity’ offered flexibility in difficult times. Although it was important to see the companies through the downturn, it was the new buildings on order that eventually gave the Norwegian companies the upper hand relative to their British competitors.

The difficult market continued into 1978, but reprieve was just around the corner. Transatlantic freight rates shot up from around US\$15 per ton in the early months of 1978 to around US\$60 by the end of the year. The boom was created by a combination of dynamic and man-made forces, which both reduced the available supply of tonnage. First, a demand increase in the petroleum products market led to the exodus of product tankers which – for lack of employment in their traditional market – had been used to transport ‘easy’ high-volume chemicals. Second, the fact that the IMCO Code became applicable to *all* ships carrying chemicals, led to the withdrawal of a substantial number of older parcel tankers. Accordingly, a small increase in demand, combined with a reduction of available tonnage, gave large improvements in freight rates.

Due to their expansion during the recession, Stolt-Nielsen and Odfjell had large amounts of modern efficient tonnage that could take advantage of the improved conditions. Two strategic elements – fleet structure and timing – reduced Panocean-Anco’s ability to do the same. The British partnership more or less missed out on the boom, and this ultimately led to the exit of Panocean-Anco as an integrated provider of chemical transport services.

With regard to fleet structure, the new building programmes meant that Stolt-Nielsen and Odfjell both had more tonnage than Panocean-Anco. However, quality was as important as quantity. The Panocean-Anco fleet, although relatively new, had fallen

near the lower end of the sophisticated parcel tanker trade.⁶¹ In particular, the lack of stainless steel capacity implied limited cargo flexibility and long turnaround times. By mid-1978 Panocean-Anco's fleet only included 42 stainless steel tanks, and more than half of the ships in the fleet had no such capacity at all. This can be compared with more than 200 stainless steel tanks in the case of Stolt-Nielsen's vessels and around 350 in the case of Odfjell.

As for timing, the problem was the substantial contract-coverage that Panocean-Anco had when the market improved. Due to their roots in the liner trade, Panocean-Anco had traditionally committed a larger share of its transport capacity to contract work of one to two years' duration. This offered security and predictability, but also impeded the ability to take advantage of high rates in the 'spot market'. Stolt-Nielsen and Odfjell had capacity available, partly as a result of the new deliveries and partly as a result of a stronger focus on short-term contracts and the 'spot market'.

During the boom at the end of the 1970s, Panocean-Anco thus had two handicaps. First, the high share of contract coverage meant that much of Panocean-Anco's capacity was used to honour contracts entered into at a low rate level, before the market recovered. Second, the technology was inferior to the Norwegians; the large share of stainless steel capacity gave Stolt-Nielsen and Odfjell higher efficiency and flexibility. Swift tank cleaning and rapid turnaround times, as well as the ability to accept all types of cargoes, enabled the Norwegians to really take advantage of the good market.

The large share of contract coverage had been a constant part of the Panocean-Anco strategy, and can be explained by the principals' roots in liner shipping (P&O and Ocean) and manufacturing (Tate & Lyle). Indeed, Davies uses the Panocean investment

to exemplify that ‘Ocean’s expertise extended only to liner shipping’ – in more competitive segments, the understanding of the market movements was limited.⁶²

It is more difficult to pinpoint exactly why Panocean-Anco had failed to modernize its fleet. One reason may be inertia following the merger, and a desire to wait until the market showed signs of improvement before committing more resources. Another reason may be the manner in which the company was organized. The three principals all had substantial interests outside the parcel tanker sector, and there was no obvious leader willing to initiate a fleet modernization programme. This can be contrasted with Stolt-Nielsen and Odfjell, which relied on their partners to provide shipping capacity, but still remained in the driving seat with substantial expansion of their own tonnage.

One indication that Panocean-Anco’s problems were of the organizational kind was the fractures that appeared in the late 1970s. Even as the boom unfolded, P&Os involvement was under review due to continuing losses. By January 1979 it had decided to get out of the parcel tanker trade altogether. The aim was to dispose of its tankers on the best terms possible, subject to the agreement of its partners, particularly Ocean, with whom it jointly owned six parcel tankers. In any event the existing partnership agreement ran to 31 December 1980, when P&O could officially notify its intention to withdraw. In the interim the dis-investment strategy was to begin negotiations with Ocean and the other two partners.⁶³

P&O was not the only principal with filtering interest, but the joint ownership with Ocean restricted their room to manoeuvre. On 4 December 1980, Tate & Lyle Shipping sold its share holding, in line with its parent company’s decision to withdraw

from shipping. As a result, the Lewis Trust Group, which purchased two of the Tate & Lyle vessels, and Societe Francaise de Transports Maritimes (the subsidiary of the Worms Group) each acquired a twenty per cent holding in Panocean.⁶⁴

Panocean-Anco was under increasing competitive pressure to buy new ships or upgrade their existing tonnage for example by providing new, single purpose, stainless steel lines and individual deep well pumps in as many tanks as possible. This would make clear their intention to remain involved in the sophisticated segment of the parcel tanker trade.⁶⁵ Another alternative, but an unlikely one, was to trade down market, thus leaving the sophisticated field to Stolt-Nielsen and Odfjell.

The classic investment dilemma for the principals in Panocean-Anco was whether to invest in new tonnage to keep abreast of competition or to withdraw from the market altogether. The response to the challenge was piecemeal. By June 1981 Seatrade reported that 'Panocean-Anco after its recent ownership restructuring, is persistently in the "rumoured to be negotiating on newbuildings" category.'⁶⁶ If a major new building programme were initiated, Panocean-Anco would again follow in the footsteps of Stolt-Nielsen and Odfjell, both of whom had ordered additional ships in 1979 and 1980. In July 1981 Panocean-Anco's long overdue modernization programme was announced. It consisted of upgrading the existing fleet with new pipelines.⁶⁷ P&O claimed that the modernization would 'put the fleet in a more competitive position.'⁶⁸ The attempt was futile, as P&O and the other partners soon realized.

Accumulated losses for P&O and Ocean in Panocean-Anco up to the year ended 31 December 1981 stood at £468,292 each and there were no signs of a recovery of the market.⁶⁹ Rather than buying new competitive tonnage, P&O and Ocean both decided to

dis-invest and sell their ships when an opportunity arrived. By October 1982 no such opportunity to sell these vessels in current conditions had materialized. Neither P&O nor Ocean found it attractive to struggle along in the market until such time that they could sell their ships. Therefore, they entered into a discussion with Stolt-Nielsen in an attempt to create an operating pattern that would offer the prospect of positive earnings, until such time arrived when they could take their six ships out and sell them.⁷⁰

By November 1982 Panocean-Anco and Stolt-Nielsen had agreed to merge their parcel tanker interests, with the expectation that the two fleets would be operating jointly by the beginning of 1983 under the Stolt-Nielsen banner. The companies would have a combined fleet of 37 parcel tankers ranging from 18,000 dwt to 36,000 dwt – by far the largest fleet of its kind in the world.⁷¹ Within Panocean-Anco, John Swire and the French partners had declared their interests in remaining in the parcel tanker trades. Their preference had originally been to go it alone from the beginning of 1983 and to take with them ongoing contracts in the South African and Australian trades. However, the position changed into accepting terms for a joint operation with Stolt-Nielsen, which had been consistently more profitable than Panocean-Anco, and offered better earnings than would have been the case had Panocean-Anco remained in existence.⁷²

To the public at large the reason for the ‘merger’ between Stolt-Nielsen and Panocean-Anco was ostensibly to pool their respective operations to engender greater efficiency. The reality as far as P&O and Ocean were concerned was that there was a separate agreement whereby their six vessels would be progressively withdrawn from the pool and sold. The first to go for sale would be an Ocean vessel, which had not been upgraded, with a date set for sale somewhere in the middle of 1983. Both P&O and

Ocean were required to give six months notice of withdrawals from the pool, but it had been agreed to totally withdraw the six vessels by the end of 1986. Clearly this joint strategy was undertaken to improve interim earnings, and also to take advantage of sale conditions as they may occur.⁷³ With the sales of *Anco Charger* and *Anco Endeavour* in 1984, Panocean's involvement in the parcel trades ended, but the company continued to operate liquid bulk terminals under the banner Panocean Storage & Transport Ltd.⁷⁴

By the mid-1980s Stolt-Nielsen and Odfjell remained leaders in the parcel tanker market. They maintained their market shares through new investments, but were joined by a newcomer – JO Tankers – which had rapidly 'moved into the big three of the chemicals trade in volume of business and tonnage trading.'⁷⁵ JO Tankers was created as a result of the division of the Odfjell group between two branches of the Odfjell family. JO Tankers originally had no deep-sea parcel tanker tonnage, but launched a nine ship new building programme in co-operation with Swedish interests. The substantial market shares captured by JO Tankers illustrate that it would indeed have been possible for Panocean-Anco to reclaim its leading position, if the participants had been willing to invest in new capacity.

V

The technological innovations and transport cost reductions associated with parcel tankers are important explanations for the growth of the international trade in chemicals. Norwegian and British companies had played important roles in the evolution of the market, and by the mid-1970s were hegemonic, controlling around four-fifths of the transport capacity in the sophisticated intercontinental end of the market. From 1984 onwards the situation had irrevocably changed. British involvement in the trade had all

but disappeared, and the field had been effectively left to the Norwegian companies – the original pioneers in the field.

Both Stolt-Nielsen and Odfjell had consistently renewed and upgraded tonnage to stay ahead of their competitors in both anticipation of and in response to market pressures. This at times had been a highly risky strategy, and had brought both companies to the brink of collapse in the difficult second half of the 1970s. However, their entrepreneurial spirit and deep commitment to the parcel tanker trade had always been evident. They were of course aided by the relatively high barriers to entering the trade, especially the huge capital costs of establishing a worthwhile presence in terms of fleets, storage facilities, agencies and ship management.

The fact that Athel, Anco, P&O, Ocean, Tate & Lyle and Panocean all eventually bowed to market realities tells us something about the differences between the organization of the firms and their commitment to the trades in the long run. According to Panocean-Anco's Finance Director, 'Foreign owners are rarely seeking the same historic accounting profit, low gearing, and ROCE yardsticks of the average British company.'⁷⁶ For the disappearing companies, it had been all along, as is the case with businesses in general, about the bottom line. The parcel tanker activities had been one of several business areas, all competing for resources. There had been very little vision and inner steel to become the market leader. Such vision that there had been was almost exclusively that of the Norwegians, who understood that sometimes firms have to speculate to accumulate in a changing environment.

Notes

¹ For an early introduction to chemical tankers in general and their cargoes, see Corkhill, *Chemical Tankers*; for tankers generally, Ratcliffe, *Liquid Gold Ships* and Newton, *The Tanker Story*. Two recent contributions dealing directly with one of the major chemical tanker companies are Thowsen, and Tenold, Odfjell and Tenold, "Steaming ahead with stainless steel".

² Whitehead, *The Dow Story*, 42. Similarly, in one of the books on the evolution of the petrochemical industry, the one-and-a-half pages devoted to transports of chemicals deal almost exclusively with pipelines; Chapman, *The International Petrochemical Industry*, 138-139.

³ Corlett, *The Revolution in Merchant Shipping*.

⁴ Calculated from H.P. Drewry Shipping Consultants, *The Demand for Chemical Carriers* and H. Clarkson and Son Ltd., *The Clarkson Tanker Register 1973*.

⁵ In this article we largely disregard the oil majors, only two of which, Shell, and Standard Oil of New Jersey (later Exxon) had substantial chemical interests. For Shell in the USA, see Beaton, *Enterprise in Oil*, and for Standard, Larson, Knowlton and Popple, *History of the Standard Oil Company*.

⁶ Calculated on the basis of H. Clarkson and Son Ltd., *The Clarkson Tanker Register 1977*.

⁷ See, for example Spitz, *Petrochemicals*, Chapter 2.

⁸ The latter had established the Shell Chemical Corporation in the USA in 1929; see Beaton, *Enterprise in Oil*, Chapter IX.

⁹ Howarth, *A Century in Oil*, 230.

¹⁰ For an analysis of the post-war trends in the industry, see Ilger, "'Better living through chemistry'" or Chapman, *The International Petrochemical Industry*.

¹¹ The term 'bulk' implies that the cargo is loaded directly into tanks integrated in the ship's hold, rather than transported in individual, pre-packaged containers such as for instance steel drums or glass balloons.

¹² Whitehead, *The Dow Story*, 242.

¹³ Fairplay, 15 January, 1959.

¹⁴ Newton, *The Tanker Story*, 134.

¹⁵ It is difficult to precisely define the parcel tanker fleet, as borderline vessels, for instance petroleum products tankers, could carry some benign chemical cargoes. Moreover, small chemical carriers, dedicated to single products, continued to be important for the transport of heavy chemicals.

¹⁶ Jacob Stolt-Nielsen, Jr. quoted in New York Times, 10 November 1963, 88.

¹⁷ Hammerborg, *Skipsfartsbyen*, 308-311.

¹⁸ Jacob Stolt-Nielsen, Jr. quoted in New York Times, 25 June 1968, 81.

¹⁹ For a thorough introduction to the history of Odfjell, see Thowsen, and Tenold, *Odfjell*.

²⁰ Only two general cargo vessels were purchased, but both had been sold by 1968. A comparison of the various vessel types shows that the return from chemical tankers was considerably higher than the return from the general cargo carriers; see Tenold, "Steaming Ahead With Stainless Steel".

²¹ Odfjell Archives (hereafter OA), held at Odfjell ASA, Bergen, Box/Representantskapsprotokoll, 14 November 1968.

²² Interview with Bernt Daniel and J.O. Odfjell, Norwegian Shipping News, No. 3, 1974, 30-33. Stolt-Nielsen purchased its first terminal, Zeetank, in Zeebrugge, Belgium in the early 1970s; Stolten (Stolt-Nielsen Company Magazine), No. 4, 1972.

²³ OA, Bergen, Box/Styremøter, Agreement of 19 February 1970.

²⁴ Meneight, *United Molasses*, Corkhill, *Chemical Tankers* and Riert, *Anco*, are the major secondary sources for much of our information on Athel-Anco, and as such we are indebted to the authors.

²⁵ Hugill, *Sugar and All That*, 259-261.

²⁶ 'Annual Summary of British Shipping Finance', Fairplay, 1940.

²⁷ Hugill, *Sugar and All That*, 263-4. Hugill informs that 19 out of 24 vessels were lost and 205 men killed.

²⁸ Mathias, and Pearsall, *Shipping*, 18.

²⁹ United had acquired a controlling interest in Tankers Ltd., (originally formed in 1920 as a subsidiary of the Scottish and American Oil and Transport Company), in December 1941. By October 1950, Tankers Ltd. owned four motor tankers and three tank steamers aggregating 84,321 dwt and averaging around 18 years of age; 'Annual Summary of Shipping Finance', Fairplay, 1951.

³⁰ Dunn, *The World's Tankers*.

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- ³¹ Meneight, *United Molasses*, 121 and 157; Hugill, *Sugar and All That*, 186. For an alternative to Hugill, see Chalmin, *Tate & Lyle*.
- ³² Meneight, *United Molasses*, 154.
- ³³ Hugill, *Sugar and All That*, 267.
- ³⁴ Meneight, *United Molasses*, 157.
- ³⁵ The company, created in 1948-9 was originally called Parcel Tankers Service and operated three vessels owned by three different shipowners in a tanker pool for the carriage of vegetable oils, oil and chemicals.
- ³⁶ Meneight, *United Molasses*, 157-159.
- ³⁷ Lloyd's List, 16 January 1969.
- ³⁸ National Maritime Museum, Greenwich (hereafter NMM) Peninsular and Oriental Papers, PO17/39 Planning and Finance, Chemical Tanker Project, 1965-69.
- ³⁹ NMM, PO17/39 Planning and Finance, Chemical Tanker Project, 1965-69.
- ⁴⁰ NMM PO39/19 Chemical Tankers Potential Opposition. 1968 figures quoted from US Chemical Marketing Research Association.
- ⁴¹ Journal of Commerce, 16 January 1969.
- ⁴² This period of British government intervention in domestic shipbuilding is analysed in Hogwood, *Government and Shipbuilding* and by Johnman, and Murphy, *British Shipbuilding since 1918*.
- ⁴³ Peninsular and Oriental Dead Company Files, held at P&O Headquarters, Pall Mall, London (hereafter P&O HQ), PO/INF/072.
- ⁴⁴ P&O HQ, PO/INF/072.
- ⁴⁵ Motor Ship, April and October 1972. Panocean Press Advertisement, June 1975.
- ⁴⁶ Motor Ship, October 1972.
- ⁴⁷ Fairplay, September 1975.
- ⁴⁸ This overexposure was of course limited in the British case, as Panocean-Anco was in effect a subsidiary of larger conglomerates. Moreover, both Odfjell and Stolt-Nielsen entered the booming Norwegian offshore sector. However, this was accomplished through separate companies.
- ⁴⁹ For the Bulk Chemical Code, see Lakey, "IMO codes for chemical and gas carriers", 57-65.
- ⁵⁰ Lloyd's Shipping Economist, Volume 1, No. 4, 1979 estimated that any fleet of less than 12-14 vessels would be unlikely to provide the necessary worldwide service.
- ⁵¹ See Tenold, *Tankers in Trouble*.
- ⁵² OA, Bergen, Box/Mag/O1, 1974.
- ⁵³ Lloyd's Shipping Economist, Volume 1, No. 4, 1979, 13.
- ⁵⁴ Meneight, *United Molasses*, 189.
- ⁵⁵ Thowsen, and Tenold, *Odfjell*, 409-412.
- ⁵⁶ Corkhill, *Chemical Tankers*, 21.
- ⁵⁷ The organization of the Odfjell group is presented in Thowsen, and Tenold, *Odfjell*, Chapter 13.
- ⁵⁸ Seatrade, June 1977, 53.
- ⁵⁹ Seatrade, June 1977, 53 and Fairplay, 28 October 1982, 10.
- ⁶⁰ OA, Bergen, Box/Odfjells rederi avsl. -78, Liquidity analysis of 1 June 1977.
- ⁶¹ P&O HQ, PO/INF/349 Memo to Executive Committee, 5 February 1981.
- ⁶² Davies, *The Trade Makers*, 380.
- ⁶³ P&O HQ, PO/INF/348 Memo from Bulk Shipping Division to Capital Investment Committee, 30 January 1979.
- ⁶⁴ Panocean, Report and Accounts to 31 December 1980.
- ⁶⁵ P&O HQ, PO/INF/349 Memo to Executive Committee, 5 February 1981
- ⁶⁶ Seatrade, June 1981.
- ⁶⁷ Seatrade, July 1981.
- ⁶⁸ P&O, Annual Report and Accounts 1981, 26.
- ⁶⁹ Panocean-Anco Ltd., Directors Report and Accounts to 31 December 1981.
- ⁷⁰ P&O HQ, P&O/INF/348 Memo to Executive Committee, 15 October 1982.
- ⁷¹ Lloyd's List, 8 December 1982, and Seatrade, November 1982.
- ⁷² P&O HQ, P&O/INF/348 Memo to Executive Committee, 15 October 1982.
- ⁷³ P&O HQ, P&O/INF/348 Memo to Executive Committee, 15 October 1982.
- ⁷⁴ P&O, Annual Report and Accounts 1983, 27; 1984, 26 and Ocean Transport & Trading plc., Annual Report & Accounts, 1984, 19.

⁷⁵ Fairplay, 8 March 1984, 7.

⁷⁶ Tomlinson, "Developing a Data Base", 43.

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